DRUMULATOR OWNER'S MANUAL

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Version 2.1

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E-mu Systems Inc
Applied Magic for the Arts

How to Use this Manual

You can use this manual to line bird cages, as kindling when starting a fire in the fireplace, as the raw material for creating paper gliders, or most importantly, as a guide to help you get the most out of the Drumulator.

Sections 1, 2, and 3 will acquaint you with the most common Drumulator functions. The further you go into each section, the more advanced the information. So, don't try to absorb a whole section at a time; experiment with the buttons and controls as you go along.

Section 4 describes the cassette interface, while Section 5 describes the various control jacks on the back. Section 6 deals with how to best use the Drumulator in studio environments.

Section 7 is a short-form summary of all the various functions presented in the first 6 sections. Once you become familiar with the Drumulator, this may be the only section, which you will ever need to refer to.

The Appendix contains background information, which you might find interesting. Or you might not. In any event, it's optional reading.

How else can you use this manual?

There are lots of ways, but for the moment, let's stick to its intended purpose. Flip the page, set up the Drumulator, and prepare to make some absolutely fantastic drum sounds.

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Drumulator Overview

The Drumulator is a rhythm/drum machine that features twelve digitally recorded drum sounds stored on computer chips, and extensive solid-state recording capabilities. You may record up to 36 individual rhythm patterns (called *segments),* and then combine these segments in just about any order imaginable to create up to 8 *songs.*

When composing/recording a segment (which can be up to 99 measures long!), a metronome click indicates the tempo, and a light shows the beginning of the segment. To record, say, the bass drum part of a rhythm, you listen to the metronome and play the bass drum wherever you want it to occur in the segment. The Drumulator then remembers where you wanted the bass drum, and can even correct for timing inaccuracies. You may record up to four drum sounds at any one time; you may then stop recording, change over to four new drum sounds, resume recording, and continue "overdubbing" these new drums for up to 12 drum parts. You can edit the part as you go along (erase some sounds, add others, erase only certain beats of certain sounds, and so on), alter the dynamics of each drum, and vary the overall mix of the drums.

You may play segments individually or combine them into songs. To create a song, you tell the machine which segments you want to use, the order you want them in, and any repeats, which might occur in the song. If you want to edit the song, no problem: you can insert new segments, delete old ones, add repeats, change tempos in the middle of a song, or even jump automatically to a different song after the first one has finished playing.

The Drumulator lets you create virtually any time signature you want, includes built -in battery backup which stores the segments and songs for up to five years (or, transfer this data over to cassette for permanent storage), provides long and short "beep" messages to confirm your instructions and advise you of the Drumulator's status, and is compatible with any device that can drive other drum units — and even some devices which can't drive other drum units.

There's more, too . . . and as you might expect, this all takes some time to learn. So, settle in with this manual, and explore the Drumulator's many possibilities.

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SECTION 1: GETTING READY

1A Hooking up the Drumulator.

1B Instant Gratification!

1C Assigning Drum Sounds to Play Buttons

1D Setting Drum/Percussion Levels

1E Setting Drum/Percussion Accents

1F Playing Back Segments

1G Setting Tempo

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1A Hooking up the Drumulator

Important: The Drumulator was set for the AC voltage indicated on the sticker attached to the Drumulator's AC plug. If this voltage does not agree with the AC voltage present in your part of the world, ***before turning on the Drumulator*** make sure the Drumulator is unplugged; then, remove the bottom plate, locate the voltage selector switch (near the ON-OFF switch), and set it to the correct AC voltage.

1. To prevent obstruction of the ventilation holes in the Drumulator's bottom plate, set up the Drumulator on a *hard* surface.

2. Patch a standard, guitar-type patch cord between the **MIX OUT** jack on the rear panel, and a high quality amp or mixing console. The better the sound system, the more life-like the sound of the Drumulator.

3. For private practice, plug high sensitivity earphones into the MIX **OUT** jack. An adapter (such as Radio Shack #274-367) will be required if your phones use ½"' diameter instead of ¼" plugs. You will hear the sound only in one ear (however, if you pull the plug outwards just a tiny bit from its fully seated position, in some cases you will hear the drums in both ears).

4. Make sure the ON-OFF switch is in the OFF position. Plug the line cord into a three-wire AC outlet. If only a two-wire outlet is available, you must use a 3-wire to 2-wire adapter (available at any hardware store). This adapter will have a wire coming out of it, which should hook underneath the screw holding the AC receptacle faceplate in place (this assumes the screw is metal and contacts the junction box ground).

5. Turn the **MIX VOLUME** and **METRONOME VOLUME** controls all the way to the left.

6. Turn the ON-OFF switch to ON; the Drumulator will run two self-tests. First, all LED's will light up briefly to show they're working properly. Second, there will be a memory integrity test. If there is any problem (bad back-up battery, parts failure, or whatever), the display will read **bAd.**

   Should the display read bAd, turn off the Drumulator, wait 10 seconds, and then turn it back on again. If the display continues to read bAd, clear the memory as described in Section 2M. If the **bAd** indication persists, contact your dealer.

7. Press switches A through D while turning up the **MIX VOLUME** control. You should start hearing drum sounds, and very realistic ones at that. Feel perfectly free to get carried away for a while playing those four sounds, but you should know there are eight other sounds available, so proceed whenever you're ready.

8. Turn up the **METRONOME VOLUME** control approximately half way (this is a preliminary setting; adjust to suit later on). The Drumulator sends beeps through the metronome channel to signal you about such things as how it feels, and whether you've entered instructions properly or not. Note that the **MIX VOLUME** control serves as a master volume control for both the Metronome volume and the various drum sounds.

Instant Gratification! 1B

Yes, the Drumulator is an extremely versatile device. But that versatility means that in order to learn about *all* the options, you'll have to spend one or two hours with the Drumulator and this manual.

If you're patient enough to actually do that right now, we salute your will power. Chances are, though, you can hardly wait to start making some sounds. So, we'll short circuit the learning process a bit with this little exercise. Follow these steps **EXACTLY** as given:

1. Hook up the Drumulator as described before.

2. Push the **SONG/SEGMENT** button until the **SEGMENT** light glows.

3. Locate the buttons numbered 1 - 8. Press 5 and then press 1. The right hand display shows 51.

4. Hold down **RECORD** and press **RUN/ STOP;** the left-hand display shows **rc**, the RUN/ STOP light glows, and you should hear the metronome (if not, check the **METRONOME VOLUME** control).

5. Press the **A** button to play the bass drum. After two measures, whatever you played will be repeated. Continue adding bass drum parts if desired.

6. Press the **B** button to play the snare drum. After two measures, whatever you played will be repeated. Continue adding snare drum parts if desired.

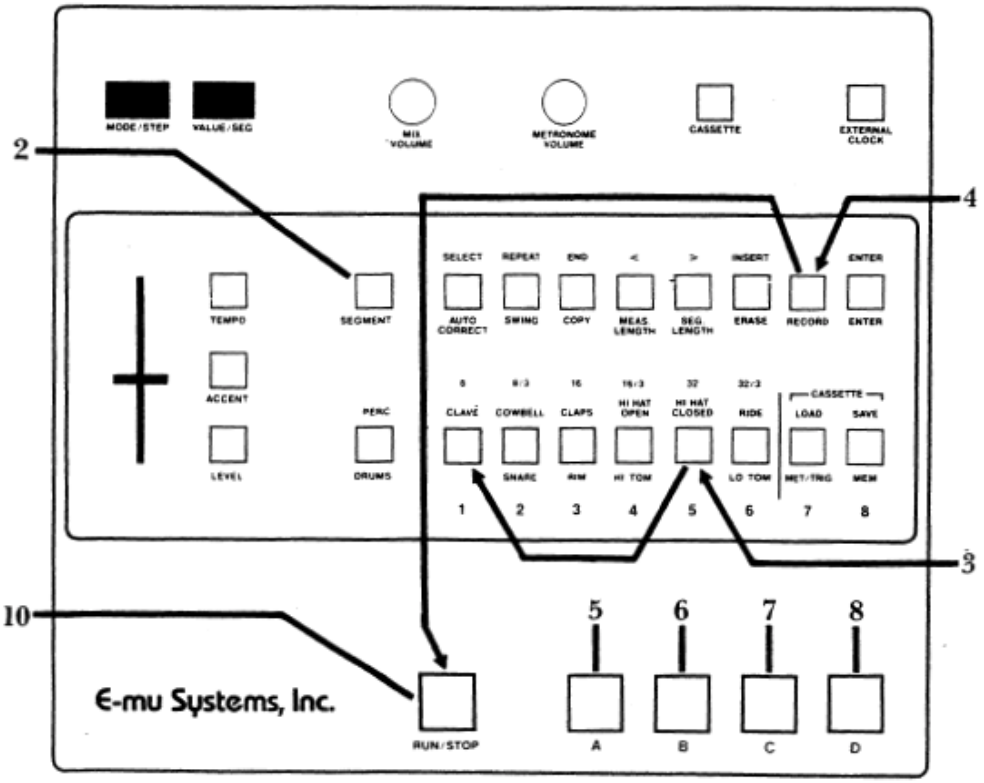
7. Press the **C** button to play the cowbell. After two measures, whatever you played wiil be repeated. Continue adding cowbell parts if desired.

8. Press the **D** button to play the ride cymbal. After two measures, whatever you played will be repeated. Continue adding ride cymbal parts if desired.

9. For now, you can only play 8th notes; later on, we'll cover how to play notes as fast as 32nd note triplets.

10. When you've finished recording, press **RUN/STOP** (the RUN/STOP light goes out). To play back what you've recorded, press **RUN/STOP** again (RUN/STOP light glows).

11. **Congratulations!** You have now experienced about 1% of the Drumulator's capabilities. To find out about the other 99% keep reading.



1C Assigning Drum Sounds to Play Buttons

When you turn on the Drumulator, Drum Play buttons **A - D** play four different drum sounds (**A**=BASS, **B**=SNARE, **C**=COWBELL, **D**=RIDE). The following procedure lets you assign any of the 12 drum sounds to any Drum Play button:

1. Press the **PERC/DRUMS** button a few times. When the PERC light is on, you may assign any of the upper row percussion sounds to the Drum Play buttons. When the DRUMS light is on, you may assign any of the lower row drum sounds.

2. To assign a lower row drum sound to a Drum Play button, use the **PERC/DRUMS** switch to turn on the DRUMS light.

3. Hold down any Drum Play button, and continue holding it down while you tap any Drum/-Percussion Sound Select button. In the picture, the **HI TOM** is being assigned to button A.

4. To assign an upper row percussion sound to a Drum Play button, use the PERC/DRUMS switch to turn on the **PERC** light.

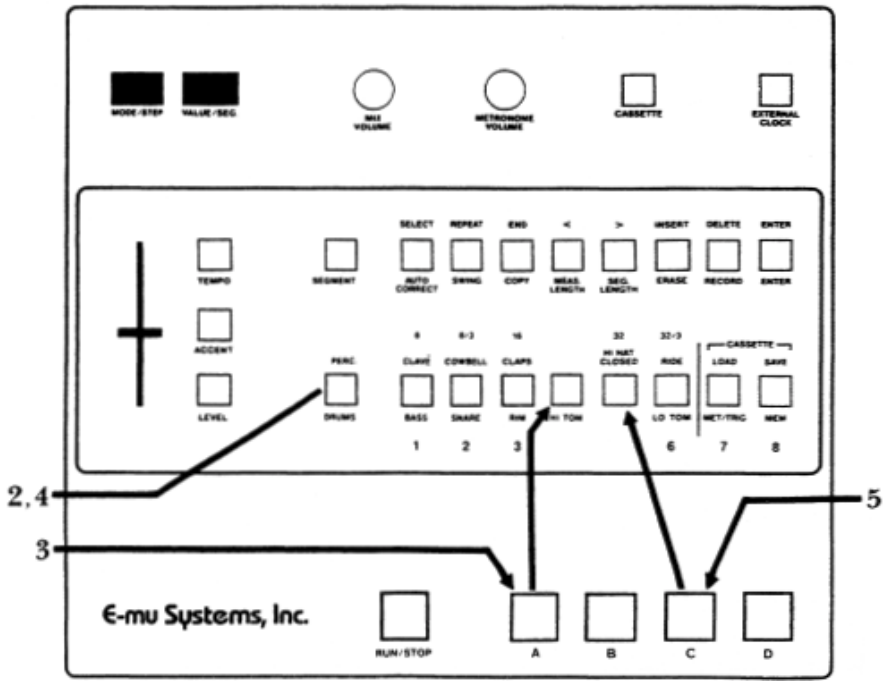
5. Hold down any Drum Play button, and continue holding it down while you tap any Drum/ Percussion Sound Select button. In this example, the **HI HAT CLOSED** is being assigned to button C. Hold down the Drum Play button to be assigned and tap **ACCENT.** While continuing to hold down the Drum Play button, press the Drum Select button corresponding to the drum/percussion sound you want accented. Try assigning the non-accented and accented versions of a drum sound to adjacent buttons, and play both in order to hear the difference between the two sounds.

6. You may also assign an accented (louder) version of any drum sound to any Drum Play button.

Notes:
To rapidly audition the various drum sounds, hold down any Drum Play button while tapping the six Drum/Percussion Sound Select buttons. If the PERC light is on, you will hear the upper row of percussion sounds. If the DRUMS light is on, you will hear the lower row of drum sounds. You can use the PERC/DRUM switch to change from drum sounds to percussion sounds while a Drum Play button is being held down.

You may assign one drum to more than one button: if you want four snares, you got 'em.

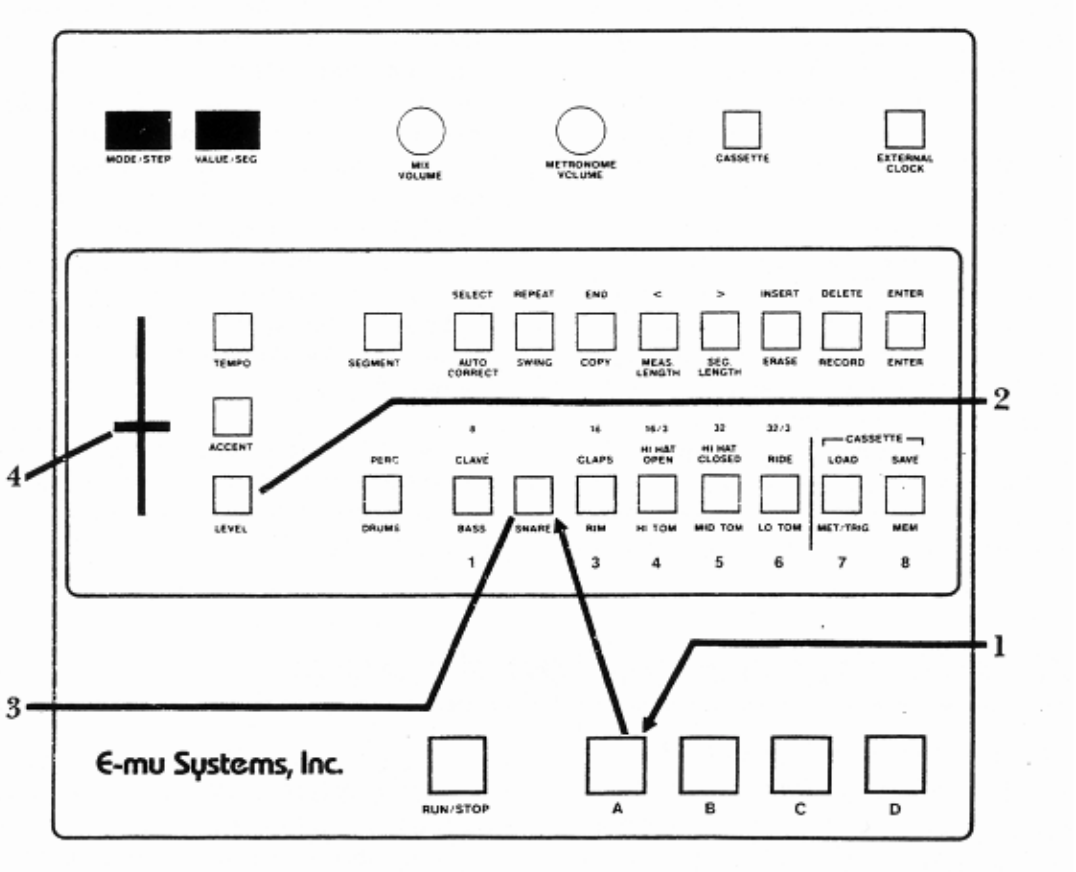
Help:
If the right-most display digit shows a flashing bar (called a *cursor),* you have pressed a Drum/Percussion Sound Select button without first holding down a Drum Play button — and the Drumulator now thinks that you have started to choose a segment (Section 1F describes choosing segments in detail). To extricate yourself, press the ENTER button; the cursor will go away, and you may then continue assigning drum sounds to play buttons.



Setting Segment Drum/Percussion Levels 1D

Each drum sound may have any one of 15 different volume levels, from 0 (full off) to 15 (full blast). When you turn on the Drumulator, the drums assume whatever levels were programmed for Song 1. You may change drum levels with the following procedure; but first, push the **SONG/ SEGMENT** button so that the **SEGMENT** light glows. Otherwise, you will end up altering the mix of a song instead of a segment (Section 3G describes altering drum levels while in *song* mode).

Note that segment levels are "remembered" by the Drumulator only while you are in *segment* mode. If you switch over to *song* mode, as described in Section 3, the Drumulator acquires the mix of the selected song. If you then switch back to *segment* mode, the Drumulator will retain the song mix.



1. Assign a drum/percussion sound to a Drum Play button. For now, assign the snare drum sound to Drum Play button **A** by pressing and holding Drum Play button **A** and tapping the SNARE Sound Select button.

2. Press **LEVEL.** The left-hand display shows **LE.**

3. Press the SNARE Sound Select button. (Remember - the DRUMS light must he lit, because if the PERC light is lit. you will be altering the COWBELL level instead of the SNARE.) The display shows **LE** and a number between 0 and 15, which is the existing snare drum volume level.

4. The slider varies the drum level from 0 to 15. However, the slider is not active *until it moves past the position, which corresponds, to its present value.* For example, if the current programmed level is 12 and the slider is all the way down (corresponding to a value of 0), you would need to move the slider *up* until it moved past 12. If the slider was all the way up (corresponding to a value of 15), you would need to move the slider *down* until it moved past 12. After passing the current value, moving the slider will instantly vary the numbers in the display.

