

Digital Atmics

Use this link to view or download the Wendeljr operations manual.

[Wendeljr Manual.PDF](#)

Here is some interesting reading. The original Wendel-1 operating manual.

[Wendel-1 Manual PDF](#)

Wendel Chronology:

1976: First computer purchase, a COMPAL-80, and 8080 assembly language classes.

1978: Developed Wendel as a sampling drum machine and audio sampler. 125kHz/12bit

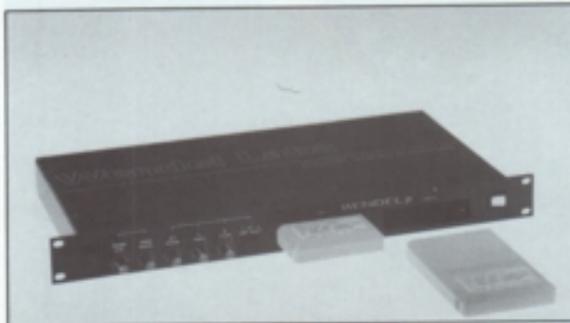
January 1979: Wendel used on Steely Dan "Gaucho" album for drums and percussion.

1981: Wendel-II 16bit 8086 version with digital i/o to 3M digital 32 track recorder. Used for drums and percussion and audio sampling on Donald Fagen's "Nightfly" album. 50kHz/16bit.

1984: Wendeljr, playback only percussion playback unit. 50kHz/16bit

Below is a photo of part of Wendel's converter, a photo of Wendel, and a couple of screen shots of the Wendel editor that was used to record and edit the cartridges for Wendeljr in 1984. Wendel was powered by a 3MHz 8085 processor. The programs were written in 8085 assembler. The I/O was analog, the converters were TRW microwave converters with a Teledyne sample and hold amplifier. The sounds were sampled at 125kHz/12bit.

FIELD TEST



Wendel jr.

by George Petersen

Capturing drum sounds has traditionally been a troublesome area for studio recordists, requiring a good room, good mics, good techniques, and a good sounding drum kit. If any of the above are lacking, then the overall results will be poor. Drum machines or sampling devices can sometimes help with the dilemma of dealing with faulty drum sounds in the studio, but then again the limitations of audio quality from 8- and 12-bit systems can be problematic, and those drum sounds themselves may not sound "right."

After a year of beta testing on major album projects by top artists, a solution has come forth in the form of a new product from Wendel Labs, of Canoga Park, California. It's a device that offers some of the best drum and percussion sounds ever recorded, but it's not a drum machine. Wendel jr., the result of years of research by renowned engineer Roger Nichols (Steely Dan, Rickie Lee Jones, Donald Fagen, John Denver), is a percussion replacement system, designed to automatically trigger high-quality 16-bit drum samples from a variety of sources: drum machines, drum pads, recorded tape

tracks, or live miked acoustic drums.

The initial concept of Wendel was born out of Nichols' attempt at maintaining consistency during the Steely Dan albums, which typically used a number of different drummers playing over a period of months in any number of studios. Wendel made its debut in December 1979 on "Hey Nineteen," on the band's Gaucho LP, and was used on all the album's other cuts as well. Wendel jr. is a simplified version of the original Wendel (which cost \$80,000), offering the same sounds in a low-cost (\$995), single rack-space, sample playback unit.

Wendel jr.'s sounds were originally recorded on the 3M digital system (50 kHz sampling rate) and then transferred in the digital domain to a hard-disk based computer for editing and subsequent "blowing" onto ROM chips for use in the Wendel Cart™ interchangeable cartridges. The carts come in several forms: "single sound carts," containing only one sound; "dual sound carts," with two different sounds available on one cartridge; and "long sound carts," which due to their extended memory requirements, use two cartridges for a single sound.

Operationally, Wendel jr. is straightforward and easy to use. A front panel

manual trigger button allows "auditioning" sounds or playing extra beats while Wendel is being externally triggered; this control also serves an additional function—when the button is held down, the unit ignores external triggers, thus acting like a mute switch. Trigger sensitivity and "ignore window" controls permit the tailoring of input signals to suit nearly any application; besides precisely following the input signal, the ignore adjustment can create flambé effects (by triggering once from the initial attack, and again from the trigger signal's decay), or skipping beats, i.e.—turning a steady quarter note kick drum trigger into a half note pattern. An endless number of variations can be created using these controls.

Certainly one of Wendel's most unique and useful features is the ability to alternate an input signal between its two cartridge slots, accomplished by adjusting the "alternate window" control and setting the cartridge select switch in the center "ALT" position. Thus, a single trigger signal—say an electronic metronome set at 120 beats per minute—could become a distinctly alternating (left-right-left-right, etc.) single stroke roll with either two snare carts in place or by using the optional Wendel left hand, right hand dual-sound snare cart.

Two separate tuning controls (one for each cartridge slot) with an approximate two-octave range increase Wendel's versatility considerably, although for most applications, a deft touch is required, as a very small variation in the tuning knob produces a major change in the sound of most cartridges, notably the kicks and snares. One cart which allowed the full range of the tuning control was the "Xplo 86," a powerful explosion utilizing the unit's full 92 dB dynamic range. Tuned high, it became a plinking, arcade-style .22 rifle, while at the opposite end of the scale, it became a booming 36-inch battleship cannon.

A good selection of carts are available—a dual-sound kick/snare cartridge is provided with the unit and optional carts include: ride cymbal (with ten seconds of natural decay), toms, more kicks and snares, cross-stick/woodblock, closed/open high-hat, handclaps, timbales, cowbells, shakers, congas, fingersnaps, and more. One unusual cart is the "snare

—CONTINUED ON PAGE 81

George Peterson Wendeljr Review 1987



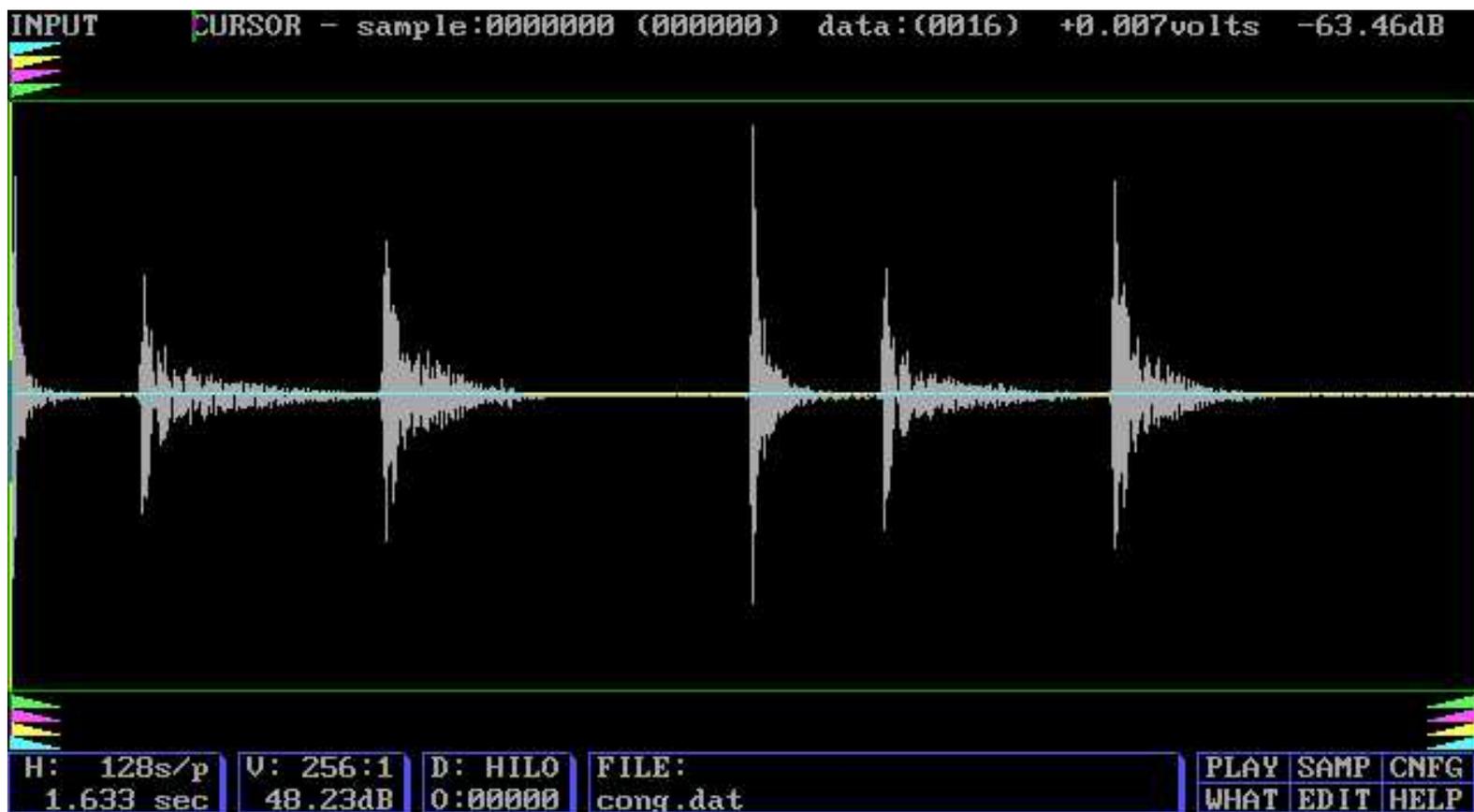
First computer. COMPAL80. 56k memory, 1.8mHz 8080. 315k Micropolis floppy.



2.5"x5" sample and hold for the 12 bit converter.



The original Wendel.S-100 card cage to the left of the 5 1/4" floppy drive, 9" monitor to the right. 1978, the first laptop computer.



Wendel-3 editing screen 1984. Editing conga for Wendeljr Carts.



Wendel-3 screen with edit markers 1984

[HOME PAGE](#)

W E N D E L jr

P E R C U S S I O N R E P L A C E M E N T S Y S T E M

S Y S T E M O P E R A T I O N

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(MSW40-060189)

WARNING

POWER REQUIREMENTS:

Power requirements for electrical equipment vary from area to area. Please insure that your machine meets the power requirements for your area. If in doubt, consult a qualified electrician.

120 Volt 60 Hz for USA and Canada
220 Volt 50 Hz for Europe except UK
240 Volt 50 Hz for UK and Australia

WHAT YOU SHOULD KNOW TO PROTECT YOURSELF AND YOUR WENDELjr.

Watch out! You might get an electric shock.
...Never touch the plug with wet hands.
...Always pull out by the plug and never the cord.
...Only let a qualified professional repair your WENDELjr.

