

drumtrags

Software Drum Computer

Version 1.0

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Table of Contents

Introduction.....	4
About This Manual.....	4
The Improbable Project.....	5
Make It Clunky.....	5
Make It Funky.....	5
Words Of Wisdom.....	6
Acknowledgments.....	6
Overview.....	7
Channels.....	7
Channel Mix.....	7
Patterns and Songs.....	8
Loading And Saving.....	8
Tempo Control.....	8
MIDI.....	9
MIDI Import And Export.....	9
Tuning Information.....	9
Plugin Handling.....	10
Options Menu.....	10
The <i>drumtraks.ini</i> Configuration File.....	10
Control <i>DrumTraks</i> Via MIDI.....	11
MIDI Learn.....	11
In Case Something Goes Wrong.....	11
Plug-In Parameters And Buttons.....	12
Parameters.....	12
Buttons.....	13
Frequently Asked Questions.....	14
The Original <i>Drumtraks Operation Manual</i> by Stanley Jungleib.....	15
About the Model 400 Drumtraks and this Manual.....	15
1 BASIC SET-UP.....	17
1-1 Connections and Power On.....	17
1-2 Master Volume.....	17
1-3 Instrument Volume.....	17
1-4 Accent.....	17
1-5 Instrument Tuning.....	17
2 PLAYING PATTERNS.....	18
2-1 Pattern Run and Stop.....	18
2-2 Selecting Patterns.....	19
2-3 Cueing Patterns.....	19
2-4 Playback Tempo.....	19
2-5 Swing Value.....	20
2-6 RUN/STOP Footswitch.....	20
2-7 NEXT/REPEAT Footswitch.....	20
3. OVERDUBBING PATTERNS.....	21
4 RECORDING PATTERNS.....	22
4-1 Erase Pattern.....	22
4-2 Basic Recording.....	23
4-3 Time Signature.....	24
4.4 # of Measures.....	25
4-5 Instrument Volume.....	26
4-6 Instrument Tuning.....	26
4-7 Error Correct/Erase Instrument.....	27
4-8 Overdub with Programmed Volume or Tuning.....	29

4-9 Copying a Pattern.....	30
4-10 Appending.....	30
4.11 Memory Management.....	31
5 BUILDING BASIC SONGS.....	32
5-1 Erase Song.....	32
5-2 Build Song.....	33
6-1 Run/Stop.....	35
6-2 Selecting Songs.....	35
6-3 Cue/Stop.....	36
6-4 Tempo.....	36
6-5 RUN/STOP Footswitch.....	36
6-6 NEXT/REPEAT Footswitch.....	36
7 ADVANCED SONG FUNCTIONS.....	37
7-1 Copying a Song.....	37
7-2 Appending Songs.....	37
7-3 Editing Songs.....	38
7-4 Inserting Steps.....	39
7-5 Deleting Steps.....	40
7-6 Extending a Song.....	41
7-7 Volume Change.....	42
7-8 Initial Tempo.....	44
7-9 Relative Tempo Change.....	45
7-10 Ending Songs and Exiting Build Mode.....	47
8 CASSETTE.....	47
9 USING CHANNEL OUTPUTS.....	47
10 CLOCK IN/OUT.....	47
11 USING MIDI.....	48
11-1 Connection.....	48
11-2 External Instrument Control.....	48
11-3 Using Two Drumtraks.....	49
11-4 Use with Sequencer.....	50
12 DISPLAY SUMMARY.....	51
PATTERN MODE.....	51
SONG MODE.....	52
13 HIDDEN FUNCTIONS.....	54
14 DETAILS.....	55
15 SPECIFICATIONS.....	59
400 DRUMTRAKS MIDI IMPLEMENTATION.....	61
TRANSMITTED DATA.....	61
RECOGNIZED RECEIVED DATA.....	62
CODED FUNCTIONS.....	63

Introduction

DrumTraqs is a software instrument plug-in (VST2/VST3/AU/CLAP/AAX) for Microsoft Windows and Apple macOS simulating the classic Sequential Circuits *Drumtraks* drum computer from 1983. It is written in native C++ code for high performance even on “lighter” systems. The main features are:

- Simulation of the original Z80 system used in the hardware
- Original factory and some additional ROM samples
- Old-school Pattern and Song building
- Built-in stereo mixing options
- SysEx and MIDI import/export
- All parameters can be controlled by MIDI controllers
- Plug-in supports Windows and macOS

DrumTraqs is not intended to be the latest hot-stuff power drum plug-in with bells and whistles (although there are some *bells...*), the most cunning AI-driven super-human composition assistance tool, nor the coolest mega spawn of those magical 80s sound machines. Instead it is a faithful recreation of the original hardware with *all* its limitations and only a few extensions. Don't be afraid of time travel – this is the way drum computers were handled more than 40 years ago!

DrumTraqs is based on the **iPlug2** framework maintained by **Oli Larkin and the iPlug2 team**. Big thanks, guys!!! Without your work it would not have been possible to create a resizable *DrumTraqs* user interface.

To resize the plug-in you just grab the yellow triangle at the bottom right of the window and drag it. You can save the current window size using the menu entry “Save Window Size” in the *Options Menu*.

If you have trouble with the standard version of *DrumTraqs*, please grab the (sound-wise identical) “N” version of the plug-in which is based on the original **iPlug** framework.

About This Manual

Since *DrumTraqs* is basically a simulation of the original *Drumtraks*, I decided to leave any explanation how to play and record patterns etc. to the original manual. Thus, I added an OCR-ed copy of the original *Drumtraks Operation Manual* written by Stanley Jungleib in 1983 and updated with images of the *DrumTraqs* plug-in as an addendum to this manual. No copyright violation of the original manual is intended – I can only hope that no one is going to sue me!