To hear the different possible snare drum volume levels, tap Drum Play button A as you move the slider (note the changing display numbers). When you reach the desired level, press **ENTER.**

Notes:

- You may set levels while the Drumulator is running (although not while it is in *record* mode). This is useful when you have completed a song or segment and want to set the final mix while listening to all of the parts.
- There's a shortcut if you want to alter the levels of several drums. First, you don't have to assign a drum/percussion sound to a Drum Play button in order to change the level (we just did that so you could hear the level changes as you moved the slider). As you become familiar with the Drumulator, you will often be able to set levels 'by the numbers" since you will know what level to expect for various settings. Second, you don't have to press **ENTER** after setting each drum level; you can move right along to the next drum, pressing ENTER only when you've finished all your level setting. For example, to set multiple drum/percussion levels:

1. Press **LEVEL.**
2. Press the appropriate Drum/Percussion Sound Select button (remember to set the **PERC /DRUMS** for the desired row of drum or percussion sounds).
3. Move the slider. When you reach the desired value, press the Drum/Percussion Sound Select button corresponding to the *next* sound you want to adjust. This enters the volume level for the drum sound you selected initially, and simultaneously prepares you to enter the next drum sound level. (You may use the
4. PERC./DRUMS switch at any point to change from upper row percussion sounds to lower row drum sounds.)

5. After setting the level of the last Drum/Percussion Sound Select button you want to adjust, press **ENTER.**

- You may set all levels to 0 (all drums muted) by pressing **LEVEL** to enter *level* mode, and then pressing and holding **LEVEL** while pressing ENTER. A beep confirms that all drum levels are now at 0. This feature is useful if you're not pleased with a mix and want to start over from scratch.
- Be careful when you set all levels to 0. Suppose you are working on a song (as described in Section 3), and start a song mix from scratch by initially setting all levels to 0. If you set your song mix and then change over to *segment* mode, any instrument which you didn't bring up from the initial 0 level (say, because you didn't use that particular sound in a song) will remain at 0. Thus, if you try to use that sound in the segment, it will appear that the sound isn't working. You don't have to be too concerned about this right now, but if at some point it seems that the Drumulator is broken and not producing certain drum sounds, check the drum levels to make sure you didn't inadvertently set them to 0.
- After you've finished setting a level or levels, always remember to press ENTER. **LE** should only appear in the left hand display when you are actually setting levels.

1E Setting Drum/Percussion Accents

Accenting lets you add dynamics to a drum part, thereby allowing for greater expressiveness. You may assign a single drum or percussion sound to *two* Drum Play buttons, with one Play button set for one level, and the other set for an accented (louder) level.

Like volume levels, accents go from **0** (no accent) to **15** (maximum accent). This represents a level change, which adds to the existing volume level. The existing volume level and accent cannot total more than 15; for example, a snare sound with a level of 10 can have an accent of 1, 2, 3, 4, or 5, but any greater accent would exceed 15, which is the maximum allowable volume. Selecting an accent of, say, 15 in this instance won't hurt anything, but the accent will be no louder than if you had chosen an accent of 5.

Here's how to set an accent; if necessary, push the **SONG/SEGMENT** button to make sure that the SEGMENT light glows. (Note: the accompanying drawing shows how to set the accent for the snare drum).

1. Assign the non-accented drum/percussion sound to Drum Play button A by holding down Drum Play button A and tapping the desired Drum Sound button.

2. Assign the accented drum/percussion sound to Drum Play button B by holding down Drum Play button B and tapping ACCENT. While continuing to hold down the Drum Play button, tap the Drum Sound button corresponding to the sound you want accented.

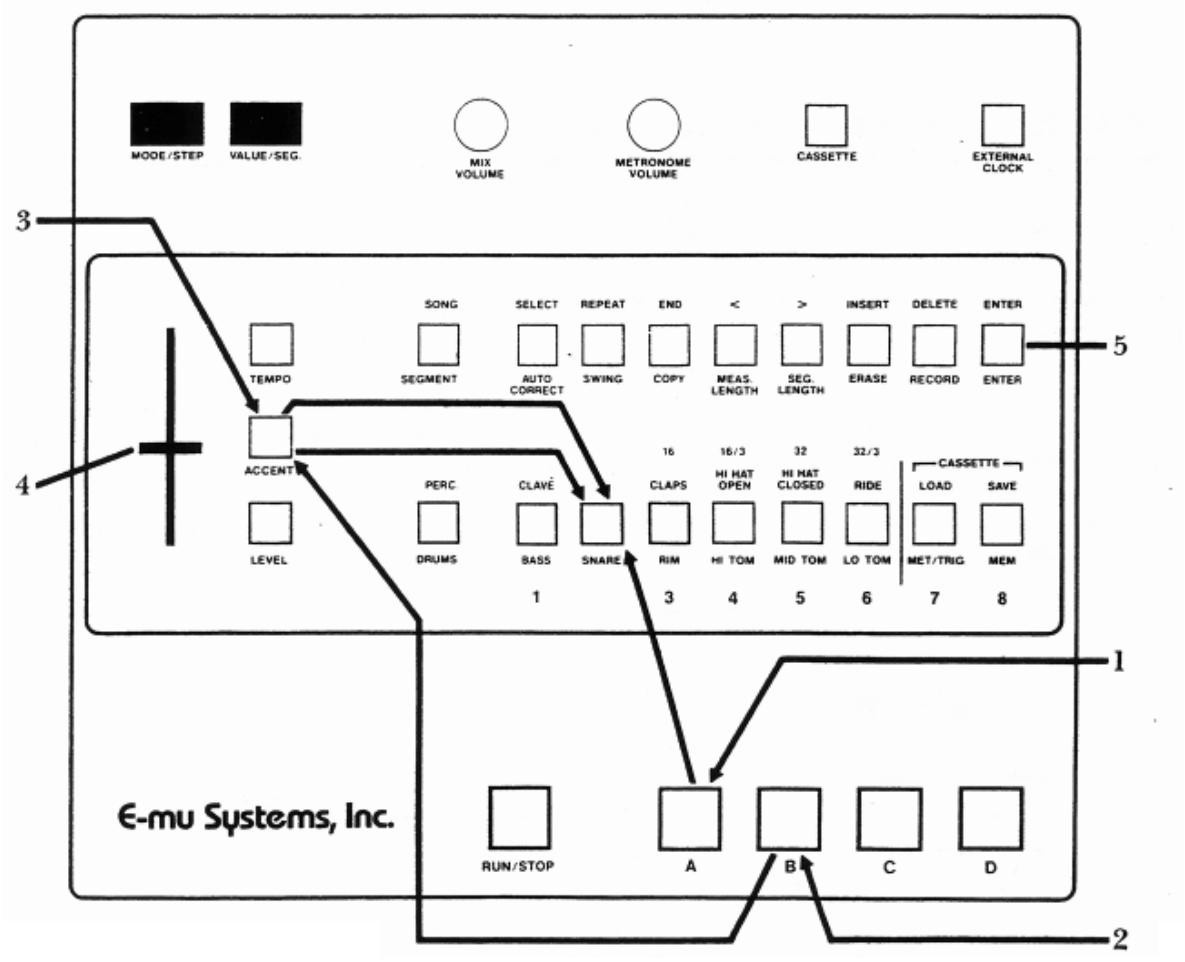
3. To set the accent, press **ACCENT** (left display shows **AC),** then the Drum Sound button whose accent you want to set. The right-hand display shows the current accent for the chosen drum sound.

4. Move the slider while alternately tapping the non-accented and accented Drum Play buttons to hear the effect of different accents. As with level setting (Section 1D), the slider is not active until it moves past the position, which corresponds, to its present value. For example, if the current programmed accent is 3 and the slider is all the way down (corresponding to a value of 0), you would need to move the slider *up* until it moved past 3. If the slider is set above 3, you would need to move the slider *down* until it moved below 3. After passing the current value, moving the slider will instantly vary the number in the display. An accent of 0 produces no level difference between the two play buttons; as you increase the accent, the accented drum will become louder, providing that the sum of the level and accent values does not exceed 15.

5. After selecting the desired accent, press **ENTER.**

Notes:

- If you press the **ACCENT** button and a Drum Sound Select button, and the readout shows an accent setting that is already correct, either press **ENTER** or press the next Sound Select button whose accent you want to vary.
- The accent "floats'' with any level changes. For example, if the snare drum level is 10 and the accent is 3, the overall volume level of the accented drum is 13. If you later change the snare drum level to 8, the accent will still be 3, and the overall level of the accented drum will now be 11.
- After you've finished setting the accent, remember to press **ENTER. AC** should only appear in the left hand display when you are actually setting accents.
- In most cases, you'll want to assign the normal drum / percussion sound to one Drum Play button and the accented sound to another Drum Play button. This way, both sounds are available for playing.
- When you turn on the Drumulator the drums assume whatever accent levels were programmed for Song 1. However if you clear all memory (see Section 2M), all drums assume the levels given in the appendix.



- When accenting drums, you will usually want to use modest accent levels (1 to 3). Greater accents are more useful with percussion sounds. For example, programming the cowbell to appear every single beat with a consistent volume level can sound very artificial, since most percussionists like to accent certain beats. In a case like this, set a low cowbell level (say, 3), an accent of 4 or 5, and use the accent to emphasize certain beats (such as beats 2 and 4 in 4/4 music).

- If a drum sound level is 0, the accented version will also be silent, regardless of the accent setting.

- You can set accents while the Drumulator is running (but not while it is in *record* mode).

Help:

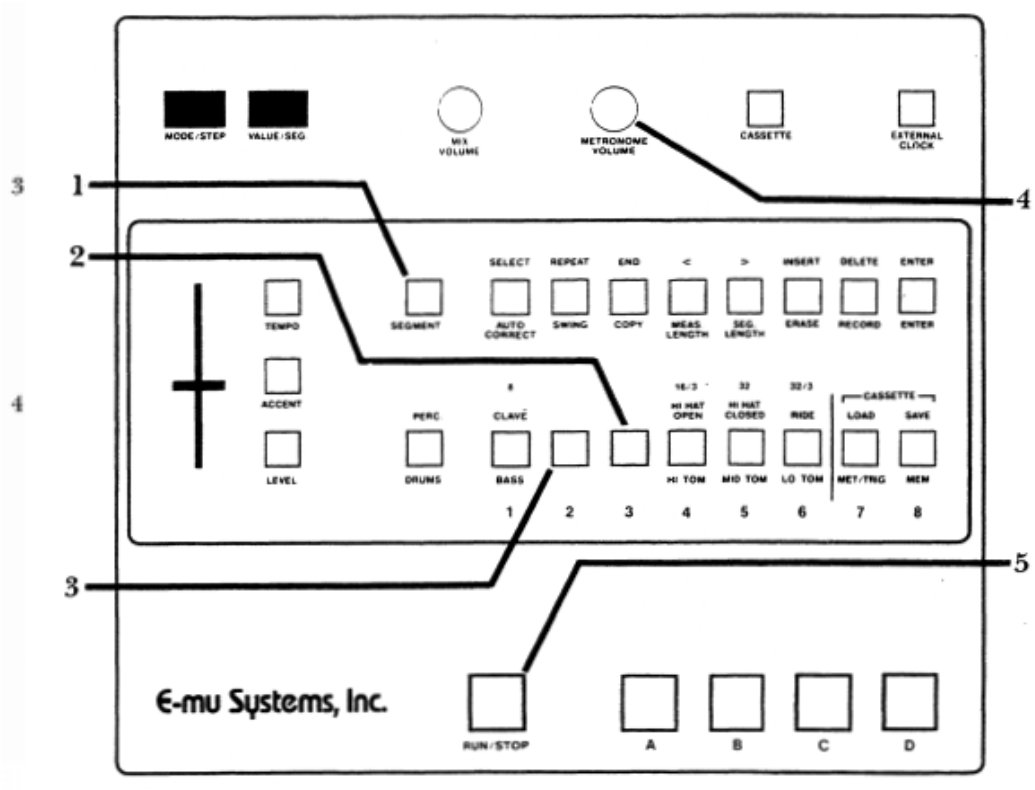
- If adding an accent doesn't appear to affect the sound, check the level of the sound you're attempting to accent. Remember that the level number and accent number must be less than or equal to 15; if the drum sound is programmed for a high volume level, adding accent may not make a very dramatic difference.

1F Playing Back Segments

You can record and play back 36 rhythm patterns, called *segments.* These are organized as 6 banks of 6 segments. Several segments were loaded into the Drumulator at the factory; here is how to play them.

1. Press the SONG/SEGMENT button a few times. The SEGMENT light shows you are in *segment* mode, and can play back or record segments. The SONG light shows you are in *song* nnode. For now, choose the *segment* mode.

2. When in *segment* mode, if you are not holding down a Drum Play button in order to assign a drum sound, the six Drum Sound Select buttons turn into bank: segment select buttons. (The setting of the **PERC/DRUMS** switch does not matter in this mode, or for that matter, any mode other than assigning drum sounds to Drum Play buttons.) Press one of these buttons to select the bank (in the example, we've selecting bank 3). The 2nd display from the right will show this bank number, while the right-most display will show a flashing cursor (this indicates that the Drumulator now expects the segment number).



3. Press one of the six bank/segment select buttons to select the segment; this number replaces the blinking cursor. In this example, we're selecting segment 2.

4. Make sure **METRONOME LEVEL** is up so that you can hear any beep messages from the Drumulator in subsequent steps.

5. Press **RUN/STOP.** Several things will happen: the segment will play continuously, the RUN/STOP light will glow (except for a blink at the beginning of the segment), and you will hear a metronome clicking along with the segment (adjust METRONOME **LEVEL** to suit). If instead of hearing a rhythm pattern you hear a beep, the segment you've selected has never been put in *record* mode (which means it cannot contain any drum sounds). Key in a different bank, and segment number. To stop a segment, press RUN/STOP a second time.

6. Repeat steps 2 and 3 to select another bank/segment. If the Drumulator is running, the new segment will begin playing as soon as the current segment ends. If the current segment ends and the Drumulator stops (light goes off), the new segment you've selected is empty.

Help:

- If you press the **RUN/STOP** switch to start a segment but hear a long beep instead, nothing is recorded in that segment.

- Remember as you go through any of these examples that the **ENTER** button, in addition to its normal enter function, is a fail-safe/reset button as long as the display shows a flashing cursor. For example, if you enter the wrong bank number accidentally, before doing anything else press **ENTER**. This restores the Drumulator to where it was before you hit the wrong key.

Setting Tempo 1G

The tempo may be varied from 40 to 240 Beats Per Minute. As with mix information, tempo settings are "remembered" by the Drumulator only while you are in *segment* mode. If you switch over to *song* mode, as described in Section 3, the Drumulator acquires the tempo of the selected song. If you then switch back to *segment* mode, the Drumulator will retain the song tempo.

1. To change tempo (the Drumulator may be stopped or running), press **TEMPO.** The left most display shows half a **T** (short for TEMPO); the other three digits show the tempo in beats per minute (BPM). Vary the slider to select the new tempo (remember — as with level and accent level setting, the slider is not active until it moves past the position which corresponds to its present value). After passing the current value, moving the slider will instantly vary the numbers in the display.

2. When you find the right tempo press **ENTER**. This tempo change affects all segments when you are in segment mode.

Programming the Metronome 1H

When playing back or recording segments, you can program the metronome for a variety of different beats. The metronome produces an accented click on the first beat of each measure and a softer click on the other beats.

1. The Drumulator must be stopped **(RUN/ STOP** light is off), and the **SEGMENT** light must be on.

2. Press **MET/TRIG.** The left display shows **ME** (well, actually the M looks more like an upside down U, but those are the breaks) to show you're in Metronome Program mode, and the right display will probably show the number 4. The four indicates that the metronome is programmed to give a click every 1/4 (quarter) note. The Drumulator assumes this setting when you first turn it on.

3. While in *metronome* mode, the six Drum Sound Select buttons become Metronome Beat Select buttons. (The **PERC/DRUMS** switch setting does not matter in this mode.)

The following summarizes your options:

Button Legend	Metronome Clicks Every	Right Display Reads
MET/TRIG	Quarter note	4
8	8th note	8
8/3	8th note triplet	.8.
16	16th note	16
16/3	16th note triplet	.16.
32	32nd note	32
32/3	32nd note triplet	.32.

After selecting the desired click rate, press **ENTER.**

4. To return to quarter note clicks, press **MET/TRIG** to enter *metronome* mode, press **MET/ TRIG** again, then press ENTER.

Notes:

- In addition to the click, which occurs on each heat, there is a louder (accented) click on the first beat of each measure. Also, the **RUN/STOP** light blinks off at the beginning of each segment.

The higher metronome speeds are very useful if you want to record a fast, complex drum part. You may slow the tempo way down, yet still have clicks occurring regularly enough so that you know where you are in the segment. (If the tempo is very slow and you select quarter note clicks, the clicks occur too far apart to be helpful).

Help:

- If you press the **MET/TRIG** button to program the metronome when the SONG, rather than SEGMENT, light is lit, the left display will show numbers and the right display will flash **ME.** This mode lets you program output trigger pulses in the *song* mode, as described in Section 3. To extricate yourself, press **ENTER**, then remember to select **SEGMENT** mode before programming the metronome.

SECTION 2: RECORDING SEGMENTS

2A Recording A Segment: Overview

2B Erasing a Segment

2C "Dimensioning" a Segment
Setting the time signature and/or measure length

2D Understanding Auto Correct

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2A Recording A Segment: Overview

Recording a segment:

- Programming the metronome if necessary.
- Erasing previously recorded sounds (if necessary).
- Defining the segment's rime signature and the number of measures in the segment ("dimensioning" the segment).
- Setting Auto Correct (to correct for any timing errors).
- Assigning the drum sounds you want to record to the four Drum Play buttons (this includes setting levels and/or accents).
- Entering *record* mode and playing drum sounds. The Drumulator memory *remembers* what you play
- Editing the segment in case you want to make changes.