Touching the internal parts of your WENDELjr may cause an electric shock.

...NEVER let a child put anything, especially metal, into your WENDELjr.

...Use only domestic AC power sources. Never use DC power.
...If water is spilled on WENDELjr, disconnect it and call your dealer.
...Place WENDELjr on a flat solid surface.
...To avoid damaging the finish, never use denatured alcohol, paint thinner or other similar chemicals to clean WENDELjr.

CAUTION!

To reduce the risk of electric shock, do not remove cover or bottom panel.

NO USER SERVICEABLE PARTS INSIDE.

Refer servicing to qualified service personnel.

Note 1:

Because of the high quality cartridge connector used in WENDELjr, insertion and retrieval of cartridges may seem a little stiff in a new WENDELjr. To facilitate easier removal of the sound cartridges, move them from side to side while pulling the cartridge out of the WENDELjr unit.

Note 2:

WENDELjr cartridge proms are in no way compatible with the proms available for other digital percussion devices. Any attempts to use one of these other proms in a WENDELjr will not only void your warranty, but may severely damage your WENDELjr and/or the amplifiers through which you are monitoring your WENDELjr.

Note 3:

The part you've been waiting for. Your WENDELjr is warranted to be free from defects in workmanship during manufacturing for a period of ninety (90) days from the date of original purchase. Any defective WENDELjr will, during this time period, be repaired or replaced by WENDEL LABS LTD. at their discretion. Proof of purchase and a return authorization number are required to return your WENDELjr for service. Items shipped to WENDEL LABS LTD. that do not bear a return authorization number will be refused.

OPENING YOUR WENDELjr WILL VOID YOUR WARRANTY!!

No other warranties are offered either expressed or implied, including, but not limited to, warranties of merchantability and fitness for a particular purpose. The entire risk as to the quality and performance of this product is that of the user.>

In no event will WENDEL LABS LTD. be liable for any damages, including any lost profits, or other incidental or consequential damages arising out of the use or inability to use this product even if WENDEL LABS LTD. has been advised of the possibility of such damages, or for any claims by any other party.

COPYRIGHT NOTICE!

All sound cartridges are Copyright (c) 1985 WENDEL LABS LTD. All rights reserved. The actual PCM data in each WENDELjr sound cartridge has been filed with the U.S. Copyright office. These sound cartridges may be used only in a WENDELjr or other WENDEL LABS LTD. product. You may only transfer these sounds to audio tape for use by you in the context of a musical recording. You may not transfer or copy any of the data contained in a sound cartridge for any other persons to use for any reason whatsoever. Your use of WENDELjr and the WENDELjr sound cartridges constitutes your acceptance of this agreement not to copy or allow others to copy in any form human or machine readable, and you further agree that to do so would cause great harm to WENDEL LABS LTD. WENDEL LABS LTD. will seek punitive damages toward anyone found violating this limited license to use the WENDELjr sound cartridges. So there!

WENDEL has played the original drum tracks, replaced drum tracks or added percussion instruments for the following artists. WENDEL's first performance was on the STEELY DAN "GAUCHO" album. WENDEL's first gig was playing drums, percussion and sequencing synthesizers on "HEY NINETEEN", in December 1979.>

W E N D E L C R E D I T S

(Partial list)

STEELY DAN
DONALD FAGEN
KENNY ROGERS
STEVIE WONDER
LEO SAYER
AL JARREAU
JOHN DENVER
JOE COCKER
CRUSADERS
DIANA ROSS
TEMPTATIONS
KASHIF
DURAN DURAN
TOTO
MILES DAVIS

JAY GRAYDON
NEIL YOUNG
HUEY LEWIS
DAVID FOSTER
DE BARGE
ROBBIE BUCHANAN
CONWAY TWITTY
OAK RIDGE BOYS
PINK FLOYD
DAVID LEE ROTH
UNIVERSAL STUDIOS
JOHNNY CARSON SHOW
EDDIE MURPHY
JACK MACK & THE HEART ATTACK
BRUCE WILLIS
HEART
SUPERTRAMP
WENDY & LISA
BELINDA CARLISLE
GEORGE BENSON
PAUL SIMON
CHRISTOPHER CROSS
BRUCE HORNSBY
REO SPEEDWAGON
STEVE WINWOOD
FRANK SINATRA
ROD STEWART
STARSHIP
Z. Z. TOP
AMY GRANT
LEE GREENWOOD
WILLIE NELSON
JOHNNY CASH
CHRIS CHRISTOPHERSON
BANGLES
DWIGHT YOKUM
ROSANNE CASH
RODNEY CROWELL
INXS
CHINA CLUB
PAUL SIMON
MARYLAND SOUND

DESCRIPTION:

WENDELjr is NOT another drum machine. WENDELjr is a state of the art, digital, percussion sound replacement device. That is, the basic function is to replace the horrible drum sounds produced by any 'drum machine', and replace drum sounds already recorded on tape, whether they were produced by a machine or a real drummer.

There is no need to use pre-delayed triggers with WENDELjr's trigger input. The trigger response time is so quick (total trigger delay does not exceed 32 microseconds), that in many cases the new drum sound may appear as if it were happening early. In addition to the ultra-fast triggering, the drum sound can be tuned over a 2 octave range from the front panel control.

WENDELjr has the unique ability to track drum fills and complex patterns. When a live drummer plays a flam or fast fills on the snare drum, he does not use just one hand to hit the drum, he uses both hands. Each hand strikes the drum head in a slightly different place, at a slightly different angle and intensity. These two beats in a row, therefore, do not sound the same. When WENDELjr detects the difference in timing which represents the drum fill, it switches to an alternate drum sound. The difference in quality between a WENDELjr snare drum and a snare drum from any other drum machine is so drastic, that many times just replacing the snare drum will make the entire drum kit sound real.

How the Sounds Were Recorded:

WENDELjr's drum sounds are 16 bit sounds sampled at 50 kHz. None of the sounds available have ever been on a piece of (excuse my language), analog tape. The drums were recorded with no equalization, on a 3M Digital Mastering System at the 50 kHz sample rate. Then, through a special interface, they were transferred, in the digital domain, into a 16 bit computer

system and stored temporarily on hard disk. The exact beginning and length of the sound was determined, at which time the sound was put back in the computer and tested to make sure that there existed no delay between the trigger and the beginning of the sound. After everyone was satisfied that the editing was correctly performed, it was transferred to the EPROMs that are in the WENDELjr cartridges. When the sound is played back in WENDELjr, it is the only time the sound has been in the analog domain since it was recorded on the digital machine.

The sounds recorded for WENDELjr are not chopped off at the end. The natural decay of the drum is totally preserved in the memory chips. All drums are recorded at the full 50 kHz sample rate, providing more than 92 db of dynamic range and full 20 kHz bandwidth. Even low toms and kick drums are recorded at this sample rate. It took more than 40 hours in the studio to come up with the snare and kick sounds that are supplied as the standard sounds that come with WENDELjr. Special attention was paid to high fidelity. The snare contains all of the basics for most of your snare drum requirements. Full rich bottom end, pleasant tone, crisp snares, all blended to allow the WENDELjr user to equalize or process the sound to fit any rhythm track.

As with all sounds available for WENDELjr, the fidelity was achieved by recording with no equalization. The sounds were obtained by changing microphones, replacing drums, drum heads, kick drum beaters, whatever was necessary to make it sound right without touching the EQ knob.

Kick drums are recorded and transferred with full 20kHz bandwidth. The first cycle of a kick drum contains information typically around 18kHz. This contributes to the tightness, the firm attack of the kick drum sound. All of the spectral range is there. Just grab for what you want. As with the snare drum, the kick drum sound is not chopped off at the end. It is allowed to decay naturally ---- no matter how much memory it takes.

Some of the sounds require a fade at the end because of low level room noise and microphone noise. This fade is performed in the digital domain, and is started after

the signal has decayed into the noise floor. But that's all that was done to the sounds. We wanted to leave the EQ up to YOU! Think of WENDELjr's output as a good mic in the right place on a good sounding drum.

The phrase "Realer than real" comes to mind, but I promised that I would not use it in this manual.

Digitally Faded Sounds:

Because of the amount of memory it takes for sounds such as crash and ride cymbals, we have produced some digitally faded versions of them. These "DF-Sounds" are faded in the digital domain to fit in one cartridge instead of two, for those persons who do not need the full eight to ten second decay present in the longer version.

Tech Info:

Drum sounds in commercially available drum machines are usually contained in a 2732 or 2764 EPROM. This is a total possible number of samples of 4096 or 8192 8 bit samples. A WENDELjr snare drum consists of 32,768 16 bit samples. A WENDELjr ride cymbal consists of 913,408 16 bit samples or 14.6 Megabits of memory for a single sound. A ride cymbal with nearly 10 seconds of natural decay. This means that WENDELjr samples are at least 6 times longer, and have 64 times more dynamic range than a companded 8 bit sound. The signal to noise ratio is also 64 times better, which means that a WENDELjr snare, kick, tom, ride cymbal, etc. will decay into pure quiet and not have to be gated because of unwanted hiss.

CONTROLS:

On the front panel of WENDELjr you will find the following controls:

1: Manual Trigger

This push-button is for manually triggering the sounds in WENDELjr. It's primary function is to allow you to audition the sound placed in the cartridge slots. If sound comes out when you hit this button, but does not come out when being externally triggered, then something is not connected properly to the trigger input. This button is active at all times in addition to the rear panel trigger input. This allows the playing of additional beats while WENDELjr is being externally triggered.

Holding the manual trigger button in the depressed position will inhibit any external trigger. This can be useful when you wish to ignore trigger signals up to a predetermined spot.

2: Trigger Sensitivity

Clockwise rotation of this control increases the sensitivity of WENDELjr to external triggers. The LED above the knob will light when an input trigger exceeds the threshold setting and the ignore LED is off. Because the WENDELjr trigger is so fast, you may need to lower this setting to make the triggered drum appear to happen later.

3: Ignore Window

As the Trigger Sensitivity is increased, there will be a tendency for WENDELjr to re-trigger. This is because a slowly decaying sound will remain above the threshold for a long period of time. Clockwise rotation of this control will mask these re-triggers. With this control set on the sensitive side, counter-clockwise, a snare drum flam would be played with each trigger instead of a single hit. When set in the clockwise direction, it is possible to skip triggers so that WENDELjr will play every other beat. This means that you could, with one 1/8th note click, put down the entire drum part by ignoring unwanted trigger pulses. Remember, this control is a time constant. If you are missing a trigger, then turn the control counter-clockwise to shorten the ignore time.