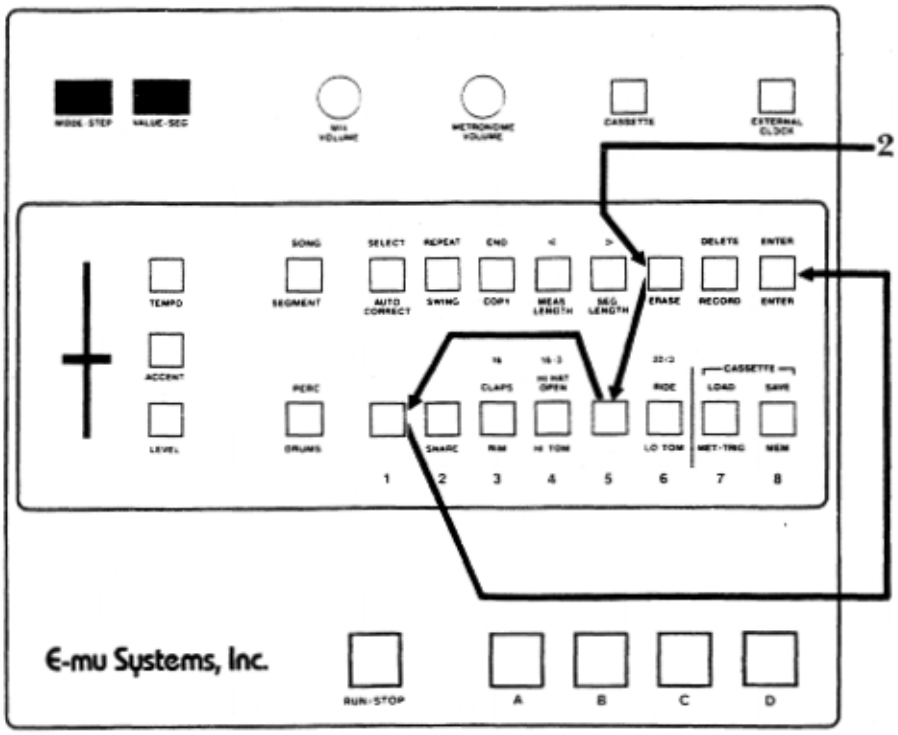
After completing these steps you may then assign different drum sounds to the Drum Play buttons, go hack into record mode, change the Auto Correct resolution or re-program the metronome if necessary, and record more drums. Or, simply play back the segment and groove to the sounds you've just created.

2B Erasing a Segment

Erasing a segment clears out all existing drum sounds, and automatically redimensions the segment to two measures of 4/4. Before erasing a segment, always check whether that segment already contains drum sounds — you may want to keep them.

Here's how to erase:

1. Key in a bank/segment number (Section 1F), and press **RUN/STOP** to play the segment.
   If you hear a beep remember, the **METRONOME VOLUME** control must be up for you to hear any beeps), the segment contains no drum sounds. If you hear an existing drum pattern and you want to keep it, key in a segment which is empty, or one which you are willing to erase.



2. To erase a segment stop the Drumulator and hold down ERASE. The left-hand display shows Er, the right-hand display shows a blinking cursor. While holding down ERASE, press the desired bank number (the right-most display now shows a blinking cursor), then press the segment number. (Note: If you change your mind about erasing, or key in the wrong segment by mistake, release ERASE and start over.) While still holding down ERASE, press ENTER. A beep confirms that the segment has been erased. The picture shows how to erase bank/segment 51.

3. After erasing, the display will return to whatever segment you had keyed in before starting the erase process. For example, if you had first selected bank/segment 11 but then decided to erase bank/segment 51, after erasing 51 you would return to 11. If you want to continue working with segment 51, make sure you key it back in again so that 51 appears in the display.

Notes:

- Sometimes you might not get a beep when you key in a segment, even though it *appears* empty since it contains no drum sounds. However, if the segment was put into *record* mode - regardless of whether you actually recorded drum sounds into the segment - it is no longer considered empty.

- Also note that if you want a segment that contains silence, simply erasing the segment is not sufficient; you must go into *record* mode to "fill" the segment with silence. Section 2F gives more information on recording.

"Dimensioning" a Segment 2C (Setting the time signature and/or measure length)

"Dimensioning" a segment defines the segment's time signature (from 1 to 99 beats per measure), and the number of measures per segment (up to 99). If desired, each segment may be dimensioned differently. If you are not familiar with time signature notation, see Appendix B.

After you erase a segment, it assumes two measures per segment and a 4/4 time signature. If this dimensioning suits your musical needs, skip ahead to Section 2D.

Otherwise, make sure you are in *segment* mode, then proceed with the following steps to re-dimension a segment.

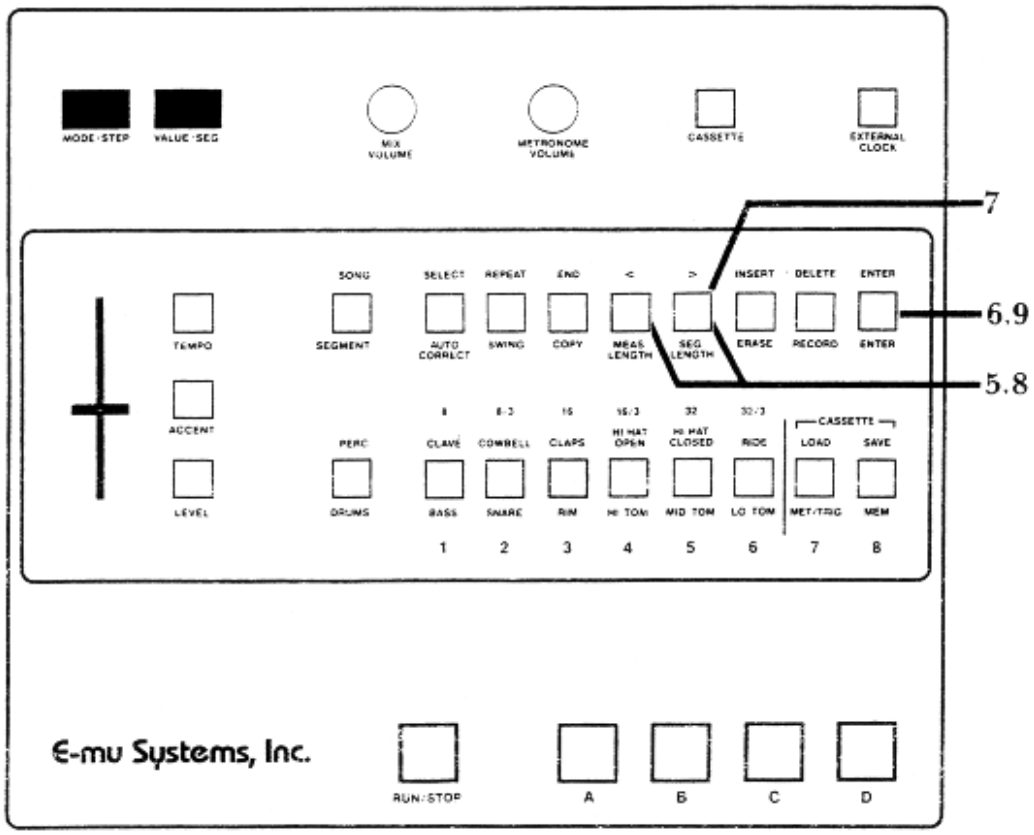
1. Set the time signature denominator (i.e. the rhythmic value of each beat in the measure) by pressing **MEAS. LENGTH.** The left-hand display will show **ML** (again, the M is more like an upside down U, but you're probably used to that by now), and the right-hand display will probably show 4, indicating that the denominator is 4 (measures are made up of quarter notes).

2. Please Note: After you press **MEAS. LENGTH** (or **SEC. LENGTH),** the function ol the **MEAS. LENGTH** and **SEC. LENGTH** buttons change from the *segment* mode designations *below* the button to the *song* rnode designations *above* the button (**>** means increase and **<** means decrease). Yes, we know this is inconsistent with the lower-row-for-segment-mode and upper-row-for-song-mode tradition, but we figured that you're all adult enough to deal with this one exception.

3. To *increase* the denominator value, press **> (SEC. LENGTH).** Pressing this button steps the right-hand display through the following denominators.

Denominator value	Right display shows
Quarter note	4
Quarter note triplet	. 4.
Eighth note	8
Eighth note triplet	. 8.
Sixteenth note	16
Sixteenth note triplet	.16.

Either tap this button repeatedly to go through a step at a time, or hold it down for a 'fast forward'' effect. To *decrease* the denominator value press **< (MEAS. LENGTH).** This steps the display in the reverse order of the above table. Tap this button to go backwards a step at a time, or hold it down for a ''fast backward'' effect.



4. When the display shows the desired denominator press **ENTER**. When the lift-hand display changes to **ML** you may now specify the time signature numerator (i.e. the number of notes in a measure). The right-hand display will probably show 04, which indicates that the numerator is 1 (four beats per measure).

5. To *increase* the numerator value up to 99 press **> (SEG. LENGTH).** Tap this button to move forward a digit at a time, or hold it down for a "fast forward" effect. To *decrease* the numerator value (down to 1), tap or hold **< (MEAS. LENGTH).**

6. When the display shows the desired numerator, press **ENTER.** The readout returns to the segment number you are dimensioning.

7. To set the number of measures in the segment *(segment length),* press **SEC. LENGTH.** The left-hand display shows **SL**, and the right-hand display will probably show **02** (indicating two measures per segment).

8. To *increase* the number of measures in a segment (up to 99), press **> (SEG. LENGTH).** You may repeatedly tap this button to go forward digit at a time, or hold it down for a ‘‘fast forward’ effect. To *decrease* the number of measures in a segment, (down to 1), tap or hold **< (MEAS. LENGTH).**

9. When the display shows the desired segment length, press **ENTER.** The readout returns to segment number you are dimensioning.

Help:

- If you hear a long beep when you press either the **<** or **>** button, then the segment is not empty. (Remember, a segment is not considered empty if it has ever been put in *record* mode, even if it contains no drum sounds.) Press **ENTER** until the display again shows the number of the segment you want to dimension. Erase the segment as described in Section 2B, then continue dimensioning.

- If while in *real time dimensioning* mode you try to create a segment length longer than the Drumulator can accommodate, the Drumulator will stop, the display will read **SEGF** (for

SEGment Full), and the segment will be erased so that you can try again. If you have used up almost all of the available memory space, the display will say **FULL** (see Section 2L).

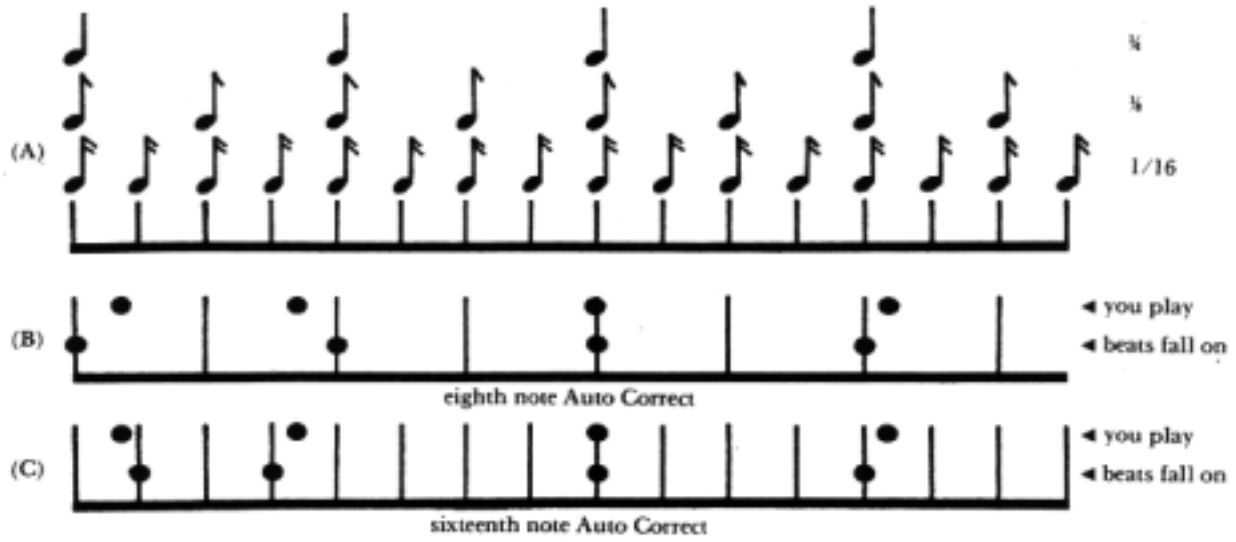
Notes:

- There is an alternate way to set segment length called *real time dimensioning* mode. This is useful when you want a segment's length to be other than some number of whole measures (i.e. if you wanted 2-1/2 measures of 4/4 or 6-1/3 measures of 3/4). Press SEC. LENGTH then press **RUN/STOP;** the metronome will click and the right-hand display will count off the measures as they go by. After the appropriate number of measures and beats have gone by, press RUN/STOP a second time. The segment is now set to that length. If you do not press RUN/STOP precisely on the beat, it will be auto corrected by the Drumulator (Section 2D gives more information on auto correction).
- If you are in *real time dimensioning* mode and miss the desired end point of the segment, hit **ENTER** while still in that mode, and you can immediately try again to set the segment length.
- It might seem musically strange to specify triplets for the denominator of the time signature. However, if you specify quarter notes for the denominator of one segment and quarter note triplets for another, chaining them together in a song will result in the quarter note triplet based segment running 33% faster than the quarter note based segment.

Understanding Auto Correct 2D

Auto correct lets you create patterns with perfect timing by placing whatever drum sound you play on your choice of the nearest eighth note, eighth note triplet, sixteenth note, sixteenth note triplet, thirty-second note, or thirty-second note triplet. (For more information on rhythmic notation, see Appendix A.)

To understand how this works, consider figure A, which shows one measure of 4/4 music (there are four quarter notes, eight eighth notes, and sixteen sixteenth notes in a measure of 4/4).



Suppose you want to record a bass drum on every quarter note, but your sense of timing is a little shaky. The upper row of dots in figure B shows where you might have played the four bass drum beats. The first one is a little behind the beat, the second a little in front of the beat, the third right on the beat, and the fourth slightly behind the beat. The lower row of dots in figure B shows how setting Auto Correct to eighth note resolution puts each drum sound on the nearest eighth note, thereby correcting a not-so-tight bass drum part for perfect timing.

Now consider figure C, which shows Auto Correct set to sixteenth note resolution. In this case, the beats you played have been assigned to the nearest sixteenth note - which is fine on beats 3 and 4, but not on 1 and 2.

This illustrates an important point: Use the least amount of resolution needed. If you are recording a simple snare back beat, there's no point in using an Auto Correct setting with any more resolution than eighth notes. To record something more complex, set a finer resolution (such as sixteenth or even thirty-second notes).

You may change Auto Correct at any point by stopping the Drumulator. Changing Auto Correct takes the pressure off of recording long drum parts - use low resolution to record most of a part, and then switch over to finer resolution to record more complex rhythms. Note that recording triplets is easy; since there are three triplet Auto Correct options, and that alternating between triplet and non-triplet Auto Correct modes lets you record complex polyrhythms.

Another option is *high resolution* mode, where the Drumulator places beats exactly where you play them rather than "rounding them off" to the nearest specified note. This allows syncopation, beats which slightly lead or lag the rhythm, and so on.

It may take some time to get used to Auto Correct, but once you have it mastered, you'll find it a powerful feature which lets you create drum patterns with perfect timing.

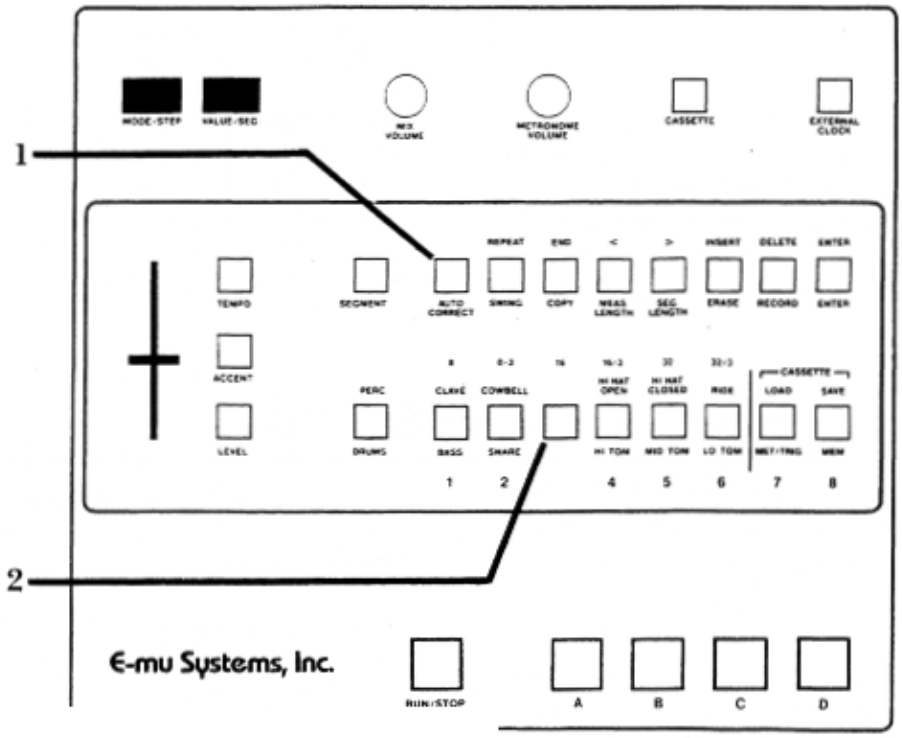
2E Setting Auto Correct

To set Auto Correct, the Drumulator must be *stopped* and in *segment* mode.

1. Press **AUTO CORRECT.** The left-hand display shows **Au** (for Auto), while the right-hand display will probably show 8. The Drumulator assumes eighth note Auto Correct when you first turn it on.

2. When in *Auto Correct* mode, the Drum Sound Select buttons become Auto Correct Select buttons (time setting of the **PERC/DRUMS** switch doesn't matter). Here are you choices:

Button Legend	Auto Correct Resolution	Right Display Reads
8	Eighth notes	8
8/3	Eighth note triplets	.8.
16	Sixteenth notes	16
16/3	Sixteenth note triplets	.16.
32	Thirty-second notes	32
32/3	Thirty-second note triplets	.32.



Press the desired Auto Correct button, then press **ENTER**. The picture shows how to select sixteenth note Auto Correct resolution.

3. To select *high resolution* mode, press **AUTO CORRECT** twice and then press **ENTER**. The first time you press this button the left display shows **Au**; the second time, the right display shows **Hr** (for "high resolution").

4. Remember that although you may change the Auto Correct resolution any time that the Drumulator is stopped, this change does not affect any parts recorded prior to the change.

Recording a Segment 2F

Now that you've selected a segment and dimensioned it, you're ready to record drum patterns into the segment.

1. Assign drums sounds to the Drum Play buttons. You may assign a sound along with its accented version to two buttons (Section 1E, or single sounds to single buttons (Section 1C).

2. Specify the drum levels (Section 1).

3. If necessary, program the metronome (Section 1) and set the Auto Correct resolution (Sections 2D and 2E).

4. While holding down **RECORD, push** RUN/STOP so that the RUN/STOP light glows. The left-hand display shows **rc and the** metronome will start. The **RUN/STOP** LED will blink off at the beginning of each segment, and there will also be an accented metronome beat at the beginning of each measure.