4: Alternate Window

This control is the hardest to get the hang of. This control sets a time window during

which a trigger received will cause WENDELjr to "alternate" sounds. This is used during drum fills or pushed beats to accent the beat. A trigger received during this window will always switch tuning settings. Whether or not it switches drum sounds depends on the position of the display above cartridge select switch.

If you want to take advantage of this feature, then turn the control clockwise until at each trigger, the LEDs above each tuning knob light alternately. Now turn the control back counter-clockwise until only the LED above the left tuning knob stays lit. At this setting, WENDELjr will put out one drum sound at one tuning until a quick trigger is encountered. When that happens, WENDELjr will switch to the tuning of the right tuning knob. If the cartridge select switch is in the "ALT" position, then the sound in the "Cart 2" cartridge slot will be output. If the cartridge select switch is in either the "1" or "2" position, the sound will not switch, but the tuning will alternate between the settings of the left and right tuning knobs.

5: Tuning A

Adjustable tuning for either cartridge "1" or the first sound during a trigger sequence. The range is approximately two octaves. When the index pointer on the knob is straight up (12:00 position), the sample rate is 50kHz and the sound will be played back exactly as sampled.

6: Tuning B

Adjustable tuning for either cartridge "2" or the sound produced if a trigger is received during the Alternate Window. If the cartridge select switch is selected to "1", then the "Cart 1" sound will be the only one played. The "B" tuning will be in effect during alternate beats of a drum fill.

7: Cartridge Select

This is a three position switch. When the LED labeled "ALT" is lit, the "1" cartridge will be the primary sound being output

during a trigger. If another trigger appears during the "Alternate Window", then the sound in cartridge "2" will be output. As long as new triggers are received within the "Alternate Windows", the sounds being output will alternate between cartridge "1" and cartridge "2". The first trigger received while the "Alternate Window" LED is off, will always output cartridge "1".

When selected to "1", cartridge "1" will always be the sound output. Tuning will continue to alternate during the "Alternate Window", but only one sound will be output.

When selected to "2", cartridge "2" will always be the sound output. Tuning will continue to alternate during the "Alternate Window", but only one sound will be output.

8: "1" Cartridge Slot

This is the slot that will contain the first sound to be output during a sequence. If there is to be no cartridge in slot "1", then the Cartridge Select Switch must be switched to "2".

9: "2" Cartridge Slot

This is the slot for the alternate sound. This will be the second sound produced during an "Alternate Window" if the Cartridge Select Switch is in the "Auto" position. It will be the only sound output if the Cartridge Select Switch is in the "2" position. It is ok to store a spare sound in this slot. If you do not want this slot to be triggered, then just turn the Cartridge Select Switch to the "1" position.

There are a couple of special cases when it comes to properly placing cartridges in their slots. The first case is when two sounds come in one cartridge. Examples of this are a left and right hand hit of one snare drum, or the kick and snare combination cartridge that came with your WENDELjr. If there is a cartridge already in the "Cart 2" slot, then it should be removed. This cartridge will behave as though it was two separate cartridges. The first sound being in the "Cart 1" slot, and

the second sound being in the "Cart 2" slot. As in the case of the "Kick/Snare" cartridge, if you want to hear only the kick drum then the "1" must be lit above the "Cart Select Switch". If you want to hear just the snare, then the "2" must be lit above the "Cart Select Switch". If "Alt" is lit above the "Cart Select Switch", triggers that would cause a tuning switch will also switch between the two sounds in the cartridge. In this example, the kick and snare. If the DUAL SOUND CART is placed in the "CART 2" slot the sounds will appear in the reverse order.

The second special case when a sound is so long that it will not all fit in one cartridge. In this case the second half of the "LONG SOUND" will be placed in the "Cart 2" cartridge slot. WENDELjr knows whether the second slot contains part of a "LONG SOUND" and will behave as if the whole sound is in the "Cart 1" slot. When using "LONG SOUNDS", the Cartridge Select Switch will be disabled.

REAR PANEL JACKS

10:Audio Output

This is where, as if by magic, the drum sounds come out of WENDELjr. The output may be connected to the line input of an audio console, or directly to the input of a tape machine. It is desirable to adjust the levels going into the tape machine with a peak indicating meter. Transient response of percussion devices may be 10 to 20 dB above the level indicated on a normal VU meter.

11:Audio Trigger Input

Audio signals from a tape machine, console feed, drum machine, drum pad, or just about anything you could imagine goes in here. The trigger sensitivity control on the front panel controls the level at which WENDELjr will start playing it's drum sounds.

The polarity of the signal does not matter. WENDELjr's trigger circuit looks for a signal rising either way from zero. Normal precautions, however, should be

maintained. It would not be wise to connect the input directly to a 110 volt AC receptacle, or with jumper cables to your car battery. I am not saying that it would hurt WENDELjr, but it might void your automobile warranty. If you treat WENDELjr's input as you would any other piece of studio rack gear, there will be no problem. Input impedance is 10k ohms.

12:Wendel system interface

This multi-pin connector provides the interface between WENDELjr and other Wendel Labs products such as the dynamics and MIDI interface, the trigger delay option and the sampler. When you receive your unit, there should be a jumper wire inserted in this connector. The unit will not operate without this jumper in place. The jumper should only be removed when necessary to plug in the interface cable to other WENDEL products.

The WENDEL BUSS connector may be used to measure the clock rate of WENDELjr by connecting a suitable frequency counter. The read out will be directly in sample rate. The sample rate displayed will be that of the tuning knob that has the LED above it illuminated. This allows for very accurate position recording of the tuning knobs on the front panel. (The very center pin of the DIN connector is ground. Looking at the rear of the WENDELjr unit, the clock appears just to the left of the jumper wire that is inserted into the DIN connector.)

13:Rear Panel Logo

The wording on this logo must be memorized by every WENDELjr owner. The Wendel Labs van may stop you on the street in Hollywood or on the beach in Maui and ask you to recite the logo information and your WENDELjr serial number. Failure to do so correctly will result in an increased probability of being molested by a deranged Pygmy.

EXAMPLES OF USES

1: Kick drum replacement

First, some vital information about what makes a real kick drum sound like a real kick drum. When the drummer playing the kick drum hits it harder, it is higher in pitch. This means that there will be a slight change in the tuning between the regular kick drum pattern and the accents played by the drummer.

So, to make the WENDELjr sound most realistic, proceed as follows:

Place the cartridge containing the kick drum in the "Cartridge 1" slot. Push the "Cart Select" button until only the green LED labeled "1" is lit.

Send the trigger source into WENDELjr. Set "Ignore Window" and "Alt Window" at approximately the 10 o'clock position. Turn the "Trigger Sensitivity" in a clockwise direction until the LED above this control starts to flash and the kick drum sound comes out of WENDELjr's output jack. Listen to both the original trigger source and the kick drum coming out of WENDELjr to make sure that they are coincident. If the WENDELjr kick drum is late, then turn the "Trigger Sensitivity" control in a clockwise direction. If the WENDELjr kick drum sounds early, then turn the "Trigger Sensitivity" control in the counterclockwise direction. If you start getting false triggers from WENDELjr, then turn the "Ignore Window" control in a clockwise direction until the multiple triggers stop.

If the kick drum pattern contains accents, that is beats that fall on the eighth note before one, or any other pickups, then we can try out the alternate tuning mode.

Turn the "Alternate Window" control in a clockwise direction until the LEDs above the tuning controls alternate with each hit of the kick drum. Now turn the control back in the counterclockwise direction until all of the kick drum beats light up the LED above the "Tuning A" control, except the kick drum on the pickup. The kick drum pickup

to the downbeat should now be causing the LED above the "Tuning B" control to light.

At this point, start playing with the "Tuning A" control to set the basic pitch of the kick drum. After that is set, then adjust the "Tuning B" control until the kick drum pickup is tuned just slightly higher than the beats using "Tuning A". Play around with these settings. Experience derived from experiment will yield the best results.

2: Snare Drum Replacement

Replacing the snare drum is done the same as the kick drum replacement for one snare drum sound. If you have obtained the optional "SNARE PAIR" drum sound cartridge, then you have the right and left hand hit of the same snare drum. Place the cartridge in cartridge slot "1" and press the "Cart Select" button until the yellow LED labeled "ALT" lights up. You will notice at this point that whenever the tuning changes between "A" and "B", that the cartridges also switch between "1" and "2". (The green LEDs above the "Cart Select" button display which cartridge is being played.)

Now, whenever a snare drum fill comes along, the sounds will alternate between the left and right hit of the snare drum, just like a real drummer might do it. (Unless he only has one hand, or is Bernard Purdie with three hands.)>

W E N D E L j r C A R T R I D G E S

It must be kept in mind that because of the high resolution and sample rate used for the WENDELjr SOUND CARTRIDGES, that a great deal of memory is required to store them. The long ride cymbal in an -H- SOUND CART required 512 kilobytes of memory. An -A- SOUND CART and the DUAL SOUND CART requires 64 kilobytes of memory. This is the smallest memory increment used for sound storage.

There are three types of SOUND CARTRIDGES. The DUAL SOUND CART, the SINGLE SOUND CART and the LONG SOUND

CART pair. Each cart is used in a slightly different manner.

DUAL SOUND CART

The dual sound cart is any cart that contains two sounds in one cartridge. This includes the HEART KICK-SNARE that comes with the WENDELjr. This cartridge acts as though there was a separate cart for each sound, and one cart was placed in each slot in the front of WENDELjr. When a "DUAL SOUND CART" is placed in slot 1, the first sound will appear when cart 1 is selected, and the second sound will appear when cart 2 is selected. When the dual sound cart is placed in slot 2, however, the sounds appear reversed. The second sound will appear when cart 1 is selected, and the first sound will appear when cart 2 is selected. This allows the order in which the sounds are played to be reversed. Example; a "DUAL SOUND CART" contains two cow bell sounds. The first sound is that of an open cowbell and the second sound is of the same cow bell, but muted. When the cartridge is placed in slot 1, the open cow bell would be the main sound and the muted cow bell would play the accents. When the cartridge is placed in slot 2, the muted cow bell would be the main sound and the open sounding cow bell would be the accents. DO NOT PLACE ANOTHER CARTRIDGE IN THE OTHER SLOT WHEN USING A DUAL SOUND CART. DAMAGE WILL OCCUR TO YOUR CARTRIDGES.

SINGLE SOUND CART

The single sound cart contains only one sound. The memory requirements, and therefore the length of the sound, determines the letter used to designate the sound such as -A- SOUND CART. The letters are -A- through -D- for a single sound cart. A SINGLE SOUND CART contains a sound which requires too much memory to fit in a dual sound cart. The single sound cart may be placed in either slot, and sounds when that slot is selected by the "CART SELECT SWITCH". Two single sound carts may be used at the same time, although the sound being played will depend on the position of the "CART SELECT SWITCH".