5. Play the various drums where you want them to occur in the segment. The segment will repeat over and over, so you may "overdub" as many drum beats as you like. For example, record a basic bass drum part first, then snare drum sounds, then some bass drum accents, then some more snare drum sounds, cowbell, etc. Any drum sounds you record during one cycle of the segment will play back on the next cycle of the segment.

6. When you've finished recording the four drum sounds, either press **RUN/STOP** again to stop the segment (the **RUN/STOP** light will go out); or, remain in *record* mode, and go into assign mode to assign new sounds to the Drum Play buttons *with-*

out having to stop the segment. To enter *assign* mode, press the RECORD button while in *record* mode. The left-hand display will read **AS** (for assign). You are now temporarily out of *record* mode and can reassign sounds to the Drum Play buttons. To continue recording, press **RECORD** again.

7. Repeat steps 1 through 6 until you have recorded the complete drum part. Note that while you can change tempo in *record* mode, you cannot set levels or accents (even while in *assign mo*de).

Notes:

- When possible assign drum sounds to Drum Play buttons in a manner that makes a part easier to play. For example; By assigning one drum sound to all four buttons 'drumming' your fingers sequentially will rapidly trigger the drum sound.

- Sounds recorded during one cycle of a segment are not permanent until the next cycle starts This is good to know if you make a mistake right at the beginning of recording a drum part; simply press **RUN/STOP** to stop the segment, and start over However if you're adding a few notes at the beginning of a song segment be sure to wait for the end of the segment to come around before hitting **STOP**. Or the new notes will not be stored.

.

2G Erasing A Specific Drum Sound

When you are in *segment* mode and editing a segment, you may erase a drum or percussion sound wherever it appears in the segment.

1. To erase a particular drum sound wherever it appears in the segment, first assign the drum sound to be erased to a Drum Play button (unless it is already assigned).

2. While the Drumulator is *stopped,* hold down **ERASE** (the right-hand display shows a blinking cursor). While holding down **ERASE,** tap the Drum Play button corresponding to the sound you want to erase. The cursor will be replaced by two letters confirming the drum sound about to be erased:

   If you change your mind about erasing, or picked the wrong drum sound by mistake, release **ERASE** and start over.

3. While continuing to hold down **ERASE**, press **ENTER.** A short beep will confirm that the drum has been erased.

Notes:

- When you erase a sound in this mode, you erase both the accented and non-accented version of the sound, regardless of which version is assigned to the Drum Play button.

Right-hand Readout	Drum sound to be erased
bA	BASS
Sn	SNARE
ri	RIM
Hi	HI TOM
Md	MID TOM
Lo	LO TOM
CL	CLAVE
Cb	COWBELL
CP	CLAPS
Ho	HI HAT OPEN
Hc	HI HAT CLOSED
rd	RIDE

Erasing a Specific Note of a Drum Track 2H

You may also erase specific notes in a drum (or percussion) track while the Drumulator is *running* and in *record* mode. As in Section *2G,* you must be in *segment* mode to erase sounds.

1. Start off with the Drumulator *stopped.* To erase a portion of a drum track, first assign the drum sound to he erased to a Drum Play button. If you want to erase the accented version of the drum sound, then you must assign the accented drum sound to a Drum Play button (Section 1E, step 2). Note that this differs from the way drum sounds are erased in Section 2G.

2. Set Auto Correct to *high resolution* mode (Section 2E).

3. Put the Drumulator into *record* mode by holding down **RECORD** and pressing RUN/STOP so that the RUN/STOP light glows. The left-hand readout should read **rc** to indicate record, and you will hear the metronome.

4. Press ERASE (the left-hand display now reads **Er** instead of rc). While holding down **ERASE,** press the Drum Play button corresponding to the sound you want to erase. Press this Drum Play button down just *before* the note or series of notes you want to erase, and release it just *after* the note(s) you want to erase ends. To erase one note out of a rapid series of notes, tap the Drum Play button simultaneously with the note to be erased.

When erasing, you will hear the drum sound in its normal place as it is being erased, however, the next time the segment cycles the drum sound(s) you erased will be gone.

Help:

- There will probably be times when you are *absolutelv* sure that the erase function is not working properly. One cause of trouble is trying to erase an accented sound without assigning an accented sound to a drum play button. Another problem occurs if you try to erase a non-accented drum sound with a Drum Play button which triggers the accented version of that sound.

- You may use Auto Correct settings other than high resolution for special effects. For example, suppose you recorded a series of four sixteenth note snare drum sounds with an Auto Correct of 16. If you erase using an Auto Correct setting of 8, you could erase only every eighth note; so two of the sixteenth notes would remain. Returning the Auto Correct to 16 would let you erase all four sixteenth notes. Note that this technique may be used to advantage if you want to "thin out" an overly complex drum part.

Copying Segments 2I

You may copy a segment to one or more other segments. For example, suppose you set up a great hi-hat and bass drum pattern in segment 54. Now suppose you want segment 55 to contain a snare part recorded over the basic bass drum/hi-hat pattern, and segment 56 to contain a torn part recorded over the same basic bass drum/hi-hat part. Rather than having to re-create the hi-hat and bass drum pattern for segments 55 and 56, you may simply copy segment 54 to segments 55 and 56 (or any segment to any other segment, of course) by following these steps:

1. You must be in *segment* mode and the Drumulator must be *stopped.*

2. Key in the segment you want to copy. (In this example, segment 54.)

3. Press COPY. The left-hand display shows Co and the right-hand display shows a flashing cursor.

4. Key in the number of the segment you want to copy to (in this example, 55), and then press ENTER to complete the copying procedure. A beep will confirm a successful copy, and the right-hand readout will return to the number of the segment being copied.

5. To now copy segment 54 into segment 56, press COPY, key in 56, and press ENTER. Again, a beep will confirm that the copy was successful, and the right-hand readout will return to the number of the segment being copied.

2J Appending a Segment

You may also copy a segment to itself. For example, suppose you create a great segment, but realize that you want it to last four times as long as you had originally intended. No problem — simply *append* the segment four times. The *append* function takes the segment and multiplies its length by anywhere from I to 8. Here's how to program the append function:

1. You must be in *segment* mode and the Drumulator must be *stopped.*

2. Key in the segment you want to append.

3. Press **COPY.** The left-hand display shows **Co** and the right-hand display shows a flashing cursor.

4. Key in the number of the segment you want to append (in other words, the number in the right-hand readout just before you pressed **COPY**). The left-hand readout will instantly change to **AP** for "append", and the right readout will show a flashing cursor.

5. In *append* mode, the Drum Sound Select buttons turn into Append Multiplier Select buttons.

Pressing button 1 leaves the segment as is, pressing button 2 doubles the length of the segment by repeating the segment twice, pressing 3 triples the length, and so *on* until pressing 8 repeats the segment S times. The number you select will replace the flashing cursor. When you've made your choice, press **ENTER.** A beep will confirm a successful append.

Notes:

- You cannot "un-append" a segment once you've appended it. So, if you want to keep a segment but also create a longer, appended version, first copy the segment von want to append to another segment. Next, append this second segment. The second segment will contain the appended version of the original segment, yet the original segment still exists in its unaltered form.

- You may re-append an already appended segment. For example; if you've appended a segment twice at and later decide you should have made it *four* times as long, simply key in the new, appended segment and append it twice.

- Large segments use up a. lot of memory - see Section 3O. Wherever possible use the *song* modes repeat function (described in Section 3F) to create a long repeating segment out of a short segment.

2K Adding Swing

While in *segment* mode, you may specify that a segment have a particular rhythmic swing to it. The Drumulator normally provides a "swing factor" of 50%, which means that each quarter note is weighted so that the first eighth note takes up 50% of the quarter note, and the second eighth note takes up the other 50%. This is the way you would normally expect things to be.

However, you may change the swing factor to 54%, 58%, 63%, 67%, or 71%. For example, with a swing factor of 58%, the first eighth note spreads out slightly to take up 58% of the quarter note, while the second eighth note shrinks slightly so that is takes up 42% of the quarter note. This lets you program a swinging, less metronomic feel to individual segments. To program a segment for swing, you must be in *segment* mode. Then, follow these steps:

1. The Drumulator must be *stopped* (RUN/s-cop light off). Press **SWING** (the left-hand readout shows SG.).

2. The Drum Sound Select buttons turn into Swing Factor Select buttons when in *swing* select mode. The following table shows, which swing factor corresponds to which button number:

Button Number	Swing Factor
1	50%
2	54%
3	58%
4	63%
5	67%
6	71%

Press the desired swing factor (the right-hand readout confirms your choice), then press **ENTER**.

Notes:

- Swing can help add a more human "feel" to a series of repeating segments. For example, if you repeat the same segment four times, try setting a swing factor of 54% for, say, the third segment. This results in a series of segments which are more psycho-acoustically interesting than merely repeating the same pattern over and over.

- 67% is considered the 'classic" jazz swing factor, where the first eighth note is 2/3 of a quarter note, and the second eighth note is 1/3 of a quarter note (i.e. the second eighth note behaves more like an eighth note triplet). If this sounds too "perfect", try a swing factor of 64% instead. The results will be similar, but the "feel" will be slightly different.

- If you're trying to record or erase in a segment, which has a swing factor other than 50%, there are two cautions. To erase a specific note, you have to erase where the note would *normally* occur if the segment had a 50% swing factor. If you record while a segment is in *swing* mode, the beats may or may not fall where you want them to fall. Therefore, it's best to go out of *swing* mode when recording or erasing, then re-enter *swing* mode after you've finished your alterations.

Checking Memory Space 2L

Whenever the Drumulator is stopped, you may check the amount of remaining memory by pressing **MEM.** The left-hand display shows **MM;** the right-hand display shows the remaining amount of memory, expressed as a percentage.

See Section 3O for information on efficient use of memory.

If you're recording segments and the display shows **FULL,** you've used up all the available memory space. The Drumulator will stop, and whatever you tried to record on the last cycle of the segment will not be put into memory. At this point, you have two alternatives: either erase segments which you don't need in order to create more space, or save the existing information on cassette (see Section 4), clear the memory (Section 2M), and start programming new segments.

Clearing All Data 2M

If you reach a memory full condition (Section 2L), save what you have on cassette (see Section 4B). After doing this, you may want to clear all data in the Drumulator to create more space. Another occasion where you might want to clear all data is if you've finished working on a song/segment or group of songs/segments, saved the data, and want to start over from scratch. Here's how to clear all data:

1. Make sure you are in *segment* mode (**SEGMENT** light is lit).

2. Hold **ERASE** and tap **CASSETTE**. The display will flash **PooF**, which means you're just about ready to blow away all the song and segment data in memory.

3. If you indeed want to clear out all the song and segment data, while continuing to hold **ERASE**, press **ENTER.** The display will continue to flash **PooF** until you release **ERASE** and **ENTER**.

4. You may change your mind about erasing the data any time before you hit **ENTER** by simply releasing any buttons you may be pressing down.

SECTION 3: CREATING A SONG

3A Creating a Song: Overview

3B Selecting a Song

3C Chaining Segments Together

3D Ending a Song

3E Editing Songs (stepping, inserting, deleting)

3F Using Repeats

3G Programming Song Drum Sound Levels

3H Setting Drum/Percussion Accents

3I Setting Song Tempo

3J Copying Segment Parameters to a Song

3K Copying Song Parameters to a Different Song

3L Programming Tempo Changes within a Song

3M Programming Trigger Outputs

3N Starting in the Middle of a Song

3O Efficient Use of Memory

3A Creating a Song: Overview

There are two ways to create songs using segments. One way is to simply run the Drumulator and key in each segment just before you want it to appear. However, a far easier way is to go into *song* mode (by pressing the **SONG/SEGMENT** switch), and programming a sequence of segments to create a song.

We suggest first writing out the order of segments on paper, and also noting any repeats or tempo changes. Writing the song out first makes the whole process go much more smoothly.

Selecting a song consists of:

- Pressing SONG/SEGMENT to go into *song* mode (the SONG light glows).
- Selecting one of 8 different songs to work on.

While in *song* mode, the left-hand display shows the current step of the song (01 is the first step, 02 the next step, and so on). A song may have up to 99 steps. The right-hand display shows what occurs during that step - a segment number, a repeat, tempo change, etc. You key in the number of each segment you want to chain together, in the order in which you want them to appear. To save memory space, you may use repeat commands if you want a segment (or group of segments) to repeat many times.

You may also edit the song with these options:

- Stepping sequentially through each step (either up or down).
- Inserting an additional step at any place in the song.
- Deleting a step at any place in the song.
- Setting drum levels for the particular song.
- Setting drum accents for the particular song.
- Setting the tempo for the particular song.

Note:
Unless you specify otherwise, when in *song* mode, segment level and tempo settings are not transferred over to the song. Instead, you set these parameters for an entire song, using the same basic procedure as setting these parameters for segments. However, if you've spent a lot of time getting the levels "just right" while in *segment* mode, it is also possible to copy this particular set of levels over to a song (see Section 3J).

When it comes time to end the song, you may:

- Unconditionally end it.
- Repeat the song indefinitely.
- Proceed immediately to a second song.

Note that you can treat this second song as a continuation of the first song, but both parts can have different mixes. Therefore, if you want to change the drum mix in the middle of a song, you can chain two songs together with different mixes.

There are many other features of song mode, such as programmed tempo changes, indefinite repeat, programmed metronome outputs, and so on.

Programming a song is a somewhat easier process than programming a segment, so we do not need to use pictures as much as we did earlier. Remember, however, to work with a song you must be in *song* mode (press the SONG/SEGMENT switch until the SONG light glows). Also note that except when keying in numbers (such as Bank/Segment numbers), we will only be using the upper row of buttons **(SELECT, REPEAT, END, <, >, INSERT, DELETE, and ENTER).**

Song Write Protection/Selecting a Song 3B

One annoying feature of earlier Drumulator software was that it was all too easy to accidentally change a song step. This usually happened when you chose a new segment (thinking you were in segment mode) only to find you were actually in song and had just changed a song step and couldn't remember its previous contents. *(Of course* you'd previously written out the song steps prior to programming - you did, didn't you? - but having to find it again could be a pain.) Also, people fooling around with your Drumulator could inadvertently change your songs without realizing what they were doing. To overcome these problems, we've added a song edit mode.

When you first turn on your Drumulator you will now find that all your songs are write protected, i.e. you are unable to change the contents of any song step. To enter edit mode:

1. Press and hold **SELECT**. The display will show **So** and the number for the currently selected song.

2. While continuing to hold **SELECT** press **ENTER.** The right hand display will now show **Ed** (for Edit). You may now change the contents of song steps.

Notes:

- Once you are in edit mode you will remain in edit mode until you switch to segment mode or turn your Drumulator off. If you switch to segment mode and then back to song mode, the songs will once again be write protected and you will again have to execute steps 1 and 2 above to make any more changes.

- Changes to levels, accents and tempos can be made in or out of edit mode. You can also copy parameters from segments or songs at any time. Edit mode only affects the actual contents of each song step.

To choose a particular song:

1. Press the SONG/SEGMENT button so that the SONG light glows.

2. Hold down SELECT (the left hand readout shows So to indicate song). While holding down SELECT choose the appropriate bank by pressing one of the lower row of 8 numbered buttons. The second display from the right will display this bank number.

3. Choose the song number within the bank by pressing another of the lower row of buttons. This number will appear in the rightmost display.

4. Release **SELECT**. The left hand readout will show 01 to indicate you are at step one of the song and the right hand display will show the contents of that step.

Note:

- If you release **SELECT** before entering the second digit of the song number, you will return to the previously selected song.

3C Chaining Segments Together

As mentioned in the overview, it's best to write out the order of segments you wish to program into a song. Let's try a simple example of using segments already programmed into the Drumulator

Bank/Segment #	Section of Song
Step 1: 61	Introduction
Step 2: 62	Introduction
Step 3: 61	Introduction
Step 4: 63	Introduction
Step 5: 64	First verse
Step 6: 64	First verse
Step 7: 64	First verse
Step 8: 65	First verse
Step 9: End	End

Here is how you would write a song using these segments:

1. Make sure you are in *song* mode (SONG light glows).

2. Select the song you want to program (Section 3B).

3. Key in the bank number of the first segment (in this case, 6). The right-hand display shows 6 and a flashing cursor.

4. Key in the segment number (in this case, 1). The right-hand display now shows 61.

5. Press **ENTER** or **>** (whichever you prefer). This enters the first Bank/Segment number into stereo 1. and advances to step *2* (the left-hand readout now shows 02 to confirm that you have reached the second step).

6. Key in the next Bank/Segment number (in this case, 62) in a manner similar to steps 3 through 5. After you press **ENTER** or **>**, the left-hand readout will show 03 to indicate that you're ready to program the next step. Continue keying in the various segment numbers until the entire eight-segment song has been entered.

7. Proceed to the next section for information on how to end the song.

3D Ending a Song

After you've programmed your song, you have several ways to end it. This assumes that you've already entered all the segments, and that the readout shows a number which is 1 greater than the number of steps in the song (for example, if you've entered 8 segments, the left-hand readout should now show 09). Here are your options:

1. To repeat the song indefinitely, press END (the right-hand readout will show E and a flashing cursor). Now press **REPEAT**. The cursor will disappear and be replaced by the 4 end repeat sign.

2. To end a song and automatically link to another song, press **END.** The right hand display will show E and a flashing cursor. Select the bank of the song you want to link by pressing one of the lower rows of numbered buttons. The right hand display will show this number followed by a cursor. Both will flash. (If after entering the first digit you change your mind, simply press enter. The previous contents of the song step will be restored.) Select the song within this bank by again pressing one of the eight numbered buttons. This number will appear in the rightmost display. The display will continue to flash.

3. To stop the Drumulator completely after the song press **END**. The right-hand readout will show E and a flashing cursor. Press **END** a second time; the flashing cursor will disappear, and the E will remain to confirm that the song ends at this step.

Notes:

- Entering End as step 1 of the song (in other words, pressing **END** twice as described above in paragraph 3) erases the song.

- If you press END and hear a beep, the Drumulator is warning you that you are going to be eliminating data (this would happen if you pressed **END** after step i for a song which already contains data). If you do not want to eliminate this data, press **ENTER to** escape.

- If you attempt to end a song which includes a begin repeat but no matching end repeat; you will hear a beep and the Drumulator will automatically put in an end repeat. You will have to advance to the next step (see Section 3E for information on advancing through song steps) in order to enter the end instruction.

- Whenever a song step containing an end and link instruction is displayed, the right hand display will blink. This is to identify it as an end instruction (since the necessity of displaying a two digit song# prevents us from including the E for end) and to differentiate it from a simple segment number.

Editing Songs (stepping, inserting, deleting) 3E

1. Stepping: To change a song step, you first need to locate the step by using the **>** and **<** buttons. Pressing **>** increases the step number. **<** decreases the step number. Tap either key once to move one step at a time, or hold either key down for a "fast forward" or "fast backward" effect. When you reach the step you want to change, simply key in the new information.

2. Inserting: Inserting creates an additional step (or steps) in an existing song. Consider a situation where you want to insert another segment in a song right after step 4. First, press **>** or **<** until you reach step 5 (the step which is right after step 4). Press **INSERT**. Two things happen:

   The right-hand readout shows a flashing cursor, and all subsequent steps are automatically renumbered to reflect the addition of the inserted step (for example, what used to be step 5 now becomes step 6. step 6 becomes step 7. step 7 becomes step 8, etc.). You may now key in the instruction for the new step 5 (in this case, it would be a segment number). After entering the instruction, press **INSERT** again to add another insert, and continue as described above.

3. Deleting: Move to the step you want to delete (let's choose step 8 as an example) by using the **<** and **>** keys. When step 8 appears in the left-hand readout, press **DELETE.** The current step 8 is deleted, and all subsequent steps are automatically renumbered to reflect the deletion of this step (step 9 becomes the new step 8, what used to be step 10 becomes step 9, and so on). To delete more steps, continue pressing **DELETE.**

Using Repeats 3F

You may enclose a segment, or group of segments, inside repeat instructions to repeat the segment(s) a selected number of times. This not only simplifies song programming, but also saves memory compared to entering multiple segments. As you write out the order of steps for a song, take these repeat instruction steps into account; consider the following song as an example:

Song Step	Segment to be Played	Song Step	Segment to be Played	Song Step	Segment to be Played
Step 1:	61	Step 11:	67	Step 21:	65
Step 2:	61	Step 12:	68	Step 22:	66
Step 3:	61	Step 13:	65	Step 23:	67
Step 4:	61	Step 14:	66	Step 24:	68
Step 5:	62	Step 15:	67	Step 25:	65
Step 6:	63	Step 16:	68	Step 26:	66
Step 7:	67	Step 17:	65	Step 27:	67
Step 8:	68	Step 18	66	Step 28:	68
Step 9:	65	Step 19:	67	Step 29:	end
Step 10:	66	Step 20:	68		

We can simplify this by inserting repeats:

Song Step	Segment to be Played or Instruction
Step 1:	Begin Repeat
Step 2:	61
Step 3:	End repeat 4 (-/4)
Step 4:	62
Step 5:	63
Step 6:	67
Step 7:	68
Step 8:	Begin Repeat
Step 9:	65
Step 10:	66
Step11:	67
Step12:	68
Step13:	End Repeat 5 (-/5)
Step14:	End

Here's how you would insert the repeat instructions in this example:

1. At step 1, press **REPEAT**. The right-hand display shows the begin repeat sign. Press **ENTER** to enter this step into the Drumulator's memory. Note that the Drumulator, being such an intelligent fellow, will automatically insert the right kind of repeat mark — if there is no begin repeat instruction in the song, it will insert a begin repeat command when you press **REPEAT**; if a begin repeat already exists, then the Drumulator will give you an end repeat command when you press **REPEAT**.
2. At step 2, key in the segment number, then press **ENTER** to enter this step into the Drumulator's memory.
3. At step 3, press **REPEAT**; the right-hand display shows the end repeat sign and a flashing cursor.
4. Using the lower row of numbered keys (1 - 8), enter the number of times you want the repeat to occur. In this example, you would press 4. (If, after entering an end repeat, you press **REPEAT** again instead of a number, the repeat will repeat indefinitely while the song is running until you press **REPEAT** again, or press the REPEAT footswitch.) After entering this step, press ENTER to enter this step into the Drumulator's memory.
5. Enter segments 62. 63, 67, and 68 as described in Section 3C.
6. When you reach step 8, press **REPEAT**.
7. Enter segments 65, 66, 67, and 68.
8. When YOU reach step 13, press **REPEAT** to end the repeat, then press **5** to indicate that von want segments 65, 66, 67, and 68 repeated five times. After entering this step, press **ENTER** to enter this step into the Drumulator's memory.
9. At step 14, press **END** twice to unconditionally end the song.
10. Now start the Drumulator; it will play hack the song, with each segment being shown in the right-hand readout as it occurs.
11. Editing: To insert repeats after entering a series of segments, first stop the Drumulator, then use the **INSERT** command to create a new step. You may then enter a repeat instruction in this new step. However, be careful — it is possible to create "illegal" repeat commands when using the *INSERT* and **DELETE** buttons, such as having one repeat inside another repeat. The Drumulator will not follow these illegal commands, but rather, will look for the last begin repeat command proceeding the first end repeat command and execute this loop, ignoring any other loops. Consider the following example:

Song Step	Segment to be Played or Instruction
Step 1:	61
Step 2:	Begin Repeat
Step 3:	62
Step 4:	63
Step 5:	Begin Repeat
Step 6:	64
Step 7:	65
Step 8:	66
Step 9:	67
Step 10:	End Repeat 2
Step11:	63
Step12:	63
Step13:	End Repeat 3
Step14:	End

Now, you might think that in the above example, the Drumulator would execute steps 1,2,3, and 4, then repeat steps 6, 7, 8, and 9 twice, then execute steps 11 and 12, then repeat steps 2 through 12 three times. This is not the case. Instead, the Drumulator will look for the last begin repeat command (step 5) preceding the first end repeat command (step 10), and execute this loop while ignoring steps 2 and 13.

12. You may exit from a repeat loop before you are scheduled to leave it by pressing**R EPEAT** (or using a footswitch, as described in section 5A). As soon as the repeating segment(s) has finished playing, the Drumulator will proceed to the next step in the song. This convenience feature is particularly useful for live performance.

3G Programming Song Drum Sound Levels

Levels, accents, and tempo are programmed individually for each song (level, accent, and tempo information programmed while in *segment* mode is generally *not* transferred over to the song, with one exception which we'll cover later). Note that when you program level, accent, or tempo information in a song, the song is updated to reflect those changes, and will retain those changes whether or not you program different level, accent, or tempo information in other songs. Thus, each song may have a different mix and different tempo. This differs from making changes while in *segment* mode, since in this mode, any updates last only as long as you are in *segment* mode.

As mentioned in Section 1, each drum sound may have any one of 15 different volume levels. First, push the SONG! SEGMENT button so that the SONG light glows. Otherwise, you will end up altering the mix of a segment instead of a song. To change drum levels, follow these steps:

1. Press **LEVEL.** The left-hand display shows **LE,** the right-hand display is blank.

2. Press the Drum/Percussion Sound Select button corresponding to the sound you want to vary (remember to set the **PERC./DRUMS** switch for the desired row of drum or percussion sounds). The right-hand display will show the existing level programmed for that sound.

3. Adjust the slider to vary the drum level from 0 to 15, using the same technique described for changing levels in segment mode (Section 1D). After adjusting the level of the last Drum/Percussion Sound Select button you want to change, press **ENTER.**

Notes:

- You may set all levels to 0 (all drums muted) by hitting **LEVEL** to enter *level* mode, and then pressing and holding **LEVEL** while pressing ENTER. This feature is useful if you're not pleased with a mix and want to start over from scratch.
- You may set levels while the Drumulator is running (although not while it is in *record* mode). This is useful when you have completed a song or segment, and want to set the final mix while listening to all of the parts.
- After you've finished setting a level or levels, always remember to press **ENTER. LE** should only appear in the left-hand display when you are actually setting levels.
- Be aware that all songs in a batik share the same mix and accent settings. (e.g. 11-18 will all have the same mix, 21-28 another, etc.)

IMPORTANT - When you change a mix or accent setting for a song, you are also making the same changes in all the other songs in that bank.

3H Setting Drum/Percussion Accents

Refer to Section 1E to refresh your memory of how accents work. Accents are programmed in a manner similar to programming levels. Remember that to program song accents, you must be in *song* mode (SONG light glows); otherwise, you will end up altering the accents in a segment instead of a song. Follow these steps:

1. Press **ACCENT.** The left-hand display shows **AC,** the right-hand display is blank.

2. Press the Drum/Percussion Sound Select button corresponding to the sound whose accent you want to vary (remember to set the **PERC./DRUMS** for the desired row of drum or percussion sounds). The right-hand display will show the existing accent programmed for that sound.
3. Adjust the slider to vary the accent level from 0 to 15 as described in Section 1E. After adjusting the accent of the last Drum/Percussion Sound Select button you want to change, press **ENTER.**

Notes:

- If you press the ACCENT button and a Drum Sound Select button, and the existing accent level shown by the readout is already correct, either press ENTER or press the next Drum Sound Select button whose accent you want to vary.
- After you've finished setting the accents, remember to press **ENTER. AC** should only appear in the left-hand display when you are actually setting accents.

- As noted above, be aware that all songs in a bank share the same mix and accent settings. (e.g. 11-18 will all have the same mix, 21-28 another, etc.) IMPORTANT—When you change a mix or accent setting for a song, you are also making the same changes in all the other songs in that bank.

Setting Song Tempo 3I

1. To change a song's tempo, press **TEMPO.** The left-hand display shows half a T (short for TEMPO); the other three digits show the tempo in beats per minute (BPM). Move the slider to select the new tempo.

2. When you find the right tempo, press ENTER. Unlike *segment* mode, where changing the wmpo affects the tempo of all segments. changing tempo in *song* mode affects only the song you've selected.

Notes:

- The Drumulator does not have to be stopped to change the tempo; this has its advantages and disadvantages. The good news is that you can change the tempo while listening to the song. but if you've got some tempo change instructions Programmed into the song (see Section 3L), changing tempo during these sections can create problems. We suggest that you not change tempo "live' if tempo change instructions ate part of the song.
- if you accidentally hit the **TEMPO** switch a second time while adjusting tempo, the left-most display will show a flashing digit (typically 1). You have ust entered *tempo change* mode, which we will describe more fully in Section 3L. This is not a problem though — press **ENTER** and the tempo von selected will be Still **be** recognized by the Drumulator
- Whenever you set a tempo while in *song* mode that tempo value is stored in the song. Upon selecting that song at a later time, the Drumulator's tempo is reset to the songs tempo. If you then switch over to *segment* mode the song tempo will be retained.
- As in Sections 3(; and 3H above, the overall programmed tempo is shared *by* all songs in a bank. However, you can get around this by using the programmed tempo change feature described in Section **3L.** Simply make step one of each song in a bank a tempo change instruction that changes **the** overall tempo to the appropriate tempo *ion* that song. This way each song in a hank can, in fact have a separate tempo. Keep in mind, however, that if you change a song's overall temp, the tempo of all the other songs in that bank will be changed proportionally.

Copying Segment Parameters to a Song 3J

If you've programmed a great mix (LEVEL and ACCENT values), but you're in segment mode rather than *song* mode, you may transfer these values over to a song.

1. Press RUN to confirm that the level and accent values are correct; once confirmed, stop the Drumulator.

2. Switch over to *song* mode (SONG light glows). Caution: Don't do anything other than the following, or you will blow the transfer.

3. Hold down **SELECT,** and select the song to which you want to transfer the segment information by pressing the appropriate numbered buttons as described in SB. While continuing to hold down **SELECT,** tap **LEVEL.** You will hear a beep to confirm that the transfer has taken place.

Copying Song Parameters to a Different Song 3K

If the level and accents programmed for a particular song are the same values as what you would like programmed for a different song, you may transfer these values from one song to the other.

1. While in *song* mode, select the song whose parameters you want to copy over to another song**. Press RUN** to confirm that the level and accent values are correct: when confirmed, stop the Drumulator

2. Hold down **SELECT** and press the appropriate numbered buttons as described in SB to select the song to which you want to copy the level and accent information. While continuing to hold down **SELECT,** tap **LEVEL.** You will hear a beep to confirm that the transfer has taken place.

3L Programming Tempo Changes Within a Song

The tempo change feature is very handy if you want to program the tempo to speed up or slow down at specific places in the song. You may introduce tempo changes at any point in a song; as you write out the song steps, allot .a step for each tempo change instruction.

Programming tempo changes is a two step process: first, you define up to 8 preset tempo changes (expressed as a percentage of the *overall programmed tempo),* and assign these changes to the lower row of numbered keys (1 - 8). Then, as you program your song. you enter the key number corresponding to the desired tempo change into those steps where you want the tempo to change. Here are the details:

1. Make sure you are in *song* mode.

2. Prepare to define the tempo changes by pressing **TEMPO** once (left-hand display shows half a T, right-hand display shows the existing song tempo), then pressing **TEMPO again** (left-hand display now shows a flashing number).

3. Press button 1. The left-hand digit becomes a flashing 1 (if it is not already).

4. Move the slider. As in our other examples, remember that the slider is not active until it moves past the position which corresponds to its present value. After passing the current value, moving the slider will instantly vary the numbers in the display. The number you're changing represents a tempo *change,* expressed as a percentage. For example, a tempo change percentage of 100% represents no change; a tempo change percentage of 105% is 5% faster than the overall preset tempo: a tempo change percentage of 90% is 10% slower; etc. For example, if the tempo is 120 BPM and you program a tempo change of 110%, the tempo will increase by 12 BPM (10%), to become 132 BPM. Note that you cannot speed up the tempo above 240 BPM or slow it down below 40 BPM.

5. After setting the desired degree of tempo change, either press **ENTER** to exit tempo change mode, or press 2 to program a second tempo change. After pressing 2, re-adjust the slider. If desired, you can program up to 8 tempo changes.

6. After you've preset the various tempo changes, press **ENTER**.

7. When you reach the song step where you want the tempo change to occur, press and hold **SELECT** and then press **TEMPO.** The right-hand display now shows half a T and a flashing cursor. Enter the number (1-8), which corresponds, to the desired preset tempo change, then press **ENTER.**

8. When you reach other steps where you want a tempo change to occur, key in more tempo changes if desired.

9. If you reach a step where you want to return to the original tempo, while holding **SELECT** press **TEMPO.** This time, instead of entering a number after the flashing cursor appears, hit **TEMPO a** second time. The right-hand display now shows **TT.** Press ENTER to enter this step into the Drumulator's memory.

Notes:

- To illustrate the tempo change procedure, consider the following example of a song whose original overall tempo is 120 BPM:

Song Step #	Segment to be Played or Instruction
Step 1:	61
Step 2:	62
Step 3:	Tempo change speed up by 10% relative to the overall tempo (10% speedup of 120 BPM = 132 BPM)
Step 4:	62
Step 5:	62
Step 6:	61
Step 7:	63
Step 8:	Tempo change — slow down by20% relative to the overall tempo (20% slowdown of 120 BPM = 96 BPM
Step 9:	66
Step 10:	67
Step 11:	Tempo change — return to original overall tempo (120 BPM)
Step 12:	68
Step 13:	69
Step 14:	End

First you would assign the desired tempo changes to the lower row of numbered keys, as described above in (2) through (6). A logical way to do this would be to assign a tempo change of 110% (necessary for step 3) to key number 1 and a tempo change of 80% (necessary for step 8) to

key number 2. While programming the song, when you reached step 3 you would follow the procedure in (7) above, and enter 1. Upon reaching step 8, you would again follow the procedure in (7) but this time enter 2. In step 11, you would follow the procedure in (9) to return to the original overall tempo.

- To relate tempo changes to BPM in a song that includes tempo changes, hit TEMPO, start the song by pressing RUN/STOP, and watch the display. It will show the tempo in BPM, changing to an updated value every time there is a tempo change.

- While adjusting tempo based on a *percentage* of the overall tempo may be initially confusing. the advantage of this approach is that should you change the overall tempo, all tempo changes are kept in proper relationship to the overall tempo.

Programming Trigger Outputs 3M

You may program the Drumulator to output trigger pulses during the course of a song. This advanced technique allows the Drumulator to generate pulses every eighth note, eighth note triplet, sixteenth note, sixteenth note triplet, thirty-second note, or thirty-second note triplet. These pulses appear at the **MET/TRIG** jack on the back (see Section 5B), and can drive arpeggiator inputs on synthesizers, sequencers and other drum units for synchro-sonic effects. Best of all, unlike other units where these pulses start when the song starts and end when the song ends, you can program any of the six pulse options to occur at any point in the song. Here's how:

1. When writing out the order of steps for the song, allot one step for each place you want the trigger pulses to begin, or want the trigger pulses to change to a different rate or stop.

2. Make sure you are in *song* mode. When you reach the step where you want to start putting out pulses, press **MET/TRIG.** The right-hand display starts flashing **ME.**

3. Press 1 for eighth note pulses, 2 for eighth note triplet pulses, 3 for sixteenth note pulses, and so on — just like programming Auto Correct. The step number in the left-hand readout starts flashing to indicate that this step contains trigger, rather than segment, information. The right-hand readout indicates 8 if you've selected eighth note pulses, .8. for eighth note triplets, 16 if you've chosen sixteenth notes, and so on (again, this is just like programming Auto Correct).

4. Press ENTER to enter the pulse train start' instruction into the Drumulator's memory.

5. Then **ou** reach a step w here von want **to** change the pulses to a different rate, press MET' **TRIG.** enter the number corresponding to the desired pulse rate, and press **ENTER** to enter this instruction into the Drumulator's memory.

6. If you reach a step where you want to stop the pulses, press **MET/TRIG.** The right-hand display starts flashing **ME.** Press **MET/TRIG a** second time. The step number in the left-hand display starts flashing, and two dashes ***(--)*** appear in the right-hand display. Press **ENTER** to enter this instruction into the Drumulator's memory.

Notes:

- A programmed trigger change occurs simultaneously with the next segment programmed into the song.

Starting in the Middle of a Song 3N

Usually, when you press **RUN/STOP** the song resets to the beginning before playing. However, you may start in the middle of a song with the following procedure:

1. Make sure you are in *song* mode.

2. Use the **>** and **<** keys to locate the step at which you want to start.

3. Hold down **SELECT** (the display shows the song you've selected) and tap **RUN/STOP.**

Notes:

- If you start in the middle of a repeat loop, the repeat instruction will be ignored by the Drumulator, and you will simply proceed to the next step after the repeat instruction.