LONG SOUND CART

This is a pair of cartridges that make up one sound. The letter designation for these carts are -E- through -H-. These sounds are so long that they will not fit in one cartridge shell. The cartridge marked "SLOT 1 ONLY" must be placed in the left cartridge slot, and the cartridge marked "SLOT 2 ONLY" must be placed in the right cartridge slot. The "CART SELECT SWITCH" will become inactive, but the LEDs above the switch will indicate which cartridge is actually producing the sound.

The following pages contain descriptions of some of the available sounds, with the length designation for each one.>

CARTRIDGE DESCRIPTIONS

SN-1B

(-A- SOUND CART)
(Optional)

The SN1-B cartridge is a deep ballad type snare drum. Plenty of low end, lots of crisp snares. If the amount of tone contained in this snare bothers you, then notch out 6db or so at 320 Hz.

KH-2

(-A- SOUND CART)
(Optional)

Kick drum two. A tight kick drum with plenty of snap on the leading edge. Don't let this one fool you. There is tons of bottom end in this kick drum. A lot of it is below 100 Hz.

SN-4,SN-1

(DUAL SOUND CART)
(Optional)

This is the right-hand left-hand snare pair that was discussed in the operations section of the manual. This snare drum has more crack to it and lacks the depth of the ballad snare drum. The snares may be used separately if desired.

HeartK,HeartSn

(DUAL SOUND CART)
(Included)

A kick drum. The best all around kick. A little more puff to this one than KH2, but not something to sneeze at. Between this one and KH2, all of your kick drum requirements for the next decade should be covered.

This is the stock snare drum that comes with WENDELjr. A nice cross between SN-1 and SN-1b. This snare cost more than your WENDELjr. I'm glad I don't have to beat on the real one any more.

HH-2a, Ho1
(DUAL SOUND CART)
(Optional)

Closed hi-hat. Nice hi-hat. Cute hi-hat. The open hi-hat, when used in conjunction with the closed hi-hat, HH2a, you can track and replace open-closed hi-hat patterns that were generated by a drum machine.

Ride Cym-1
(-H- LONG SOUND)
(Optional)

This two cartridge set is a long sound. That is, the sound was too long to fit in one cartridge, so we had to put it in two cartridges. CYMA must go in slot "1". CYMB must go in slot "2". The function of the "CART SELECT" switch will be locked in the "ALT" position. The "1" and "2" lights above the cart select switch will indicate which one of the cartridges is producing the sound as it is being played.

Tom-2
Tom-3
(-D- SOUND CARTS)
(Optional)

A-typical tom tom. Notice that one hi-fi recorded tom can be used for many tom applications. Tuned down low, it sounds like a great floor tom. Tuned up high, it sounds like a little tom, not like a mickey mouse rendition of a larger tom.

Xplo-86
(-C- SOUND CART)

(Optional)

Canada had theirs, so here is our big bang for the year. This is an explosion. Make sure that your amps are turned down before you try this one. You could discharge a 357 magnum in the echo chamber on each back beat, but look at all the money you'll save on ammunition, not to mention the cost of patching up all the holes. Just wait 'till the next time a client asks you for an explosive back beat.

Cstik-1, Block-1
(DUAL SOUND CART)
(Optional)

A great cross-stick. Every Country record uses this one. We were going to throw in a kidney shaped swimming pool, but we only had room for a wood block.

Clap-A, Clap-B
(DUAL SOUND CART)
(Optional)

Hand claps. We had a perfect recording of one hand clapping, but it didn't turn out to be very practical. In this cartridge we have eight hands clapping. I think that works out to four people with two hands each. When I say that this cartridge contains a lot of transients, I don't mean that the people we used were just passing through town.

Clap-B is the second half of this dual cartridge. This is another event just like the one above, but not quite as tight. This works well double-tracking with CLAP-A so it sounds like more people, or select "Alt" so that it will be alternated with the other claps. Here is a hint. Multi-Track either of these clap sounds, but each time you switch to a new track, change the tuning just slightly. You can build up to some very large crowds this way.

Tymb-1
Tymb-2
Tymb-3
Tymb-4
Tymb-5
Tymb-6
(-A- SOUND CARTS)
(Optional)

Of course these are timbale sounds. There are a total of six different cartridges with timbale sounds on them. They consist of two timbales each struck three different ways. Medium intensity, very hard and with a rim shot. Just about any rhythm combination can be built with this set.

Cow-1,Cow-2

Cow-3,Cow-4

Cow-5,Cow-6

Cow-7

(DUAL SOUND CARTS)

(Optional)

These sounds consist of various size cows struck solidly with a baseball bat. (Just kidding!) Actually seven different cow bells. Take your pick. Two to a cartridge.

Duck-1,Duck-2

(DUAL SOUND CART)

(Optional)

Well, it sounded like a duck to me! This sound is a Guiro stroked with a small wooden stick. See, I told you that it sounded like a duck.

Snap-1,Snap-2

(DUAL SOUND CART)

(Optional)

Finger snaps of the greatest fidelity. A couple of different ones so that you can add them together if you want to.

Shake-1,Shake-2

Shake-3,Shake-4

(DUAL SOUND CARTS)

(Optional)

Shaker pairs. These sounds should be used in pairs, just as real shaker sounds are used in pairs. The forward motion of the shaker produces a sound different than the reverse direction of the shaker. This method produces a much more realistic performance.

Block-1,Block-2

Block-3,Block-4

(DUAL SOUND CARTS)

(Optional)

Four different wood blocks. Many uses. Trust me.

Conga-1,Conga-2

Conga-3,Conga-4

(DUAL SOUND CARTS)

(Optional)

Two hits of each drum. A muted one and an un-muted one. Take a couple of WENDELjrs to "Carnaval" next year. Play them with pads while towing a "Red Flyer" wagon with Honda generator and P.A. system. I'll come with you to take pictures.

Echo-L

Echo-R

(-A- SOUND CART)

(Optional)

THIS SOUND IS AMAZING, This sound is amazing, (this sound is amazing). (Get it?). How many times have you rented a digital echo unit just for snare drum echo? This pair of cartridges contains the echo only return of just such a device produced by using our SNARE1 and SNARE4 sounds as the source. These cartridges should save you around \$250.00 per day all by themselves. Or, if you feel guilty, just send the \$250.00 per day to WENDEL LABS. We'll use it to pay off our lunch debt.

W E N D E L
R H Y T H M A U G M E N T A T I O N S Y S T E M
A U D I O S A M P L E R
A D S R E N V E L O P E & T R I G G E R S Y S T E M

0 1 / 0 1 / 7 9

S Y S T E M O P E R A T I O N

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Wendel Labs

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SYSTEM OVERVIEW

Wendel is the latest in "state of the art" applications involving digital audio storage. Wendel can be used to repair or to augment rhythm tracks in an almost infinite number of ways. Wendel will not easily become obsolete because the entire operating system is loaded into the system each time it is used. Updating to future enhancements is done simply by obtaining a new system diskette.

<METRONOME:>

This mode allows Wendel to put down a perfect click track for the musicians to play along with. This need not be the every day digital click track that we are all used to. Wouldn't it be great to play along with machine steady hand clapps instead of "thwap - thwap - thwap - thwap". How about 1/4 note wood blocks with accents on 2 and 4? Have you ever wanted to have both 1/4 note and 1/8th note clicks on tape for future overdubs? Tired of playing along with a rhythm box that doesn't have quite the right feel for the tune? "Gee, it sure would be nice if the snare drum were layed back a little more on the rhythm machine!" Wendel can do all of these things, and much more.

<MANUAL:>

The manual play mode lets you select a number of sounds from the disk library and play them manually. If you can tap your finger in time to the music, you can be a drummer.

<AUTOMATIC PLAY:>

This mode will come in very handy if you have trouble keeping time by taping your fingers. As a matter of fact, Wendel plays so steady that we included the ability to make the playing as loose as you want it to be. You can lay back the snare drum till any normal drummer would fall off the stool. Have you ever listened to a tune and heard a couple of bars where you thought, "Wow, if this guy could lay back like that all of the time, he would be greatest drummer in the world!"..... Enter Wendel.

AND TALK ABOUT STEADY!!! Too bad disco is dead..... Oh well, maybe in the next life.

<REPAIR:>

Repair mode could save your whatchamacallit. Yup, that live performance when the snare drum broke. "OOOOOH NOOOOOOOooooooo. That take was perfect! we'll never be able to fix the snare track. Boooo hoooo, hoooo glub." Oh yes, you can fix the snare track, or just about anything else in the rhythm track that didn't quite make it on to the tape the way you had hoped.

There are two basic ways to fix a broken snare. You can replace the entire track with a sound already stored in Wendel, or you can store the sound of the snare drum from the beginning of the tune, and use it to repair the broken snare sound at the end of the tune. This method also works well when you intercut two or more takes of the same tune, and the snare sounds different from one piece to the next. Take the sound you like, and use it for the whole tune.

The same concept works on tracks for an album that were cut with two different drummers, or 6 months apart. One snare drum sound can be used throughout the album to make it sound more like it was the same band playing all the tunes.

Keep in mind that in the repair mode, Wendel will play exactly what the original track played. If the player rushed, Wendel will rush. If he was perfect (a person, perfect), then Wendel will be perfect. Of course if you want it to be different, Wendel can do that too.

<AUTOMATIC SEQUENCER:>

This mode enables Wendel to sequence a synthesizer as well as control the envelope, attack and decay of the notes played on the synthesizer by a keyboard player. This mode is used generally for playing perfect rhythm keyboard parts on which to build a track.

<STORE:>

Store mode lets you add your favorite drum or percussion sounds to the disk library. This is accomplished simply by plugging Wendel into the console, and playing the sound you want stored. Wendel samples the sound, cleans up all the extraneous noises, and saves it on disk for future use. Since the bulk of the stored sounds are on floppy disks, and only the ones that you are going to use on the session are loaded into Wendel, the total number of sounds available becomes limitless.

SYSTEM CONFIGURATIONS

There are five basic configuration groups associated with Wendel. These are:

GROUP-1	MEMORY
GROUP-2	OUTPUT CHANNELS
GROUP-3	DISK STORAGE
GROUP-4	MULTI-TASKING
GROUP-5	PACKAGING

<MEMORY OPTIONS:>

Standard memory configuration is 64k bytes, and is expandable to 256k, 512k, up to 16 megabytes of internal memory.

<OUTPUT CHANNELS:>

Standard configurations are four and eight output channels. This is expandable to 128 channels for special applications.