• Suppose you're in *segment* mode, have come **RUN/STOP.** The song will now play with the setup with a great segment mix, and want to know how ment mix. If you decide you don't want this mix after this mix would sound if transferred over to a certain all, simply stop the Drumulator. If you do want to song. You can use the "Starting in the Middle of a transfer the mix, after stopping the Drumulator and Song" feature to "preview" the mix without wiping before doing *anything* else, press and hold **SELECT** out the song's currently programmed mix. First, and then press LEVEL. A beep will confirm the select the song; next, hold down SELECT then press transfer.

3O Efficient Use of Memory

The more efficiently you use memory, the more space you'll have available for storing all those wonderful drum sounds. Consider a song where you have an 8 measure chorus, consisting of *7* identical measures followed by 1 different measure which serves as a "fill":

• The least efficient use of memory would be to treat the entire 8 measure chorus as one long segment.

• A much better use of memory would be to treat the *7* identical measures as *7* distinct song steps, followed by an additional song step for the "fill".

• The best use of memory would be to repeat the identical measure ***7*** times (this only requires three song steps: begin repeat, the segment number of the measure, and end repeat 7 times), followed by an additional song step for the "fill".

• Remember, the most efficient way to use memory is to repeat segments whenever possible. Song steps take up very little memory space compared to the memory needed to record a segment; for example, filling up all eight songs with 99 song steps only uses about 21% of the total memory. Any time you can replace segments with song step instructions, you save considerable amounts of memory.

• The shorter the segment, the better. If a segment consists of two identical measures, change it into one measure and repeat it twice.

• Periodically check the remaining percentage of memory (see Section 2L). If you start getting close to a memory full condition, erase unneeded segments, or program a smaller number of songs. You may save what you already have on tape via the cassette interface (see Section 4).

SECTION 4: USING THE CASSETTE (TAPE) INTERFACE

4A Overview of how to Hook Up, the Drumulator Cassette Interface

4B Saving Drumulator Data on Tape

4C Verifying Saved Data

4D Loading Data from Tape into the Drumulator

4E Loading a Single Segment from Tape into the Drumulator

4F Tips on Using Cassette Interfaces

4G Drumulator Data Cassette Label

4H Drumulator Data Cassette Song Index

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4A Overview of, and How to Hook Up, the Drumulator Cassette Interface

The Drumulator has a cassette (tape) interface that lets you save both segment and song data on tape. Suppose you've worked out a great set of drum parts on the Drumulator, but have used up enough memory that there's no more room to work out another song. Simply save the existing song on tape, clear the memory, and proceed with developing your new songs and segments. If you ever want to go back to the older songs and segments, simply re-load the data from tape back into the Drumulator.

The Drumulator has three tape interface functions: Save (to transfer Drumulator data to tape), Check (to verify that this stored data is correct), and Load (to transfer data from tape back to the Drumulator). Note that you may be either in *song* or *segment* mode — it doesn't matter.

To hook up the Drumulator cassette interface, run a patch cord from the CLK/CAS OUT jack to the input jack of your tape recorder. This may be a reel-to-reel or quality cassette deck. For best result, use the line level input (microphone inputs will be overloaded in most cases). Run another patch cord from the speaker/headphone output (or line level output) jack of your tape recorder to the Drumulator's CLK/CAS IN jack. If you have a stereo recorder, use a Y-cord or similar adapter to feed *both* channels with the Drumulator's signal. By doing this, if one of the tracks has a dropout or becomes damaged, you will still have the Drumulator data available on the other track. However, when playing back from a stereo deck, only use *one* of the channels. This prevents problems if the tape head azimuth is misaligned (which unfortunately is the case with many tape recorders).

When you use your recorder, leave any noise reduction OFF. However, limiting the signal may be helpful.

4B Saving Drumulator Data on Tape

To save Drumulator data:

1. Press CASSETTE. The display shows CASS and the CASSETTE light will glow.

2. If your tape recorder has VU or LED meters, put your tape recorder into *record* mode but do not yet run the tape (this lets you set signal levels of the signal going into the recorder). Press SAVE (one of the two CASSETTE buttons) to send a signal to the recorder; adjust the recorder's input level for an approximate +3 VU signal (you can even overload the tape pretty heavily and the interface will still work well). While the information is being sent out from the Drumulator to the recorder, the CASSETTE light will flash until the save operation is complete, at which point it glows continuously.

   If your tape recorder does not have VU meters, patch into the line level input, and if the recorder includes a limiter, turn it on.

3. Start your recorder running and make sure it is in the *record* mode. Press SAVE; the display will say SAVE, and the CASSETTE light will start blinking. After the data has been transferred, the CASSETTE light will stop blinking and the display will again say CASS. Keep the recorder running in *record* mode, allow a few seconds of silence, then press SAVE again so that you have a back-up copy of the Drumulator data. After the second save, you may even want to do a third save, just in case there are problems with the tape (such as drop-outs). This way you can be pretty confident that at least one of the saves will be good.

Verifying Saved Data 4C

Cassette interfaces, while very reliable, can sometimes fall victim to bad tape, incorrect record levels, and so on. Therefore, it is important to verify the accuracy of the saved data using the following procedure:

1. Rewind the tape recorder to just before where the saved data is recorded.

2. If you are not already in *cassette* mode, press the **CASSETTE** button as described in Section 4B, step 1.

3. While holding **SAVE,** tap LOAD then release both buttons. The display shows **CHEC,** and the CASSETTE LED should be lit.

4. Put the tape recorder into *play* mode. As soon as the data starts playing back, the CASSETTE light should start flashing. If not, there is not enough signal getting to the Drumulator. Turn up the recorders output control a bit, or if you are plugged into a line level output jack, try plugging into the headphone or speaker output jack instead. Rewind and try again; with enough level, the CASSETTE light will start flashing.

5. After the data has finished playing back, the CASSETTE light will glow continuously, and the right display will (hopefully!) show **GOOd.** This means that the data has been properly stored on tape. Follow the same procedure to check the other saves you did.

   If the right display shows **bAd,** it means that the data was not saved properly. The problem could be dirty tape heads, a tape drop-out, a physically damaged piece of tape, and so on. Check the other saves and see if the same problem occurs. If the bAd indication comes on often, refer to Section 4F, "Tips on Using Cassette Interfaces."

6. After verifying the data, either proceed to tile next section, or press **CASSETTE** again to end the checking procedure.

Notes:

- The Drumulator check option is a bit more sophisticated than the verification option found on some polyphonic synthesizers. Most synthesizers compare the data on tape to the data inside tile machine; if it matches, tile data is considered good. You cannot, however, verify data unless the synthesizer contains the exact same data. The Drumulator, on the other hand checks the integrity of the stored data independently of whatever is in the Drumulator. Therefore, if you suspect that an old tape has been damaged, you may check it regardless of whatever data is currently in the Drumulator.

Loading Data from Tape into the Drumulator 4D

This procedure is very similar to checking. Follow these steps:

1. Rewind the tape recorder to just before where the saved data is recorded.

2. If you are not already in *cassette* mode, press the **CASSETTE** button as described in Section 4B, step 1.

3. Press **LOAD**; the display shows **LOAd**, and tile CASSETTE LED should he lit.

4. Put tile tape recorder into *play* mode. As soon as tile data starts playing back, the CASSETTE light should start flashing. If not, there is not enough signal getting to the Drumulator. Turn up the recorder's output control, or if you are plugged into a line level output jack, try plugging into the headphone or speaker output jack instead. Rewind and try again; with enough level, the CASSETTE light will start flashing.

5. After the data has finished playing back, the CASSETTE light will glow continuously, and the right display will probably show **GOOd**. This means that tile data has been properly loaded into the Drumulator.

6. If the right display shows bAd, it means that a problem occurred while loading the data. Possibly the data was not saved properly on tape (although the Check procedure in Section 4C should have caught any problems), or maybe you're using an intermittent cord, tile level was changed during tile loading process, etc. Try loading tile other saves and see if the same problem occurs. If the bAd indication

comes on often, refer to Section 4F, “Tips on Using Cassette Interfaces”.

Note that if the **bAd** message occurs while in *cassette* mode, the Drumulator automatically clears its memory so that the bad information does not remain in the Drumulator’s memory. However, if the **bAd** occurs after tile memory integrity test which occurs upon turn-on, memory will not be cleared.

7. To return to normal operation, press **CASSETTE** again; the CASSETTE light will go out. If you were in *segment* mode before going into *cassette* mode, segment number I 1 will appear in tile right-hand display. If you were in *song* mode, the first step of song 1 will appear in the display.

4E Loading a Single Segment from Tape into the Drumulator

To load in a single segment from cassette, follow the above procedure but when it comes time to press **LOAD,** press and hold **LOAD** and, while continuing to hold **LOAD,** use buttons 1-6 to key in the number of the segment you want to load

Notes:

- Loading in a single segment overwrites any data, which already exists in that segment. Check the contents of any segment before loading, just in case it contains something you want to keep.
- If there is no information in that segment, the display will show **nonE.**
- If the segment takes up lots of memory and the Drumulator memory is close to full, the display might show **FULL** if you attempt to load this segment.
- Cassette tape speed accuracy is more critical when loading single segments than when loading general data.

4F Tips on Using Cassette Interfaces

• **How they work:** Pushing buttons on the Drumulator feeds data on songs and segments into the Drumulator’s “brain”. This data, expressed in *digital* form, is conveniently stored in the Drumulator’s memory banks, and backed up with a battery to keep the data intact even when tile power is off.

By translating this data into a series of alternating audio tones rather than voltages, we may store the data on a standard audio tape recorder. Thus, the recorder stores a complete record of all the segment and song information, expressed as audio tones. The hardware, which records or reads this data to or from tape, is called a *cassette interface.* Once this data is stored on cassette, it may then be re-loaded back into the Drumulator at any time in the future.

• **Use the right kind of tape:** Standard audio cassettes, while they may be used with cassette interfaces, are not recommended for this particular application. First of all, saving all the Drumulator data takes up only about 15 seconds of tape. So, if you’re using a C-90 cassette or equivalent, you’re either going to waste a lot of tape if you only store a few patches, or you‘re going to have a very difficult time locating a particular 15 seconds out of the available 45 minutes on a side.

Another problem is drop-outs. With audio tape, a short drop-out (while annoying) is no big deal. If that drop-out occurs in the middle of your data, though, look out! The cassette interface will receive garbled information, and may not even be able to load the data at all.

A better alternative is the *certified data* cassette. Certified data cassettes (available at Radio Shack, computer stores. some office supply stores, etc.) are terrible for audio, hut wonderful for data storage. They come in relatively short lengths (C-5. C-10, and C-20) so you don’t waste tape, and are not too expensive. Ask your local computer freak (he’s the nerd with the glasses and $60,000 salary) for a good local source.

• **Use one cassette deck consistently:** When using cassettes, store and play back data on the same tape recorder, preferably one with AC power. This gives the most reliable results, since there might be enough variations between different machines to cause problems.

• **Recording data on reel-to-reel recorders:** If you’re working in the studio on a song, which uses recorders, and use good quality tape, drop-outs and similar hassles should not be a problem. And, if you come

back to the song at a later date, the Drumulator data will he right there waiting for you. Reel-to-reel recorders also usually give you more flexibility in terms of setting input and output levels, thus allowing y ou to better match the tape interface to the tape.

Identify data vocally: Since most small cassette machines have built-in mikes, and other decks have mic input jacks, it's easy to record a brief bit of narration describing the nature of the data saved on the cassette. However, note that the vocal sounds may cause strange triggering of the cassette interface. So, listen to the recorder with the interface deactivated (or the cassette output unplugged from tilt' Drumulator) until hitting the vocal announcement. After the narration is over, plug the cassette player back into the Drumulator and start loading the data. Another option is to record the voice at a low enough level that the interface simply ignores it.

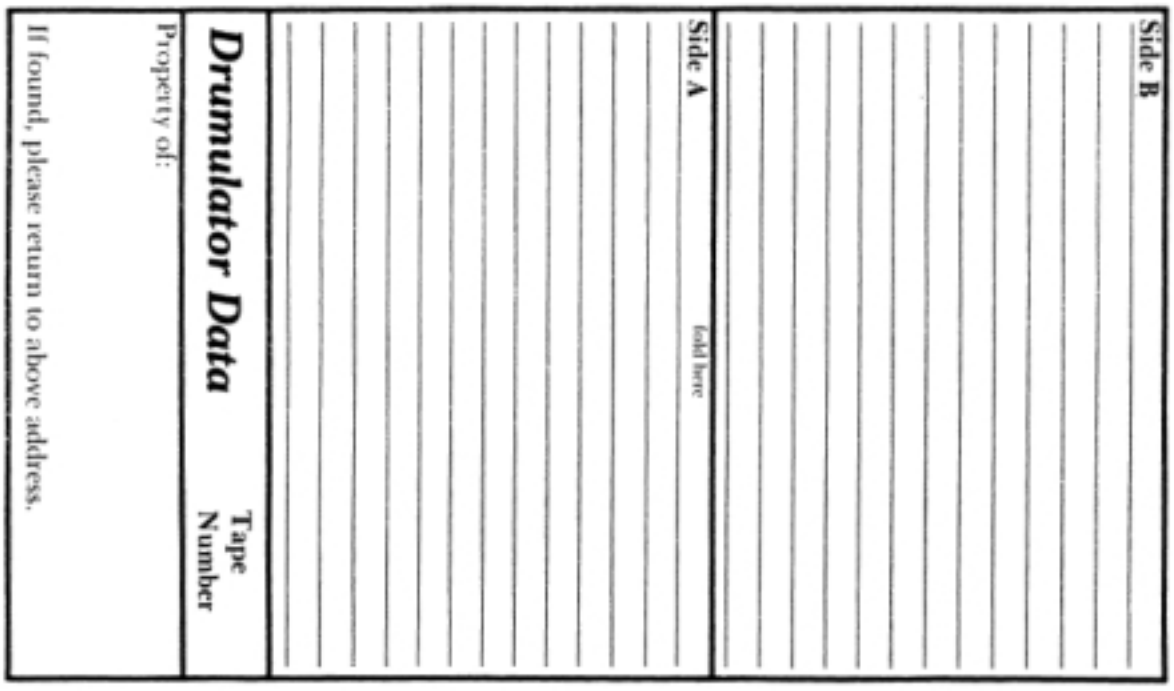
- Maintain a back-up cassette: Recording multiple saves is the only way to prevent the loss of valuable data; another is maintaining a **second** cassette on which you also record the data several times. That way if something drastic happens to the first cassette, you'll have a duplicate. Computer owners are very aware of the need to make back-ups of important data - and if you ever lose an important cassette, you'll appreciate the value of back-ups as well.

- Take care of your recorder: Remember to clean the heads, capstan, and pinch roller, as well as perform regular demagnetization.

Drumulator Data Cassette Label 4G

This data cassette label can replace tile stock label included in most cassettes. To use, photocopy the page, cut out tile label, and fold Side B back against side A.

We suggest that in addition to writing down the titles of all compositions stored on the data cassette, you also include the song select numbers. This will make it easier for you to find specific songs.



4H Drumulator Data Cassette Song Index

If you're like most Drumulator players, before too long you'll end up with a bunch of data cassettes containing various songs and rhythm patterns. Feel free to photocopy this page in order to keep a record of what songs are on what tapes.

Song Title	Tape Number	Song Title	Tape Number

SECTION 5: CONTROL JACKS ON THE BACK

5A Footswitch Jacks

5B Met/Trig Output

5C Gate Inputs

5D Overview: Clock Input and Clock Output Jacks

5E Recording a Sync Track on Tape

5F Recovering the Drumulator's Sync Track from Tape

5G Using the Drumulator with 24 Pulses Per Quarter Note Clocks

5H Using the Drumulator with 48 or 96 Pulses Per Quarter Note Clocks and Audio Rate Clocks

5I Synchronizing Applications

5J External Computer Interface

5A Footswitch Jacks

1. **RUN/STOP** jack: Plugging a footswitch that shorts the hot line to ground (most guitar amp foot switches and synthesizer control footswitches operate this way) into this jack lets you operate the RUN/STOP function via footswitch. Press once to *run,* press again to *stop.*

2. **REPEAT** jack: If you're in *song* mode, the Drumulator is *running,* and you have programmed a repeat of any length into the song, plugging a footswitch (again, the kind that shorts the hot line to ground) into the **REPEAT** jack and pressing **it** gets you out of the repeat. For example, suppose you have programmed a song where a solo of indeterminate length is played over a repeating series of segments. By using repeat instructions (see Section 3F) to put these repeating segments into an infinite repeat loop, the segments will keep repeating for as long as the solo lasts. When the solo is about to end, press the footswitch; the Drumulator will ignore the infinite repeat instruction, and proceed with the remainder of the song.

   If you're in *song* mode and the Drumulator is stopped, pressing this footswitch advances you to the next song. For example, if you are currently in Song 3, then pressing this footswitch jumps you to Song 3.

5B Met / Trig Output

In *segment* mode, the metronome signal appears at the **MET/TRIG** output jack, with the level being independent of the **METRONOME** VOLUME control. In *song* mode, any triggers which you programmed to appear during the course of a song (see Section 3M) appear at this jack. The level and drive capability of these triggers make them compatible with many (if not most) synthesizer arpeggiator clock inputs, sequencer clock inputs, gate inputs, and the like. (For the techno-weenies in the crowd, you might like to know these triggers are narrow +5 Volt pulses, which are TTL compatible.)

5C Gate Inputs

Gate inputs **GATE A** through **GATE D** accept +5, LSTTL compatible pulses (the kind generated by many sequencers, drum units, and soon) to trigger the drum sounds assigned to Drum Play buttons A - D, respectively. If you're in *record* mode, you can also use these jacks to program the drums from an external trigger source.

Another application for these jacks is to drive them with Syndrum™ type trigger pads, through an appropriate interface (contact the factory for information on interfaces). Thus, you could play the Drumulator's drum sounds manually from trigger pads using drum sticks. Remember, too, that you may play drum sounds simultaneously with the sounds occurring during a programmed pattern; thus, you can program a pattern in the Drumulator, and play up to four sounds over it using drum sticks and trigger pads**.**

5D Overview: Clock Input and Clock Output Jacks

The clock input and output jacks are indispensable for studio work using the Drumulator. Here's why: Suppose you record a Drumulator part on tape. Now, suppose you want to add some overdubs, so you try adding another Drumulator part. Whoops! At some point, the two different tracks are bound to go out of sync, since
even slight variations in tape speed can cause sync problems.