<DISK STORAGE:>

There are two standard disk configurations. The first is a single 630k floppy disk system that can be expanded to four disk modules of 630k each. The second is a 5 megabyte hard disk with 630k floppy drive for system backup. There is also a hard disk option that includes up to eight drives of 32 megabytes each with up to four 630k floppy drives for backup.

<MULTI TASKING:>

The multi tasking option includes add on slave processors that allow Wendel to perform as if there were additional Wendels without duplicating disk storage or memory options.

<PACKAGING:>

Wendel is available in two different packaging configurations.

"System One" includes Wendel installed in a portable carrying case much like a typewriter. The keyboard folds down to reveal a single disk drive, (either the 630k floppy disk or the 5 megabyte hard disk) and the 9 inch CRT display.

"System One" also comes with a separate interface adapter that plugs into the rear of Wendel and contains the necessary access jacks and electronics for attachment to the recording console. "System One" comes with two flight cases.

"System Two" consists of a terminal unit which includes the computer, a 12 inch CRT, and the keyboard. There are two additional units included in the "System Two" configuration. One of the units contains the disk drive units, (a 630k floppy drive and a 5 megabyte hard disk) while the other unit contains the console interface adapters. Both units plug into the rear of the terminal unit.

SYSTEM INSTALLATION

<SYSTEM ONE:>

Flight case number one contains Wendel. Open the case and remove the unit. Place the unit on a flat surface (producers console or desk area) and open the latches that lock the keyboard closed. Lift the unit in the area of the keyboard hinge and rotate the keyboard away from the unit until the keyboard is fully extended and it's feet are flat on the desk top. Make sure the keyboard has a firm footing, as the front of the unit is now fully supported by the keyboard.

Open flight case number two. In the middle compartment is the console interface unit. Remove it from the case and place it along side or behind Wendel. In the left compartment of the flight case you will find an AC cord and two four foot long ribbon cables. Each end of the ribbon cables is labeled. Locate the end of each cable labeled "INTERFACE UNIT". Plug the cable labeled "INTERFACE UNIT RIGHT" into the connector on the interface unit labeled "RIGHT". Plug the cable labeled "INTERFACE UNIT LEFT" into the connector on the interface unit labeled "LEFT".

The other end of the ribbon cables are marked "DIGITAL" and "ANALOG". Connect these to the back of Wendel. The labels on the ribbon connectors should exactly match the labels on the connectors at the rear of Wendel. To make it even plainer, connect "DIGITAL" to "DIGITAL", and "ANALOG" to "ANALOG".

Make sure the power switch on the rear of Wendel is in the off position. Connect the AC cord to the AC receptacle just to the left of the power switch. Plug the other end into an appropriate 117VAC grounded outlet.

<IMPORTANT> Do not use a ground lifting adapter. Wendel MUST be grounded. Static could damage any computer system. Make sure it is grounded.

In the right forward compartment of flight case number two is located a set of orange cables with Cannon type connectors on one end, and TT patch bay plugs on the other end. These cables will be used to connect the interface unit to the console patch bay. For now, we will use three of the cables.

Select two cables with female Cannons. Plug one of them into the interface unit at the jack labeled "OUT 1F". Plug the other end of this cable into a line level input to the console. Mark this input "WENDEL ONE" at the console. Plug the other cable into the interface unit at the jack labeled "OUT 1E". Plug the other end of this cable into another line level input to the console. Mark this input "WENDEL TWO" at the console.

Select a cable with a male Cannon. Plug it into the interface unit at the jack labeled "TRIGGER IN". Plug the other end into a line level console output over which you have control of the audio level.

All connections are now complete.

SYSTEM INITIALIZATION

<STEP 1:>

Turn on the power to Wendel. After about 15 seconds, you will see a sign-on message in the top left corner of the CRT.

Wendel 8517 monitor

>

<STEP 2:>

Insert the disk labeled:

"WENDEL SYSTEM DISK VERSION xxx"

with the label facing toward your left. Push it in all the way and close the disk drive door. (This step may be skipped if Wendel is equipped with a hard disk).

<STEP 3:>

While holding down the key marked "CTRL", depress the key marked "D". The disk drive light should illuminate, and in a few seconds the CRT will display the current Wendel status report, and a sign-on message.

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1F				ramp port = 1F											

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>>>Buffer11 ver X.xxxx. .vxxx..ready

<STEP 4:>

Depress the key marked "Z", and then "RETURN". A "MENU" of system commands will appear on the lower portion of the CRT. Wendel is now ready for commands.

<STEP 5:>

On floppy disk only systems, open the drive door and remove the "SYSTEM" disk. Insert the disk labeled:

"WENDEL PERCUSSION DISK #01"

and close the drive door.

You are now ready to procede to the next section of this manual.

SYSTEM OPERATION

After performing the steps outlined under SYSTEM INITIALIZATION, the following display should be present on the CRT:

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1F				ramp port = 1F											

G - go run main program
 K - clicks. uses 1E.1F.X0
 M - assign ramp I/O port
 P - output 1 ramp..X1=S1 etc.
 R - display all registers
 T - assign trigger port
 X - set delay counter
 Z - display command list
 # - continuous A/D-D/A
 |

I - assign buffer I/O port
 L - set buffer length
 O - output 1 buffer (immediate)
 Q - re-init buffer program
 S - set buffer start
 W - warm start WDOS
 Y - init delays & buffers
 * - input one buffer (immediate)
 \$ - continuous display A/D byte

The system prompt "|", when displayed, means that the system is ready to accept command input from the console.

SYSTEM OPERATION

<CONSOLE INPUT:>

There are three basic types of input accepted from the console. These are "numeric data" in hex, "subsystem commands" which are non-hex characters, and the "RETURN" key which initiates "command execution".

As an example, suppose that you wanted to output a click with a tempo of 60 beats per minute to port 1F. The typed sequence would be as follows.

```
0600KF<cr>
```

The numeric value is input as 4 digits, followed immediately by the sub-command to be executed and a one digit numeric value for the port number.

As data is typed on the keyboard, it is placed in one of three areas of memory. Any hex numbers entered from the keyboard following the system prompt are shoved onto a 4 character stack. Only the last 4 numbers typed are saved. Therefore;

```
if you meant to enter:      ]2345
but you typed:              ]2355
then just keep entering
until the display is:      ]23552345
```

Only the last 4 entries are used, even though all previous digits are still displayed on the screen.

Some commands require that only the sub-command be entered followed by a <cr>, while others require more information to operate correctly. If a required field is not input, but is required by the sub-command, the data previously entered into the buffer is used.

As an example, if you wanted to set the start of buffers 1, 2 and 3 to an address of 5000hex, the commands would be:

```
]5000S1<cr>
]S2<cr>
]S3<cr>
```

The sub-command used the 4 digit number placed on the stack during the first operation for the next two operations, because there was no new data pushed onto the stack before the next sub-command was entered.

Once the method used to process command and data entry is understood, it can greatly reduce the amount of time spent entering values into the various data areas. For instance, if you wanted to set the start of buffer 1 at 5000hex, the start of buffer 2 at 0000 and the length of buffer 2 to 0400hex, the entry could be done the long way:

```
]5000S1<cr>
]0000S2<cr>
]0400L2<cr>
```

Or the same results could be attained from the sequence:

```
]5000S1<cr>
]0S2<cr>
]400L<cr>
```

Take your pick, they both do the same thing.

SYSTEM OPERATION

<SUBSYSTEM COMMANDS:>

There are three subsystems that make up the total operating system in Wendel. These are:

DISK FILE EXECUTIVE
MAIN OPERATIONS PROGRAM
APPLICATION DEFINITION & SETUP

In the next three sections of this manual, each subsystem will be explained thoroughly, including explanation and examples for each command under the subsystem.

The DISK FILE EXECUTIVE subsystem does just what is implied. It enables the user to save newly created sounds, save tune setup data from a current work file, load special programs, load drum sounds from disk and all the things disk operating systems should be able to do.

The MAIN OPERATIONS PROGRAM is the meat of Wendel. This is the portion of the system that actually does the sequencing, playing, clicking, sampling and all around good things that Wendel was designed for.

The APPLICATION DEFINITION & SETUP program is an interactive module designed to enable the user to tell the computer what instruments to play, when to play them, what rhythm patterns to play and that kind of stuff. Believe me, it is much easier than without this subsystem.

(So turn the page!)

SYSTEM OPERATION

<DISK FILE EXECUTIVE:>

To enter the disk file executive from the main operations program, type the following:

```
]W<cr>
```

That is, in response to the "]" prompt character, the user must type a "W" followed by a "carriage return". The display on the CRT will be:

GROUP - 7 MDOS VS. X.X - COPYRIGHT 1981

>

Notice that in this subsystem that the prompt character is ">". The disk executive is now waiting for a command.

<ENTERING EXECUTIVE COMMANDS:>

Executive statements are entered by typing characters in sequence on the console keyboard. An executive statement is terminated by pressing the "RETURN" key. Error correction is handled differently in this subsystem. There are two control features that enable the user to correct input errors.

<1:> Each time the "BACKSPACE" or "DELETE" key is pressed the next previously typed character will be deleted from the line.

<2:> Holding down the control key and typing X (^X) will cause all of the current line to be cancelled. The cursor will be positioned at the beginning of the next line to except entry of a new line.

<EXECUTIVE STATEMENT FORMAT:>

An executive statement has the following form:

[unit:]NAME ["ASCII" "ASCII" "ASCII" hex hex hex]

The NAME in an executive statement may be the name of an explicit command or the name of a disk file. There are 23 explicit commands allowed under this subsystem. Explicit commands are upper case only and must not be preceded by any spaces. In addition, executable machine language programs may be loaded from the disk and run just by entering the filename.

When an executive statement is entered the executive program searches for a match to the command. If the match is successful the command will be executed immediately. If the match is not made the executive will treat the command as an implicit command and must be found on disk. Implicit command filenames may be prefixed by an optional unit number for systems with multiple disk drives. No unit number need be specified for single drive systems. If a unit number is specified it must be separated from the first character of the NAME by a colon (:). The executive processes the implicit command by searching the directory of the specified disk drive for the file. If the file is found and is of the right file type, it is loaded into memory and control is transferred to the program. If the file is not found on the unit specified, an error message is output to the console; COMMAND NOT FOUND. If the file is found in the disk but is not an executable file then the error message output to the console is; WRONG FILE TYPE.

Executive statements consist of a NAME followed by parameters, as necessary. Parameters can be ASCII or numeric. There can be up to four ASCII parameters and up to four numeric parameters. There must be at least one space between the NAME and any parameters. All parameters must be separated from each other by at least one space. Entry of an executive statement with too many parameters of either type, or without the required spaces between fields will result in a SYNTAX ERROR.