The solution is to record a master sync track on tape as your very first track, and synchronize all rhythmic events to this track. Thus, you can feed this sync track into the Drumulator to have it sync up exactly with the timing information put on tape. With appropriate interfacing circuitry (such as the "Dr. Click" or "Master Synchronizer" sync units), you may also use this sync track to drive synthesizers, sequencers, envelope generators, etc. This sync track consists of triggers, which

follow a 24 pulses per quarter note standard, as used by Roland's TR-606, TR808, and TB-303;

PAIA's Master Synchronizer: the Alpha Syntauri computer system; and equipment made by other manufacturers. Therefore. any units which accept external clocks following a 24 pulses/quarter note standard will work with the Drumulator, and conversely, the Drumulator can drive any of these units.

Not all equipment follows this standard, however; the LinnDrum follows a 48-pulses/quarter note standard, while the Oberheim DMX follows a 96 pulses/quarter note standard. Luckily, the Drumulator can also divide incoming clocks by any integer from 1 to 99, and since these nonstandard clocks are *multiples* of *24* pulses/quarter note, the Drumulator can use these higher speed clocks by dividing them down into an acceptable range.

Recording a Sync Track on Tape 5E

1. To record a Drumulator song or segment -sync track on tape, patch the **CLK/CAS OUT** jack to one channel of your tape recorder. For best results, choose an inside channel since tile outer tape tracks are most prone to wear.

2. Press **RUN/STOP** to start the song. but do not run tape just yet. Observe tile level on the tape recorders VU meter, and set the recorder's input control for a level of about -5 to -7 VU. This level is sufficiently loud (in most cases) to trigger the Drumulator, yet soft enough to not cause crosstalk problems with adjacent tracks.

3. After setting the correct level, *stop* the Drumulator. Put the recorder into *record* mode, roll tape, and leave a few seconds of silence. Then *run* the Drumulator, which puts the sync signal on tape. Note that if you have programmed tempo changes into the song. the sync track will change tempo to reflect these changes.

Recovering the Drumulator's Sync Track from Tape 5F

1. Patch the output of the recorder channel containing the snc track to tile **CLK/CAS IN jack.**

2. Rewind the tape **tO** tile period of silence just before tile SVflC track starts.

3. Press **EXTERNAL CLOCK** (the EXTERNAL CLOCK light will glow), then press RUN/ **STOP. The EXTERNAL CLOCK** light will flash, indicating that the Drumulator is looking for tile sync track information.

4. Roll tape. As soon as the sync track starts, the EXTERNAL CLOCK light should glow continuously. If not, the Drumulator is not getting enougil signal level **(it** wants a minimum 1V peak-to-peak signal). Turn up the recorder's channel output, rewind the tape, and try again.

5. To return to normal after the sync track ends, *stop* the Drumulator, then press **EXTERNAL CLOCK.** The EXTERNAL CLOCK light will go out.

Using the Drumulator with 24 Pulses Per Quarter Note Clocks 5G

1. Connect a patch cord from tile other unit's clock output to tile Drumulator's **CLK/CAS IN** jack. For example. when using the Alpha Syntauri, select the 24 pulses 'quarter note mode, and run a cord from tile Alpha Syntauri's sync output jack to tile Drumulator. (Note. however. that older versions of the Alpha Syntauri software may require that you use tile 96 pulses/quarter note mode; see section 5H). When using the PAIA "Master Synchronizer" patch the clock out jack to the Drumulator.

2. If you can stop the other unit's clock, keep it stopped for now. Press and hold **EXTERNAL CLOCK** (the EXTERNAL CLOCK light will glow and the left-hand display will say **EC).** Check that the right-hand display says 01; if not, press and hold **<** until it does. Release **EXTERNAL CLOCK,** then press **RUN/STOP.** The EXTERNAL CLOCK light will flash, indicating that the Drumulator is looking for the external clock. If you cannot stop the other units clock, press **RUN/STOP** to run the Drumulator when you want it to start drumming.

3. Start the other unit. As soon as the clock starts, the EXTERNAL CLOCK light should glow continuously. If not, the Drumulator is not getting tile right kind of clock. Consult the manufacturer regarding compatibility with other manufacturer's equipment.

4. To return to normal after the external clock ends, *stop* the Drumulator then press **EXTERNAL CLOCK.** The EXTERNAL CLOCK light will go out.

Notes:

- When you start and stop the Drumulator by stopping and starting the external clock, the Drumulator does not reset to the beginning.

- If the Drumulator is running and you stop the clock, the Drumulator "goes to sleep" until the clock resumes, at which point your song or segment picks up from where it left off when the clock was stopped.

5H Using the Drumulator with 48 or 96 Pulses Per Quarter Note Clocks and Audio Rate Clocks

1. Connect a patch cord from the other unit's clock output to the Drumulator's **CLK/CAS IN** jack.

2. Hold **EXTERNAL CLOCK.** The left readout will show **EC** for External Clock, and the right readout will show the number by which the Drumulator will divide the external clock. In most cases, this number will be 01.

3. To accept a 48 pulses/quarter note clock, while holding' down **EXTERNAL CLOCK** use the **<** and **>** controls to change tile number in the right-hand readout to 02. This divides the 48 pulses by 2, thereby presenting the Drumulator with a 24 pulses/quarter note signal.

4. To accept a 96 pulses/quarter note clock, while holding down **EXTERNAL CLOCK** use the **<** and **>** controls to change the number in the right-hand readout to 04. This divides the 96 pulses by 4, thereby presenting the Drumulator with a 24 pulses/quarter note signal.

5. To accept an audio rate clock, while holding down EXTERNAL CLOCK use the > and < controls to choose the appropriate divisor to end up with 24 pulses per quarter note.

6. To return to normal after the external clock ends, stop the Drumulator, then press EXTERNAL CLOCK. The EXTERNAL CLOCK light will go 'out.

Please note that Oberheim DMX and LinnDrums use a different method from the Drumulator of storing a sync track on tape. Therefore, you cannot directly use a tape sync track generated by these units with the Drumulator; you must instead use the external clock capability of these machines**.**

5I Synchronizing Applications

By putting down a sync track on tape, you have the option to synchronize numerous devices together. For instance, first you can put down a drum track using the Drumulator, while simultaneously feeding programmed trigger pulses to the arpeggiator of a keyboard synthesizer.

Now you can program a different set of trigger pulse rhythms into the Drumulator, rewind the tape, and use these pulses - without recording the Drumulator, since that has already been done - to drive something like a sequencer to create a bass part.

Or, suppose you have an audio processor with a sync jack. You could drive that with trigger pulses, or program a drum sound every time you want a trigger to occur, then process that sound through an envelope follower to generate a trigger pulse capable of driving the processor's sync jack.

Want more ideas? How about: envelope following the ride cymbal, and using the envelope followed output to open up a synthesizer VCA which passes a guitar or keyboard sound...dividing the clock by 2 for automatic half-time effects...dividing the clock by 3 for off-tempo effects. Recording one Drumulator part, then overdubbing the same part but with the tape recorder speed altered slightly to give a "fat" sound...

For more information on synchronization, the author has written two articles for *Keyboard* magazine (20605 Lanzaneo, Cupertino, CA 95014) in the January and February 1983 issues, titled “Synthesis and Synchronization”. Part 1 describes how synchronizing works, while Part 2 describes a do-it-yourself device, which can synchronize numerous devices together. Also, *Polyphony* magazine (P.O. Box 20305, Oklahoma City, OK 73156) carries articles on synchronized music techniques.

5J External Computer Interface

The Drumulator was designed as a low cost digital drum machine with a minimum *of* expensive frills. As a result, the hardware contains no provision for external control, such as a parallel or serial port (nor is there any extra board space for adding the required hardware). However, due to popular demand, a method has been devised whereby advanced computer hobbyists can completely control the Drumulator sound generators via an external computer. This External Computer Control feature comes standard with all Drumulator’s, and allows the unit to accept a 9600 Baud, 8 bit serial RS-232C signal such as typically supplied by standard microcomputer serial interfaces. Here’s how to use the External Computer Control mode:

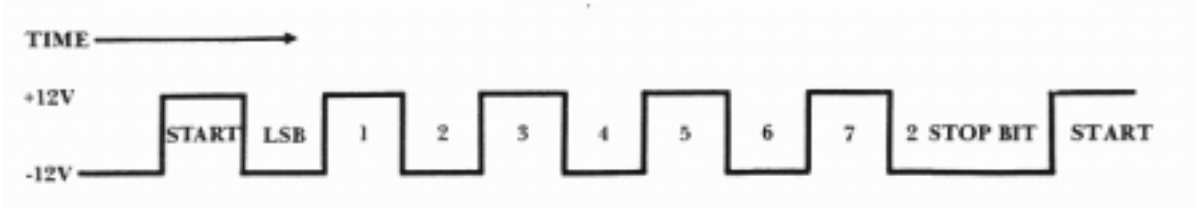
1. Hook up a cable from the computer’s RS232C connector to the Drumulator as shown. Note that the Drumulator needs only the serial output from the computer; all other signals are ignored. Note that some of the pins on the computer connector are connected together, because some UART’s require certain signals to be “true” to operate.

2. Press and hold the EXTERNAL CLOCK button on the Drumulator (the display will read EC 01 or something close), then press RUN/STOP. The Drumulator will appear to completely die — all LED’s will go out. This is because tile Drumulator is so busy looking for data it can’t do anything else. However, it will now faithfully respond to any serial data that you might send it.

Computer RS232 Connector	
Pin	**Name**
1	Protective Ground (no connection)
2	Serial Output (connects to the Drumulator’s **CLK/CAS** IN hot lead)
3	Serial Input (no connection)
4	Request to Send (connect to pin 5 on the computer connector)
5	Clear to Send (connect to pin 4 on the computer connector
6	Data Set Ready (connect to pin 20 on the computer connector)
20	Data Terminal Ready (connect to pin 6 on the computer connector)
7	Signal Ground (connects to the Drumulator’s **CLK/CAS** IN shield ground)

Note that depending on the size of tile national debt and the phase of the moon, the first byte you send to the Drumulator in this mode may give an erroneous sound; so send a test byte before doing serious work.

3. The data format required by the External Computer Control mode is an 8-bit serial data format. Because the Drumulator CPU is both controlling the sound generator and interpreting the serial data, 2 stop bits (or a parity bit and 1 stop bit) are required in between data bytes. This can generally be accomplished by programming the UART appropriately. Graphically, the data sent will be:



Because RS-232C is an inverting data format, the data shown above would be 01010101 binary or 55 hexadecimal.

4. The data format required by the Drumulator is interpreted to give a sound and level for each byte sent. The sound is initiated during the2 stop bit interval following data transmission. The most significant 4 bits indicate the level of the sound, according to the following table:

LS 4 BITS (HEX)	SOUND
0	Clave
1	Cowbell
2	Claps
3	Open Hi Hat
4	Closed Hi Hat
5	Ride Cymbal
6	Bass Drum
7	Snare Drum
8	Rimshot
9	HiTom
A	Mid Tom
B	Low Tom
C	Metronome Click
D	Ignored
E	Ignored
F	Ignored

   Note that the metronome click ignores the level data, and that the click will last about 2 millise-conds, preventing re-triggering during this time.

   As an example, sending the data string 37H, ABH, OCH would produce a snare drum at volume level 3, a low tom at volume level 10, and a metronome click.

5. To exit External Computer Control mode, press **ENTER.**

E-mu would be interested in hearing about whatever uses you make of this interface. Please contact the marketing department if you create any useful programs, or if you have any questions about properly applying the interface.

SECTION 6: MIXING AND PROCESSING THE DRUMULATOR

6A Mixing and Processing: Overview

6B Separating the Drumulator Drum Outputs

6C Pseudo Automated Mix Down

6D Creating Ambience

6E Using Special Effects in the Studio

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6A Mixing and Processing: Overview

Sure, the Drumulator sounds astonishingly realistic... but it doesn't necessarily sound like the drum sounds you hear on records. Why? Because when recording engineers record acoustic drums, the drums become part of a stereo acoustical space ("ambience"). Also, special effects may be added to various drums to make them punchier, brighter, fatter, and so on.

The Drumulator can benefit from these same techniques. While you can simply plug the **MIX OUT** jack into a tape Lrack or amplifier, a better approach is to plug the different drum sounds into a stereo mixing board. This lets you place the drums in the stereo field, add special effects, and vary equalization (tone).

Don't forget that you can also mix one drum sound subtly behind another drum sound. For example, mixing the low torn sound in behind the snare at a lower volume level results in a fuller sounding snare, while mixing the open hi-hat in with the ride cymbal results in a different ride sound.

6B Separating the Drumulator Drum Outputs

The following sounds are available at the following jacks:

BASS:	Bass drum
SNARE/RIM:	Snare and rim
HATS:	Closed and open hi hat
RIDE:	Ride
CLAP:	Handclaps
CLAVE/CWB:	Clave and cowbell
H/M TOMS:	High and mid toms
LO TOM:	Lo torn
MIX OUT:	Composite output of all drums

The individual outputs are affected by the levels and accents you programmed into the Drumulator.

6C Pseudo Automated Mix Down

Remember that you can chain up to 64 songs together. If you make each "song" a subsection of one master song, then that master song can change mix many times. Since the levels and accents programmed into the Drumulator are preserved at the various drum outputs, you could set all your mixer level controls to the same level, and use the level programming capabilities of the Drumulator to give pseudo automated mix down (at least for the drums!). Likewise, you can use up five or six songs of a few beats each to program a gradual crescendo or decrescendo at one point in a master song.

You won't believe how handy this is until you actually try it.

Creating Ambience 6D

In most cases, you'll plug the drum outputs right into the mixing console, and pan these sounds across the stereo field. While that will give you a good, clear sound, some people may find it *too* clear and clinical. The solution is to add ambience — a feeling of acoustical space — to help give a more "live" sound.

You may synthesize an acoustic space using delay lines, reverb, acoustic techniques, or any combination of the three. The author recommends adding at least one channel of acoustic ambience. The easiest way o do this is to consider the signal coming from the **MIX OUT** jack as a sort of "ambience/reverb send" jack **—** after all, it contains all the drum sounds mixed in their proper proportion. Feed this output to an amplifier/speaker combination inside an acoustical space (preferably a large, "live" room with fairly hard surfaces), and turn the sound up pretty loud. You might also want to cut back on the bass as much as possible to keep tile bass drum out of the ambient mix. Next, put a good quality mic in the same room. This mic should be at a distance from the speakers, and pointing away from the speakers towards one of the hard surfaces. Feed the mic output back into the board to mix some of this ambient sound in with the direct drum sound.

It's very helpful to have someone who can move the mic around as you listen to the results of these changes on headphones. You might want to mark the floor with chalk or tape if you find some particularly sweet spots for mic placement.

So far, that's one channel of ambience. You could add a second channel, but another approach is to split the mono ambient signal into two feeds. One of these would be panned left, while the other would be delayed by about 15 to 80 ms and be panned right. This gives a uniform ambient sound, yet one, which covers the full stereo field. Connecting more time delay effects (chorusing, flanging, pitch transposes, etc.) in parallel with the drum sounds adds very pleasing subliminal effects, assuming that you mix any of these effects in at a relatively low level.

Another popular ambience effect involves noise gating the ambient signal, and triggering this noise gate from the snare drum and toms. Thus, every time you hit the snare or a torn, the ambience cuts in; but when the snare and toms *aren't* happening, there's no spillover or noise from the ambient signal.

Using Special Effects in the Studio 6E

Here are some special effects, which are very useful with electronic drums:

Reverb is a common special effect. Unfortunately, spring reverbs (which are common in small studios) have some limitations, one of which is an inability to handle sharp bursts of energy — like drum beats. To minimize this problem, try limiting the drums before going into the reverb unit.

Splashing is a technique used with reverb. If you want to reverb specific beats, advance the reverb send control just before the beat, then turn it down after the beat. That one beat will be sent to the reverb and reverberated.

Echo units, when synched as closely as possible to the tempo of the song, can add interesting synchrosonic effects. For example, try feeding the Drumulator's snare output into an echo unit whose echo time equals a quarter or half note, and whose regeneration (feedback) is up part way. You can also add double-time effects easily by setting the echo time equal to an eighth note.

Equalization can perk up the sound of individual drums. Actually, the quality of the Drumulator sounds is superb, so in practice little equalization is needed. However, a little extra bottom on the bass drum, some extra sheen on the high hats, and an upper midrange boost on the snare drum can do for a Drumulator what a little tasteful make-up can do for a face.

Noise gates, in addition to enhancing ambient effects as described above, can also clip the decay of drums for a more percussive, clipped sound.

Ring modulators give great outer space and gong-like effects.

Pitch transposers can fatten up a drum sound by adding harmonics or sub-harmonics to the drum sound. They are especially effective with handclaps.

Chorus units can really enhance handclaps. Drum unit handclaps tend to sound unrealistic, since after all, no group of humans is going to clap their hands in *exactly* the same way every time. One way around this is to set the chorus for maximum delay (usually about 20 ms), and use modulation to vary the width. As the amount of delay changes, the handclaps tend to sound thinner or thicker.

6F Interfacing the Drumulator with the World

SEQUENTIAL CIRCUITS

Poly Sequencer and Prophet 10 Sequencer:

Drumulator clock out to sequencer clock in.

Pro One:

(In song mode) connect the Drumulator trigger out to the Pro One ext clock input to drive the Pro One arpeggiator. You can also use the individual sound outputs to run the arpeggiator by connecting to the audio-in jack on the Pro One.

Prophet 600:

Requires drum mod 0. 1 to widen trigger pulse horn 1 to 10 milliseconds. Connect metronome output of Drumulator to the control footswitch jack on the Prophet 600. This will allow control over the Prophet 600 arpeggiator but not the sequencer, which cannot be controlled from an external clock.

ROLAND

For interfacing to most Roland equipment, it is best to use the Drumulator to drive the Roland gear because the Drum ulator's clock can be controlled by the run stop button or footswitch. Also, for most Roland equipment a special adaptor cable is required since Roland uses a 5 pin "din" conncetor and requires 2 signals, "run/stop" and "clock."

If your Drumulator is before serial #2500, it will require changing the capacitor C-74 to a jumper (contact factory).

Connect clock-out of Drumulator to pin 3 of Roland "din" connector. Connect a footswitch (normally open) to a "y" adaptor. Connect one end of the "y" adaptor to the run/stop jack on the back of the Drumulator. Connect the other end of tile "y" adaptor to pin 1 of the Roland "din" connector. Connect ground from the Drumulator to pin 2 of the "din" connector. This configuration works with the TR606 Drumatix, TB303 Bassline, TR808, and most other Roland equipment.

The MC-4 Micro Composer can be operated in this way or more simply by connecting clock out of the Drumulator to the external sync input on the MC-4 front panel. The time base on the MC-4 should be set to 24 and the sync switch set to external.