ASCII parameters consist of from 0 to 10 ASCII characters. These may be any character produced by the keyboard except "BACKSPACE", "DELETE" and double quotation marks. ASCII parameters must be enclosed in balanced double quotation marks. Entry of an executive statement with unbalanced quotation marks or illegal characters in an ASCII parameter will result in SYNTAX ERROR.

ASCII parameters in executive statements are generally used to specify disk filenames. In usage a unit number may be prefixed to the ASCII filename within the quotation marks by typing the unit number followed immediately by a colon (:). If no unit is specified, unit 0 or the single drive in a one drive system is assumed. For example, "WENDEL11" and "1:WENDEL11" are both valid ASCII parameters in an executive statement.

Numeric parameters in an executive statement are unsigned hexadecimal values from 0 to FFFF. They represent such elements as memory addresses, filetypes, and databytes. Entry of a numeric parameter greater than FFFF or with illegal characters will result in a SYNTAX ERROR.

<CANCELLING AN OPERATION:>

All explicit commands can be cancelled in progress by holding down the control key and typing a "C" (^C) on the keyboard. The operation will be terminated as soon as the ^C is recognized and the message CANCELLED will be output to the console. Control is returned to the executive.

<DISPLAY CONTROL:>

All explicit commands can be temporarily stopped in progress by holding down the control key and typing "S" (^S). The process will stop upon recognition of the ^S. Typing any key other than ^S or ^C will cause the process to resume. This function is very useful in controlling commands that output display at high speed. For example, output of the DUMP command may be viewed at reading speed by stopping and resuming the output as necessary.

<EXPLICIT EXECUTIVE COMMANDS:>

Command syntax for each of the explicit commands is illustrated in this section with the aid of the following notation:

[] Option brackets. Any parameters enclosed between brackets are optional.

< > Symbol brackets. This space should be replaced by the item described.

<The COMP command:>

COMP <start addr. block1> <end addr. block1> <start addr. block2>

The COMP command compares two blocks of memory and displays address locations that do not compare and the data at those locations. Example:

```
>COMP 5000 500F 5010
5004 01 09 5014
```

The block of memory from 5000 to 500F is compared with the block of memory from 5010 to 501F. One location fails to compare. Location 5004 contains 01 while the corresponding location, 5014, in the second block contains 09.

<The DUMP command:>

DUMP <start addr.>[<end addr.>]

The DUMP command outputs to the system console a formatted hex display of the contents of a block of memory. Sequential memory locations are shown 16 to a line with the memory address at the left margin. If the optional end address parameter is not entered, only one byte is displayed. Example:

```
>DUMP 5000 5011
5000 50 C0 27 77 4F 33 4F CD 7D 9E 98 00 6A FD 82 90
5010 77 2B
```

<The ENTR command:>

ENTR <start addr.>

The ENTR command allows data to be entered into memory directly from the console device. Example:

```
>ENTR 7000
>78 89
6F/
```

Three bytes were entered starting at location 7000 hex. These were 78 at 7000, 89 at 7001 and 6F at location 7002.

Typing in an ENTR command places the executive in a special enter mode. While in the enter mode each line of values that is typed is entered into memory when the RETURN key is pressed. Until the RETURN key is pressed the standard backspacing and ^X tools are available for line correction. The last value on the last line must be followed by a slash (/) to properly terminate the enter mode. Entry of a illegal hex value in any line will also cause termination of the enter mode with the message SYNTAX ERROR.

<The FILL command:>

FILL <start addr.> <end addr.> <byte>

The FILL command fills a block of memory with a specified byte. Example:

```
>FILL 7000 8000 9
```

Each byte of memory in the block from 7000 to 8000 is changed to a 09 by this command.

<The MOVE command:>

MOVE <source addr. start> <source addr. end> <dest. addr. start>

The MOVE command copies the source block of memory to the destination block. The source block is not changed. The destination block is changed to be an exact copy of the source block. Example:

```
>MOVE 3000 4000 7000
```

Each byte in the memory block from 3000 to 4000 is copied into the corresponding position in the memory block from 7000 to 8000.

<The SEAR command:>

SEAR <start addr.> <end addr.> <byte>

The SEAR command searches a block of memory for all occurrences of the specified byte and displays all locations with a match. Example:

```
>SEAR 3000 3020 9F
3004 9F
3018 9F
```

The block of memory from 3000 to 3020 is searched for all occurrences of a 9F. Location 3004 and location 3018 both contain 9F. No other locations in the block contain 9F.

<The SEARN command:>

SEARN <start addr.> <end addr.> <byte>

The SEARN command searches a block of memory for all non-occurrences of a specified byte and displays all locations that do not match. Example:

```
>SEARN 3000 3010 67
3002 09 67
3006 76 67
```

The block of memory from 3000 to 3010 is searched for all non- matches with the mask 67. Location 3002 contained a 9 rather than a 67, and 3006 contained a 76 rather than a 67.

<The CREATE command:>

CREATE "[unit:]<filename>" [<file type>]

The CREATE command creates a new file in the directory of the diskette in the specified unit and allocates the initial track for the file. If no unit is specified, unit 0 is assumed. The second parameter optionally gives the file a TYPE designation. If no type is specified the type is defaulted to 0.

<The DISP command:>

DISP "[unit:]<filename>" [<record number>]

The DISP command outputs a formatted hex display of the data contents of a file to the system console. The unit number indicates the disk drive on which the file is to be found. If no unit is specified, unit 0 is assumed. The optional record number indicates on which record in the file the display is to begin. If no record number is specified, record 1 is assumed.

Each record is displayed with a header line that contains the record number, the address in memory where the record is to be loaded, and the number of data bytes in the record. Data lines follow the record header. Each data line has up to sixteen data bytes preceded by the index position in the record of the first data byte on that line.

```
>DISP "1:TEST" 29
0029 3C00 0022
00 12 2A BD 76 8F ED 54 41 89 00 00 82 BC CC 76 89
10 78 88 3B BB 88 54 58 56 90 88 32 31 30 0D 00 00
20 89 55
002A 3C80 0003
00 FF FF FF
002B 3F00 0009
00 45 43 4B 4C 31 37 38 0D 00
002C 2B00 000
END-FILE
```

<The FILES command:>

FILES [<unit>]

The FILES command outputs a formatted display of the file information in a diskette directory to the system console. The unit number indicates which disk drive directory is to be displayed. If no unit is specified, unit 0 is assumed. Example:

```
>FILES 1
```

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DIR	03	0000
RES	03	0013
MDOS	0F	001C
LINEEDIT	15	000C
ASSM	15	0010
SYMSAVE15	0003	
FILECOPY15	0003	
DISKCOPY	0F	0009
BASIC	0F	004B

The files on drive one are displayed on the console. The left column contains the filename, the second column is the file type, and the third column contains the number of sectors the file uses. All numbers are in hex.

<The FREE command:>

FREE [<unit>]

The FREE command outputs to the system console the number of tracks left unallocated (free) on a diskette. The unit number indicates which disk drive. If no unit is specified, unit 0 is assumed. Example:

```
>FREE 1
003B
```

The diskette on drive one has 3B tracks available to be allocated.

<The SCRATCH command:>

SCRATCH "[unit:]<filename>"

The SCRATCH command removes a named file from the directory of a diskette and returns its allocated tracks to available status. Disk drive 0 is assumed if no unit is specified.

Note: Some files cannot be SCRATCHed without first changing the file TYPE.

<The LOAD command:>

The LOAD command loads (reads) a named file from a diskette into the computers memory and then returns control to the executive. If no unit number is specified, the file is expected to be found on unit 0.

The LOAD command can be used in conjunction with two categories of files, OBJECT files and DATA files. The specific nature of the load that is performed depends on the category of the specified file to be loaded. The process of LOADING an OBJECT file is described in THE LOAD COMMAND FOR OBJECT FILES. The process for LOADING a DATA file is described in THE LOAD COMMAND FOR DATA FILES.

<The LOAD command for object files:>

An OBJECT file is defined as any file with a file type value in the range 08 - 0B hex or 14 - 1B hex. These ranges include ASSM object files, BASIC 'save memory' files, executable system files, and executable user files.

The format of the LOAD command for OBJECT files is:

```
LOAD "[unit:] <filename>" [<start addr.>]
```

OBJECT files are LOADED by using the address and length information in the header of each record of the file. This is called a 'scatter load' because it permits records in the file to be loaded into non-contiguous portions of memory depending on the associated addresses. The LOAD is terminated when the first 0 length record in the file is encountered.

If the load address of the first record is less than 2B00 hex, the message LOAD ADDRESS ERROR is displayed because file may not be loaded beneath the application area.

If the optional start-address is specified in the LOAD command, then the first record of the file is loaded starting at the specified address. The load address in the record header of the first record is subtracted from the start-address to produce an offset. When the records following the first record of the file are loaded, the calculated offset is added to the load address in the record header and the record is loaded starting at the calculated address. This is called an 'offset scatter load'.

If the optional start-address is less than 2B00 the message LOAD ADDRESS ERROR is displayed.

<The LOAD command for data files:>

Any file which is not an OBJECT file and not an OVERLAY file is treated as a DATA file by the LOAD command. DATA files thereby include file type values in the ranges 0-7, 10-13 hex, and 1C-FF hex. These ranges cover BASIS DATA files, ASSM and LINEEDIT source files, BASIC program files and all of the unassigned file types.

The format of the LOAD command for DATA files is:

```
LOAD "[unit:] <filename>" <start addr.>
```

The start address parameter is mandatory. If a start address is not specified a SYNTAX ERROR message will be displayed. If the start address is less than 2B00 HEX a LOAD ADDRESS ERROR will result. This prevents accidental destruction of the operating system.

Data is loaded starting at the specified address and continuing until the number of records in the file as shown in the directory have been loaded. The data is loaded into memory sequentially and contiguously. Only the number of data bytes in each record are loaded. The LOAD command does not pad records of less than 256 bytes. If a file were loaded at location 3000 and the first record had only 4 data bytes in it, then the first data byte from the next record would be loaded at location 3004. Records with zero length are skipped over. The load address in the sector header has no meaning when doing a data LOAD.

<The SAVE command:>

```
SAVE "[unit:]<filename>" <start addr.> <end addr.> [<file type>] [<exec. addr.>]
```

The SAVE command saves (writes) a new file to a diskette from a block of memory. The file is written sequentially from the memory start address through the memory end address into full sequential records. If no unit number is specified, the file is written to unit 0. If a file type is not specified, the execution address of the file will be set to the start address of the memory block. Note that the type and execution address parameters are position dependent such that if an execution address is specified then a file must also be present. Example:

```
>SAVE "1:NEWFILE" 2B00 3700 0 3000
```

A file is created on the diskette in drive one with the name NEWFILE and the memory block from 2B00 to 3700 is written to that file. The file is given a type of 0 and the execution address saved with the file is 3000. If no execution address had been specified then 2B00 would be saved as the execution address.

<The RENAME command:>

```
RENAME "[unit:]<filename>" "new name>"
```

The RENAME command changes the name of a diskette file to a specified new name. If no unit number is specified, the file to be renamed is expected to be found on unit 0. Example:

```
>RENAME "1:OLDFILE" "NEWFILE"
```

The file named OLDFILE on the diskette in drive one is changed to NEWFILE on the diskette in drive one. The file type is unchanged by the renaming process.

<The TYPE command:>

```
TYPE "[unit:]<filename>" <type>
```

The TYPE command changes the type designation of a specified file. The type designation is a single hex byte.

Example:

```
>TYPE "1:PROGRAMX" 15
```

The type of the file PROGRAMX on disk drive one is changed to a value of 15.

<The APP command:>

```
APP ["<ASCII>"..."<ASCII>"] [<hex> <hex>...<hex>]
```

The APP command transfers program control from the executive to the start of the applications area at 2B00 hex. It expects a valid executable program to be in the applications area with its entry point at the beginning. Up to four ASCII parameters and four hex parameters can be passed to the program. For example, if you are doing several assemblies, the assembler need only be read into memory once from diskette as it does not change itself in the process of assembling a program. After it is once in memory the APP command can be used to communicate with the assembler.

Example:

```
>APP "1:SOURCE" "OBJECT" "P"
```

If the assembler were already in memory, the above example would transfer control and the necessary parameters to the program and the assembler would assemble the source file called SOURCE from drive one; produce an object file on drive 0 called OBJECT; and output a paginated listing on the print device.

The APP command functions like the EXEC command in that it PUSHes the address of the operating systems warm start entry point onto the system stack. Therefore if the program in the applications area does not provide its own stack, a RET would return control to the operating system.

<The EXEC command:>

```
EXEC <address>
```

The EXEC command transfers processor control directly to the specified memory address. It expects a valid program to begin at that address. The address of the operating systems warm start entry point is PUSHed onto the 8080's hardware stack by the EXEC command. Therefore, if the executed program does not set its own stack, a final RET in the program will return to the operating system. This feature allows subroutines to be exercised separate of the rest of a system under development.

<The MATH command:>

```
MATH <hex number> <hex number>
```

The MATH command performs 16 bit integer math functions on the two specified hex numbers. It displays the sum, difference, product, quotient, and modulus. Example:

```
>MATH 4 5  
0009 FFFF 0014 0000 0004
```

The results are displayed from left to right: $4+5=9$; $4-5=FFFF$; $4*5=14$; $4/5=0$ (integer division) and a remainder (modulus) of 4.

<PROMPT "<ASCII>":>

The PROMPT command sets the executive prompt string to the value of the ASCII string. The string can be up to ten characters long. Spaces are not allowed. The prompt is initially > when the system is configured. Example:

```
>PROMPT "***"  
**
```

The prompt is changed from > to a **

<The INIT command:>

INIT <unit>

The INIT command initializes a diskette in the specified drive. The drive unit number must be specified. The INIT command formats the diskette by writing an empty block with the correct track and sector identification on every sector of the diskette and reading each sector to verify the media. It creates a blank directory and places a system loader on the diskette. The INIT command essentially cleans the diskette of any data previously on the diskette and prepares it for new use. Accidental use of the INIT command could destroy the entire content of a diskette. Therefore, the system prompts ARE YOU SURE?. It waits for a 'Y' or 'N' response to indicate a yes or no. An 'N' cancels the command without doing any damage. Example:

```
INIT 1  
ARE YOU SURE?
```

The diskette on drive one will be initialized if a 'Y' if typed. All other replies will result in the command being canceled. Control returns to the executive.

SYSTEM OPERATION

MAIN OPERATIONS PROGRAM

The MAIN OPERATIONS PROGRAM is active upon initial system start-up. The MAIN OPERATIONS PROGRAM can also be entered from the DISK FILE EXECUTIVE. This is done in one of two ways. First by entering the implicit command from the console in response to the system prompt as follows:

```
>WENDEL11<cr>
```

The system diskette must be in the disk drive unit. The MAIN OPERATIONS PROGRAM will be loaded into system memory from the disk and executed.

The second method is by typing the explicit command from the console in response to the system prompt as follows:

```
>APP<cr>
```

The MAIN OPERATIONS PROGRAM must already reside in system memory to invoke this command. This method is often used to jump back and forth between the DISK FILE EXECUTIVE and the MAIN OPERATIONS PROGRAM. The system diskette does not need to be present for this method.

If you have performed some action while in the DISK FILE EXECUTIVE which has erased the MAIN OPERATIONS PROGRAM from system memory, then you must invoke the implicit command as stated in the section previous.

The MAIN OPERATIONS PROGRAM is the meat of the system. This is the program that outputs the drum sounds to the console, samples in sounds from the outside world, sequences the synthesizers, plays the click track etc. All the good stuff, you know what I mean?

The MAIN OPERATIONS PROGRAM will sign on with the following CRT display:

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001
buff port = 1F				ramp port = 1F											

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>>>Buffer11 ver X.xxxx. .vxxx..ready

]

<CRT DISPLAY:>

The CRT display is divided into two halves. The upper portion of the CRT does not scroll, or move off the screen at any time. This displays the current values used for timing delays, sound buffer beginning addresses and lengths and current ramp and buffer port assignments. The lower half of the screen displays console messages from the computer, and echos console input from the user.

An important feature of the lower half display is the way in which the data entered scrolls, or moves up the screen as new data is input from the keyboard. When a command is typed followed by a <cr>, the cursor does not move to the beginning of the next line, but to the middle of the screen on the same line. This allows 24 previous commands to be viewed as opposed to only 12 if the bottom half of the screen scrolled up in the normal manner.

The top half of the screen is divided into three sections. The upper section displays the data used for delays. There are 16 delay counters numbered 0 thru F. Each counter contains four digits in hexadecimal notation. As the data in the internal delay counters changes, so does the display.

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF															

The center section displays the data for each of 16 internal sound buffer areas. The center section takes two rows on the screen because there is twice as much data to display. The data is buffer start addresses, located under the "S", and buffer length, located under the "L". (Notice how well that seems to work out?). The number of the buffer is located between the "S" and the "L" like this:

S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001

This display shows that all buffers start at 4000 hex and are only 0001 byte long. This is the normal initial set-up condition

The lower section displays the current assignable port through which the drum sounds will emerge, and looks like this:

buff port = 1F ramp port = 1F

The sign-on message only appears when the MAIN OPERATIONS PROGRAM is entered from initial system startup or upon return from the DISK FILE EXECUTIVE.

<SUBSYSTEM COMMANDS:>

There are several subsystem commands associated with the MAIN OPERATIONS PROGRAM. These will each be discussed in detail with examples of the command entry and a sample CRT display for each command. Multiple commands including short form commands will be used where possible. Each CRT display will include all previous commands as it would on the actual CRT.

The lower half of the CRT display below shows a list of the subsystem commands.

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1F				ramp port = 1F											

G - go run main program
 K - clicks. uses 1E.1F.X0
 M - assign ramp I/O port
 P - output 1 ramp..X1=S1 etc.
 R - display all registers
 T - assign trigger port
 X - set delay counter
 Z - display command list
 # - continuous A/D-D/A
]

I - assign buffer I/O port
 L - set buffer length
 O - output 1 buffer (immediate)
 Q - re-init buffer program
 S - set buffer start
 W - warm start WDOS
 Y - init delays & buffers
 * - input one buffer (immediate)
 \$ - continuous display A/D byte

Z - display command list:

Typing the following in response to the system prompt "]" will result in the above display of the command list.

]Z<cr>

X - set delay counter:

This command changes the value of the delay counter. The delay counter is used to set the tempo of the click track and to vary the amount of delay before outputting a drum or percussion sound, or to vary the delay between the trigger and a sequence pulse to a synthesizer. The command is issued by entering the amount of delay in hexadecimal followed by the command "X" and the number of the specific delay counter to be set. An example command sequence is:

```
]6700X3<cr>
]X6<cr>
]X8<cr>
```

This command would place the value 6700 hex into delay counters number 3, 6, and 8. Note that the higher the number, the shorter the delay time. That is, FFFF would be the shortest amount of time (no delay) and 0000 would be the longest delay possible.

The top half of the screen would immediately update to show the change to delay counters number 3, 6, and 8 and the cursor would advance to the next portion of the screen and re-display the cursor.

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L		S-1-L		S-2-L		S-3-L		S-4-L		S-5-L		S-6-L		S-7-L	
4000 0001		4000 0001		4000 0001		4000 0001		4000 0001		4000 0001		4000 0001		4000 0001	
S-8-L		S-9-L		S-A-L		S-B-L		S-C-L		S-D-L		S-E-L		S-F-L	
4000 0001		4000 0001		4000 0001		4000 0001		4000 0001		4000 0001		4000 0001		4000 0001	
buff port = 1F				ramp port = 1F											
]6700X3						]X6									
]X8]			

S - set buffer start:

This command changes the value of the buffer start address. This data is used by the drum program so that it knows where in system memory to get the drum sound you want to put out. The command is issued by entering the starting address of the drum sound followed by the command "S" and the number of the buffer to which that address is to be assigned. An example of the command sequence would be:

```
]B400S1<cr>
]S2<cr>
]C000S5<cr>
```

This command would place the address B400 hex into buffer start number 1 and buffer start number 2, and place the address C000 hex into buffer start number 5.