To drive the arpeggiators in the Roland JP-4, JP-8, and Juno 60, Mod. 0.1 most be installed in the Drumulator to widen the trigger pulse from 1 to 10 milliseconds. Once installed, tile trigger output on the Drumulator can be connected to the external dock inputs on these keyboards.

LINN

LM-1:

Linn products run off a 48 pulse/quarter note time so it is necessary to have the Linn drive the Drumulator. Connect the "Internal Clock Out" of the LM-l to the "External Clock Input" on the Drumulator. Set the external clock divider on the Drumulator to 2. Set "Auto Correct" on the LM-l to HI.

Linn Drum:

Connect "Tape Sync Out'' on the Linn Drum to the "External Clock Input" on the Drumulator. Set the external clock divider to 2.

OBERHEIM

DMX:

Oberheim uses a 96 pulse/quarter not timebase for their drum machines and sequences so it is necessary to use them to drive the Drumulator. Connect "Clock Out" of the .DMX to "External Clock" on the Drumulator. Set the external clock divider to 4 on tile Drumulator.

DX:

This uses the same connection as the DMX.

DSX:

For some reason, the DSX has a different clock structure than the DMX. The pulse width of the clock signal on the DSX is so narrow that the Drumulator cannot see it. To make it work, the clock pulse from the DSX must be widened through a simple timing circuit or divided in half by a flip-flop which will produce a nice square wave at half the frequency (48 pulses/quarter note). Contact E-mu for more details.

Drum Mod OJ

1. For Drumulator's before serial #2500, replace capacitor C-74 with a jumper.

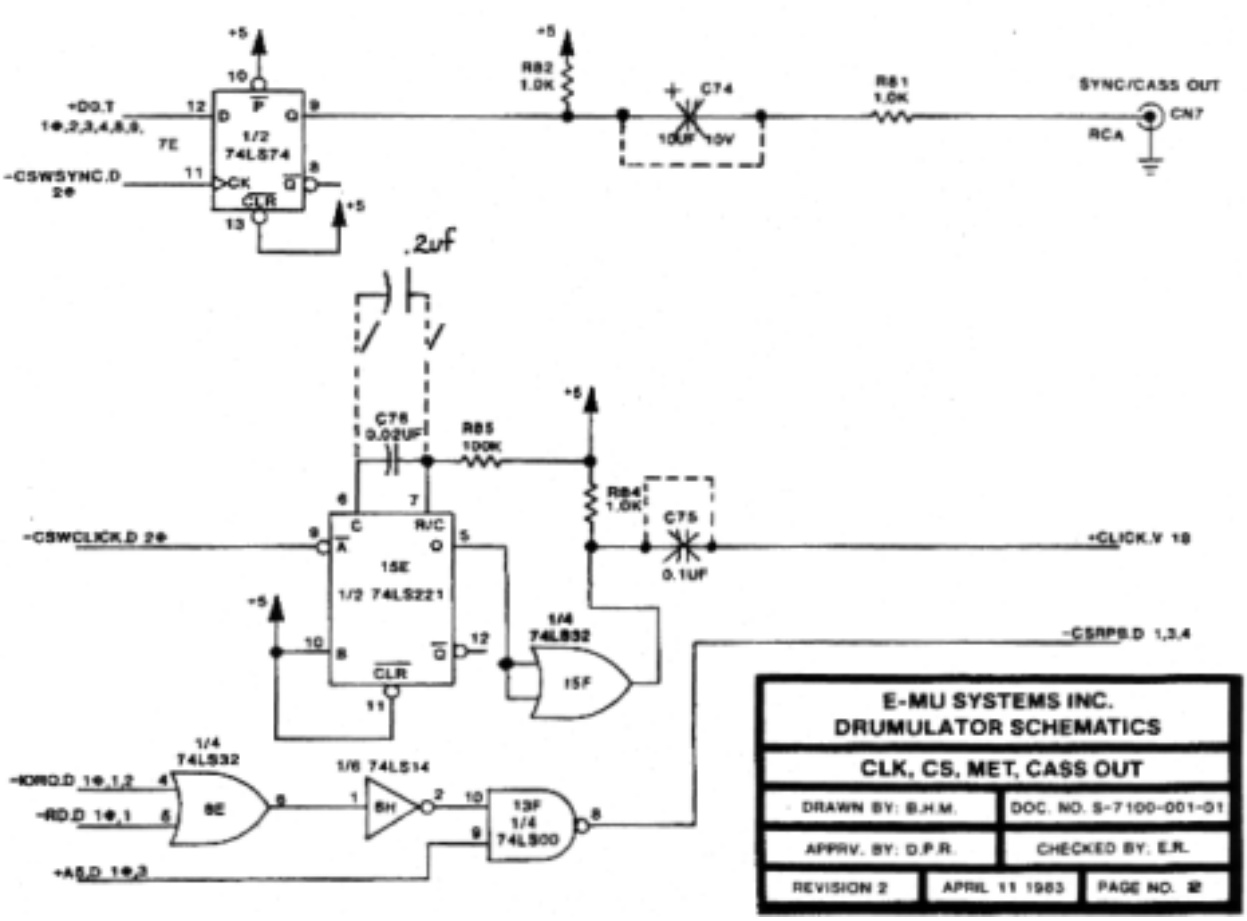
2. Remove C-75 and replace with jumper.

3. Install a single throw/double pole switch on the back of the Drumulator. You will have to. drill a hole (below the word MIX OUT is a good place).

4. Solder .2uf capacitor across both wipers of the switch.

5. Solder 2 lengths of wire to the switch contacts. Solder the other end of one of the wires to pin 6 of IC 15E an the other to pin 7, it doesn't matter which wire goes to which pin. There are feedthrough holes next to both pins 6 and 7 of IC 15E, connect the wires there.

6. Changing the capacitor value affects the sound of the metronome. It is better to use the original value for creating segments but the new value is better for syncing to other rhythm machines. That is the reason for the switch.



SECTION 7: REFERENCE SECTION

7A Default Settings

7B Summary of Functions and Controls

7C In Case of Trouble

7A Default Settings

When you first turn on the Drumulator, it assumes the following:	
Accent: All drums assume the accents programmed into Song 1	**Segment length:** The segment length programmed for segment 11
Auto Correct: 8 (eighth notes)	**Song/Segment:** *Song* mode
Display, left: 01 (first step of song 1)	**Swing:** The swing factor programmed for segment 11
Display, right: Segment number in the first step of song 1	**Tempo:** The tempo programmed for Song 1
Drum Play Button A: Bass drum	**Tempo changes:** All tempo changes are initially set to 100%; however if you change this, the changed settings are stored in memory.
Drum Play Button B: Snare drum	**Time signature:** The time signature programmed into segment 11
Drum Play Button C: Cowbell	If you clear all memory as described in Section 2M, the Drumulator assumes the above but with the following exceptions:
Drum Play Button D: Ride Cymbal	All segments assume 4/4 time signature, 2 measure segment length, and 50% swing factor standard)
External Clock: Whatever had been previously specified (typically 01 for the 24 pulses/quarter note standard)	All songs end on the first step
Level: All drums assume the levels programmed into Song 1	All tempos are set to 120 BPM
Metronome: 4 (quarter notes)	All tempo changes revert to 100%
Perc./Drums: *Perc.* mode	External clock is set for 01 (24 pulses/quarter note standard)
Run/Stop: Stopped	

7B Summary of Controls and Functions

The following is a short-form summary of the various Drumulator functions. For more information, refer to the indicated section number.

Segment Mode Functions

Unless noted otherwise,
the **SEGMENT** light should be lit.

1C Assigning 'standard Drum Sounds to Play Buttons: Choose *drums* or *perc.*mode. Hold down any Drum Play button, and continue holding it down while you tap the desired Drum/Percussion Sound Select button.

1C Assigning accented Drum Sounds to Play Buttons: Hold down the Drum Play button to be assigned and tap **ACCENT**. While continuing to hold down the Drum Play button, press the Drum Select button which corresponds to the drum or percussion sound you want accented.

1D Setting Drum/Percussion Levels: Press **LEVEL.** Press the desired Drum/Percussion Sound Select button. Vary the slider. When you reach the desired level, press **ENTER**.

1D Resetting All Drum/Percussion Levels to 0: Press **LEVEL** once to enter *level* mode; then press and hold **LEVEL** and press **ENTER**. A beep confirms this operation.

1E Setting Drum/Percussion Accents: Assign the sound to be accented to a Drum Play button (Section 1C). Press **ACCENT,** then the Drum Sound Select button you want to accent. Move the slider. When you reach the desired accent, press **ENTER**.

1F Playing Back Segments: Press one of the numbered buttons **1** - **6** to select the bank, then press one of these buttons to select the segment number. Press RUN/**STOP** to start the segment.

1G Setting tempo: Press TEMPO. Vary the slider to select the new tempo. When you find the right tempo, press ENTER.

1H Programming the metronome: Press MET/TRIG. Press one of the six metronome select buttons (8, 8/3, 16, 16/3, 32, 32/3) then press **ENTER.** Or, press **MET/TRIG** again for quarter note clicks.

2B Erasing a Segment: While holding down ERASE, press the desired bank number, key in the segment number, then press **ENTER.** A beep confirms that the segment has been erased.

2C Setting time signature: To set the time signature denominator, press MEAS. LEN(YTH Press > to increase, < to dec the denominator value. After reaching the right value, press ENTER. You are now ready to set the time signature numerator. Press > to increase, < to decrease the numerator value. Press **ENTER.**

2C Setting segment length: Press SEG. LENGTH. Press > to increase, < to decrease the number of measures per segment. After reaching the right value, press **ENTER.**

2C Real time segment length setting: Press SEC. LENGTH then RUN/STOP. After the appropriate number of measures have gone by, as indicated by the display, tap RUN/STOP a second time.

2E Setting Auto Correct: Press AUTO CORRECT. Press one of the 6 Auto Correct buttons (8, 8/3, 16, 16/3, 32, 32/3), then press ENTER. To select high resolution mode, press AUTO CORRECT twice and then press ENTER.

2F Recording a Segment: While holding down RECORD, push RUN/STOP so that the RUN/STOP light glows. Play the various drums where you want them to occur in the segment. When you've finished recording, press RUN/STOP again to stop the segment.

2F Recording a Segment, Assign Mode: While in *record* mode, press the **RECORD** button. The left-hand display will read AS (for assign). You are now temporarily out of *record* mode and can reassign sounds to the Drum Play buttons. To continue recording, press **RECORD** again.

2G Erasing A Specific Drum Sound: The Drumulator must be *stopped.* While holding down **ERASE**, tap the Drum Play button which triggers the sound you want to erase, and while still holding down **ERASE**, press **ENTER**. A short beep will confirm that the drum has been erased.

2H Erasing a Specific Note of a Drum Track: The Drumulator must be *running* and in *record* mode. While holding down **ERASE**, tap the Drum Play button which triggers the sound you want to erase on the note or notes you want to erase, or hold the Drum Play button down continuously to erase several consecutive beats of a drum sound.

2I Copying Segments: The Drumulator must be *stopped.* Key in the bank/segment you want to copy. Press **COPY**. Key in the number of the segment you want to copy to, and then press **ENTER** to complete the copying procedure. A beep will confirm a successful copy.

2J Appending a Segment: The Drumulator must be *stopped.* Key in the bank/segment you want to append. Press COPY. Key in the same bank/segment number, select the number of times to be appended (1- 8), then press ENTER. A beep will confirm a successful append.

2K Adding Swing: The Drumulator must be *stopped.* Press SWING; press buttons 1 - 6 to select the desired swing factor, then press **ENTER.**

2L Checking Memory Space: The Drumulator must be *stopped.* Press MEM. Display shows amount of remaining memory, expressed as a percentage.

2M Clearing all Data: While holding **ERASE** tap **CASSETTE**. While continuing to hold ERASE, press **ENTER.** A beep confirms that the data has been erased.

Song Mode Functions

Unless noted otherwise,
the SONG light should be lit

3B Selecting a Song: While holding down **SELECT**, press one of the lower row of eight numbered buttons.

3C Chaining Segments Together: Select the song you want to program. Key in the bank number of the first segment, then the segment number. Press **ENTER** or Key in the next bank/segment number, press **ENTER** or **>**, and continue keying in the various segment numbers until the entire song has been entered.

3D Ending a Song (repeating the song indefinitely): When you reach the last step of the song press END, then press REPEAT.

3D Ending a Song (proceeding to another song after the first song has ended): When you reach the last step of the song press END. Next, press one of the lower rows of numbered keys (1 - 8) to select the song number to which you want to jump.

3D Ending a Song (unconditional end): When you reach the last step of the song press END, then press END a second time.

3D How to Erase a Song: Enter an unconditional end at step I of the song by pressing END twice.

3E Editing Song (stepping): Locate the step by using the **<** and **>** buttons to make the appropriate change.

3E Editing Songs (inserting): To insert an additional step, locate the step number where you want the insert. Press INSERT. All subsequent steps are automatically renumbered to reflect the addition of the inserted step; you may now key in the instruction for the new step. After ending the instruction, press **ENTER.**

3E Editing Songs (deleting): Locate the step you want to delete, and then press **DELETE.** All subsequent steps are automatically renumbered to reflect this deletion. To delete more steps, continue pressing **DELETE.**

3F Using Repeats: Press **REPEAT** at the step where the repeat should begin. Press **REPEAT** again at the step where the repeat should end, then enter the number of times you want the repeat to occur using the lower row of numbered keys (1 - 8). If you want the repeat to continue indefinitely, press **REPEAT** again instead of entering a number. After keying in this step, press **ENTER** to enter the instruction into the Drumulator's memory.

3F Exiting from a Repeat Loop: You may exit from a repeat loop before you are scheduled to leave it by pressing **REPEAT** (or using a footswitch, as described in Section 5A). As soon as the repeating segment(s) has finished playing, the Drumulator will proceed to the next step in the song.

3G Programming Song Drum Sound Levels: Press **LEVEL.** Press the Drum/Percussion **Sound Select button** corresponding to the sound you want to vary, adjust the slider to vary the drum level from 0 to 15, then press the next Drum/Percussion Sound Select button whose level you want to program. After adjusting the level of the last Drum/Percussion Sound Select button you want to change press **ENTER**.

3H Setting Drum/Percussion Accents: Press **ACCENT.** Press the Drum/Percussion Sound Select button corresponding to the sound whose accent you want to vary, adjust the slider to vary the accent level from 0 to 15, then press the next Drum/Percussion Sound Select button whose accent you want to adjust. After adjusting the accent of the last Drum/Percussion Sound Select button you want to change, press **ENTER**.

3I Setting Song Tempo: Press TEMPO. Vary the slider to select the new tempo. When you find the right tempo, press **ENTER.**

3J Copying Segment Parameters to a Song: After perfecting the segment level/accent parameters, switch over to *song* mode. Hold down **SELECT** and press the appropriate numbered button (1 - 8) to select a song. While continuing to hold down **SELECT, tap LEVEL.** You will hear a beep to confirm that the transfer has taken place.

3K Copying Song Parameters to a Different Song: While in *song* mode, select the song whose parameters you want to copy over to another song. Hold down SELECT and press the appropriate numbered button (1 - 8) to select the song to which you want to copy the level and accent information. While continuing to hold down **SELECT,** tap **LEVEL.** A beep will confirm a successful transfer.

3L Programming Tempo Changes Within a Song (assigning tempo changes to the number buttons): Assign tempo changes to the buttons numbered 1 through 8 by first pressing **TEMPO** twice. Press button 1, then move the slider to find the appropriate amount of tempo change (expressed as a percentage). Next, either press **ENTER** to end this first part of the tempo change procedure, or press 2 to program a second tempo change in a manner similar to the above. You may program up to 8 tempo changes. After presetting the various tempo changes, press **ENTER**.

3L Programming Tempo Changes Within a Song (inserting these changes into a song): When you reach the song step where you want the tempo change to occur, while holding SELECT press TEMPO. Enter the number (1 - 8) which corresponds to the desired amount of tempo change, then press ENTER.

3L Programming Tempo Changes Within a Song (returning to the original tempo): When you reach the song step where you want the tempo change to occur, while holding SELECT press TEMPO. Press TEMPO a second time, then press ENTER to enter this step into the Drumulator's memory.

3M Programming Trigger Outputs (starting the pulse train): When you reach the song step where you want the pulses to start, press MET/TRIG. Press 1 for 8th note pulses, 2 for 8th note triplet pulses, etc. - just like programming Auto Correct. Press ENTER to enter the "pulse train start" instruction into the Drumulator's memory.

3N Programming Trigger Outputs (stopping the pulse train): When you reach the song step where you want the pulses to end, press MET/TRIG, press MET/TRIG a second time, then press ENTER to enter the "pulse train stop" instruction into the Drumulator's memory.

3O Starting in the Middle of a Song: Use the < and > keys to locate the step at which you want to start. Hold down SELECT, then tap RUN/STOP.

Cassette Interface Functions

In any of these steps, make sure you are in cassette mode by pressing **CASSETTE** so that the display shows **CASS** and the **CASSETTE** light glows

4B Saving Drumulator Data on Tape: Make sure levels are correct, then put tape recorder into *record* mode. Roll tape. Press **SAVE** to send the Drumulator song and segment data to the recorder. Make at least 3 saves to guard against defective tape.

4C Verifying Saved Data: Rewind the tape recorder to just before where the saved data is recorded. While holding SAVE, tap LOAD, then release both buttons. Put the tape recorder into *play* mode. After the data has finished playing back, the right display will (hopefully!) show GOOd to indicate that the data has been properly stored on tape. If the right display shows bAd, it means that the data was not saved properly.

4D Loading Data from Tape into the Drumulator: Rewind the tape recorder to just before where the saved data is recorded. Press LOAD. Put the tape recorder into *play* mode. After the data has finished playing back, the CASSETTE light will glow continuously, and the right display will (hopefully!) show GOOd. This means that the data has been properly loaded into the Drumulator. If the right display shows bAd, it means that a problem occurred while loading the data.

4E Loading a Single Segment into the Drumulator: Follow the above procedure but when it comes time to press **LOAD**, press and hold **LOAD** and, while continuing to hold **LOAD**, use buttons 1 - 6 to key in the number of the segment you want to load.

Control Jack Functions

5A Footswitch Jacks, RUN/STOP jack: A footswitch plugged into this jack duplicates the **RUN/STOP** switch. Press once to *run,* press again to *stop.*

5A Footswitch Jacks, REPEAT jack: When the Drumulator is *running* and in a repeat loop, pressing a footswitch plugged into this jack gets you out of the repeat.

5A Footswitch Jacks, REPEAT jack: When the Drumulator is *stopped,* pressing this footswitch advances you to the next song number.