The top half of the screen will be updated as follows:

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	B400 0001	B400 0001	4000 0001	4000 0001	C000 0001	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1F				ramp port = 1F											
]6700X3								]X6							
]X8								]B400S1							
]S2								]C000S5							
]															

L - set buffer length:

This command changes the value of the buffer length. This data is used in conjunction with the buffer start address to tell the drum program how much data to output during a drum sound. The command is issued by entering the length of the buffer followed by the command "L" and the number of the buffer whose length you are changing. An example of the command would be:

```
]3100L1<cr>
]1A00L2<cr>
]L5<cr>
```

This command would place the length 3100 hex into buffer 1, and the length 1A00 hex into buffers 2 and 5. The screen would show the changes thus:

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L		S-1-L		S-2-L		S-3-L		S-4-L		S-5-L		S-6-L		S-7-L	
4000 0001		B400 3100		B400 1A00		4000 0001		4000 0001		C000 1A00		4000 0001		4000 0001	
S-8-L		S-9-L		S-A-L		S-B-L		S-C-L		S-D-L		S-E-L		S-F-L	
4000 0001		4000 0001		4000 0001		4000 0001		4000 0001		4000 0001		4000 0001		4000 0001	
buff port = 1F				ramp port = 1F											
]6700X3								]X6							
]X8								]B400S1							
]S2								]C000S5							
]3100L1								]1A00L2							
]L5]											

I - assign buffer I/O port:

This command manually assigns the current buffer output port. This command is issued by entering the command "I" followed by the last digit of the desired port. The valid range of port assignments is from 19 to 1F. Any value entered less than 9 will default to a 9. To assign I/O port 1C the command sequence would be:

]IC<cr>

M - assign ramp port:

This command manually assigns the current ramp I/O port. The ramp port is used for synthesizer VCA and ENVELOPE generation. The forms and limits of the command are the same as buffer I/O above. An example of assigning ramp port 19 would be:

]M9<cr>

CRT display update would be:

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	B400 3100	B400 1A00	4000 0001	4000 0001	C000 1A00	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1C				ramp port = 19											
]6700X3				]X6											
]X8				]B400S1											
]S2				]C000S5											
]3100L1				]1A00L2											
]L5				]IC											
]M9]											

O - output 1 buffer (immediate):

This is the manual command for Wendel. When this mode is entered, the system will manually output a sound each time a key on the numeric key pad is typed. If you type "0", the computer will output the sound assigned to buffer 0 out port 1F. If you type "1", the computer will output the sound assigned to buffer 1 out port 1E. This allows you to manually play drum sounds and have each sound appear at a different fader for mixing and equalization.

KEY TYPED	BUFFER	PORT
0	0	1F
1	1	1E
2	2	1D
3	3	1C
4	4	1B
5	5	1A
6-F	6-F	19

To enter manual mode type "O<cr>". To exit type <cr> or any non hex key. When in manual there is no prompt and a message is displayed as illustrated below.

```

X0  X1  X2  X3  X4  X5  X6  X7  X8  X9  XA  XB  XC  XD  XE  XF
FFFF FFFF FFFF 6700 FFFF FFFF 6700 FFFF 6700 FFFF FFFF FFFF FFFF FFFF FFFF

S-O-L      S-1-L      S-2-L      S-3-L      S-4-L      S-5-L      S-6-L      S-7-L
4000 0001  B400 3100  B400 1A00  4000 0001  4000 0001  C000 1A00  4000 0001  4000 0001

S-8-L      S-9-L      S-A-L      S-B-L      S-C-L      S-D-L      S-E-L      S-F-L
4000 0001  4000 0001  4000 0001  4000 0001  4000 0001  4000 0001  4000 0001

buff port = 1C      ramp port = 19

]6700X3      ]X6
]X8          ]B400S1
]S2          ]C000S5
]3100L1      ]1A00L2
]L5          ]IC
]M9          ]O - output 1 buffer (immediate)
]

```

*** - input one buffer (immediate):**

This is the command that is used to input drum sounds manually into Wendel. When this mode is entered, Wendel will input the sound presented to the currently assigned I/O port and store the information in the specified buffer area. After entering the input mode, each subsequent typing of the return key will again sample the input port into the buffer, overwriting the data existing in the buffer previously.

It is always a good idea when inputting data to have a totally empty buffer area, and assign a starting address of 4000 and a length of 9FFF to the buffer used. This will help in case you are a little slow on the trigger when inputting new drum sounds. The command sequence to input one buffer full of data from the currently assigned I/O port to buffer 1 would be:

] *1 <cr>

The command sequence is terminated by typing any non hex key, such as the space bar.

CRT display update would be:

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	B400 3100	B400 1A00	4000 0001	4000 0001	C000 1A00	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1C				ramp port = 19											
]6700X3	]X6														
]X8	]B400S1														
]S2	]C000S5														
]3100L1	]1A00L2														
]L5	]IC														
]M9	]O - output 1 buffer (immediate)														
] *1 - input one buffer (immediate)]															

P - output 1 ramp..X1=S1 etc.:

This command initiates one ramp output to the currently assigned ramp port for single shot sequences to a synthesizer. This command is useful when testing VCA or envelope ramps one at a time to make sure that they are of the proper duration before running a program.

The command sequence consists of the "P" command followed by the number in hex of the ramp to be output. An example of outputting ramp 4 to the assigned ramp port would be:

]P4<cr>

CRT display update would be:

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	B400 3100	B400 1A00	4000 0001	4000 0001	C000 1A00	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								

buff port = 1C

ramp port = 19

```

6700X3      ]X6
]X8         ]B400S1
]S2         ]C000S5
]3100L1     ]1A00L2
]L5         ]IC
]M9         ]O - output 1 buffer (immediate)
]*1 - input one buffer (immediate)]P4 - output 1 ramp..X1=S1 etc.
]
    
```

T - assign trigger port:

The assign trigger port command changes the assignment of the trigger input to a port of your choosing. The normally assigned trigger port is 19 hex. The trigger signal conditioning circuits are physically tied to this input port, and under almost all circumstances the assignment should be left to this port. If there are some applications where it becomes necessary to bypass the trigger signal conditioning circuits, then this command is used to re-assign the port to the desired value. The command sequence is:

]TE<cr>

This sequence would assign the trigger port to 1E hex.

CRT display update would be:

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	B400 3100	B400 1A00	4000 0001	4000 0001	C000 1A00	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1C				ramp port = 19											

```
]6700X3      ]X6
]X8          ]B400S1
]S2          ]C000S5
]3100L1     ]1A00L2
]L5         ]IC
]M9         ]O - output 1 buffer (immediate)
]*1 - input one buffer (immediate)]P4 - output 1 ramp..X1=S1 etc.
]
```

Y - init delays & buffers:

The "Y" command initializes all of the delays to a minimum delay value of FFFF hex, initializes all of the buffer start addresses to 4000 hex and initializes all of the buffer lengths to 0001 hex. This is used to clear out all of the garbage left from a previously run program. The command sequence is:

]Y<cr>

R - display all registers:

The "R" command updates the top portion of the screen to reflect the values currently in effect. During program execution the screen is not updated due to the relatively large amount of time it takes compared to the program operations that are being performed. Therefore the "R" command allows the operator to update the display at a more convenient time. The command sequence is:

]R<cr>

Q - re-init buffer program:

The "Q" command is the only one that will allow you to exit from a running program. After exiting from a running program, the top half of the screen is updated to reflect the current data values, the bottom half of the screen is cleared and the system prompt is displayed. The command sequence is:

]Q<cr>

CRT display update would be:

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	B400 3100	B400 1A00	4000 0001	4000 0001	C000 1A00	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1C				ramp port = 19											

>>>Buffer11 ver X.xxxx. .vxxxx..ready
|

\$ - continuous display A/D byte:

The "\$" command is used to check the level of the in-coming A/D conversion. The value of the byte input from the currently assigned I/O port is displayed in real time in the upper left hand corner of the top half of the screen. The command sequence is terminated by typing any key on the keyboard. The command entry is as follows:

]\${cr}

CRT display update would be:

current A/D byte = F6

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	B400 3100	B400 1A00	4000 0001	4000 0001	C000 1A00	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1C				ramp port = 19											

>>>Buffer11 ver X.xxxx. .vxxxx..ready
]\$ - continuous display A/D byte]

- continuous A/D-D/A:

The "#" command is a continuous flow of data into the currently assigned I/O port input, and out through the currently assigned I/O output port. This allows the operator to listen to the sound that is being digitized to adjust the input level for optimum signal to noise level. This is similar to recording on a tape machine and monitoring the output. The command sequence is:

]#<cr>

Any key typed will terminate this command sequence.

CRT display update would be:

current A/D byte = F6

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	B400 3100	B400 1A00	4000 0001	4000 0001	C000 1A00	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1C				ramp port = 19											

>>>Buffer11 ver X.xxxx. .vxxxx..ready
]S - continuous display A/D byte]# - continuous A/D-D/A
]

W - warm start WDOS:

The "W" command is used to jump from the MAIN OPERATIONS PROGRAM to the DISK FILE EXECUTIVE. The command sequence is:

]W<cr>

To return to the MAIN OPERATIONS PROGRAM, type APP<cr> in response to the DISK EXECUTIVE prompt ">".

CRT display after the "W" command will be:

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>

The commands available are listed under SYSTEM OPERATION, DISK FILE EXECUTIVE in this manual.

G - go run main program:

The "G" command executes a system program for playing drum sounds by following the trigger from an external source. Thorough explanation of this command will be found under SYSTEM OPERATION, USER PROGRAMMING and RUNNING USER PROGRAMS. The command sequence is:

]G<cr>

The cursor will remain at the end of the prompt line until one bar of music has passed, then the cursor will advance to the beginning of the next command line after the prompt. This tells the operator that Wendel is receiving the trigger information properly.

While Wendel is executing a user program, any of the MAIN OPERATIONS PROGRAM commands may be executed. The command is entered with the normal command sequence, but the command will not be executed until the end of the current bar of music being played. When the command is executed, the cursor will advance to the beginning of the next command line and the prompt will be displayed.

CRT display update would be:

current A/D byte = F6

X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
FFFF	FFFF	FFFF	6700	FFFF	FFFF	6700	FFFF	6700	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
S-O-L	S-1-L	S-2-L	S-3-L	S-4-L	S-5-L	S-6-L	S-7-L								
4000 0001	B400 3100	B400 1A00	4000 0001	4000 0001	C000 1A00	4000 0001	4000 0001								
S-8-L	S-9-L	S-A-L	S-B-L	S-C-L	S-D-L	S-E-L	S-F-L								
4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001	4000 0001								
buff port = 1C				ramp port = 19											

```
>>>Buffer11 ver X.xxxx. .vxxxx..ready
]S - continuous display A/D byte ]# - continuous A/D-D/A
]
```

This concludes the description of the MAIN OPERATIONS PROGRAM commands. A word of caution is in order for commands entered during the running of a USER PROGRAM. The "R" command takes a significant amount of time to perform, and may have an effect on the performance of the program being run. Usually other commands entered during a running USER PROGRAM are during the testing and fine tuning stages, so a misplaced beat is secondary to the command entry that is being performed. Most commands, such as the "S", "X", and "L" commands will have no adverse effects on the running program. These will be entered to change the pre-programmed delays and buffer lengths to get "just the sound you were looking for".

Experimentation is encouraged. Wendel was developed by experimenting with different parameters with a "what if" attitude. Your imagination is the only limit to the number of things Wendel is capable of doing.

Keep up the good work.