Sometimes it is required to “press and hold a button” while doing something (for example changing a track's volume) or to access a special function (for example initialize a sound program).

In case of the *DrumTraqs* plug-in, right-click the respective button to simulate the “pressed button” state.

The Improbable Project

Sometimes things turn out differently than expected: I never planned to create a simulation of the Sequential Circuits *Drumtraks*. But right after the release of my *Six-Traq* plug-in I received a mail from Wolfgang Paulke, a former user of the original *Six-Trak*. Being a rock guitarist with a strong affection to electronics, Wolfgang had performed many concerts in the former German Democratic Republic and was a close friend of Reinhard Lakomy¹. We soon changed the medium, now talking on the phone about Wolfgang's life as a "GDR Electrician" and how he was able to obtain his gear in the 80s – remember that at that time the Iron Curtain especially between East and West Germany still existed!

Wolfgang enjoyed the fact that he was now able to reproduce the sounds of his long-gone *Six-Trak* and asked me if I would do the same to the *Drumtraks*, his 80s workhorse drum computer. Of course I said "No way"! At least I *think* I said that. But soon I found myself studying the schematics of the *Drumtraks* which is very much in keeping with the typical design of Sequential Circuits instruments from this era: A Z80 micro computer system controlling some audio electronics.

In one of our next calls I said to Wolfgang "Oh by the way, I am doing *DrumTraqs*, but you have to be my Beta tester!", and Wolfgang agreed.

Make It Clunky

This time I decided to really simulate the Z80 system within the final plug-in – I didn't want to reprogram the whole shebang of the *Drumtraks* operating system. I also did not want to change the way patterns and songs would have to be programmed by the user: The plug-in should be an exact replica of the original machine. I finally ended up with the ability to import at least MIDI data to patterns.

Creating my own Z80 simulator would have been stupid since there are already many fantastic simulators available. I chose Nicolas Allemand's simulator written in plain C99, not least because of its liberal MIT licensing. The base of *DrumTraqs* is the latest *Drumtraks* OS 0.5 which I grabbed along with the sound ROMs from Vincent's dbwbp.com website.

To understand how the Z80 micro-processor system interacts with the rest of the hardware, it was necessary to translate the byte code of the system ROM into "human readable" assembler code using DASMx.

Make It Funky

Emulating the audio electronics itself was straight forward, although the *Drumtraks* has some hidden peculiarities – in the end it is reading samples from ROMs at variable sample rates, expanding them according to the μ -law algorithm and do some final processing. This includes the two CEM 3320 filter chips for the *Bass* and the *Tom* channels.

1 Google those guys up and check out their work on YouTube – you will hear some fantastic stuff!

Words Of Wisdom

So here is *DrumTraqs* plug-in – feature-wise in no way a competitor to modern drum-related software instruments. And of course it does not sound like the original *Drumtraks* – but you would not have expected that, do you? 😊

Acknowledgments

- **Oli Larkin** and the **iPlug2** team.
- **Wolfgang Paulke** – influencer, Beta tester and a really fine chap!
- **kraftraum** (<https://soundcloud.com/kraftraum>) – “my” Beta tester and a really fine chap, too!
- **Stanley Jungleib** who wrote the original *Drumtraks Operation Manual*.
- **Nicolas Allemand** for his Z80 simulator (<https://github.com/superzazu/z80>).
- **Vincent** from dbwbp.com.
- **My family** for bearing me and my crude hobby.

No, I am not affiliated with Sequential Circuits (nor KORG) in what relation ever except that I find myself entangled with their instruments. 😊

Overview

DrumTraqs consists - roughly speaking - of two main parts: The *channels* that generate the drum sounds, and the *drum sequencer* that make the unit swing.

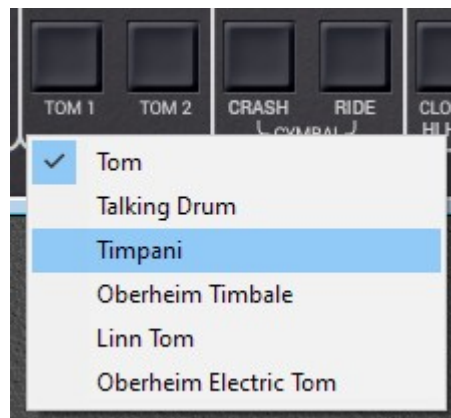
Channels

DrumTraqs features six individual drum channels that can play a total of 13 sounds. Thus, *DrumTraqs* is 6-voice polyphonic. However, it is not possible to play two sounds of one channel (for example *Snare* and *Rim* on channel 2) *at the same time!* When a sound is played, the respective LED of the channel lights up briefly².

Channel	Factory Sounds	Additional Sounds
CH 1 – Bass	<i>Bass</i>	<i>Linn Kick</i>
CH 2 – Snares	<i>Snare, Rim[shot]</i>	<i>Linn Snare</i>
CH 3 – Toms ³	<i>Tom</i>	<i>Talking Drum, Timpani, Oberheim Timbale, Linn Tom, Oberheim Electric Tom</i>
CH 4 – Cymbals	<i>Crash, Ride</i>	–
CH 5 – Hi Hats	<i>Closed Hi Hat, Open Hi Hat</i>	<i>Linn Hihat</i>
CH 6 – Percussion	<i>Claps, Tamb[ourine], Cowbell, Cabasa</i>	<i>Conga Slap, Agogo, Woodblock, African Bell, Mouth, Snaps</i>

The original *Drumtraks* was delivered with so-called *EPROMs*, fixed memory chips that contained the factory drum sounds. It was possible to exchange those sounds with different EPROMs (although not every EPROM would match with every channel!). The *DrumTraqs* plug-in allows you to instantly swap sounds by clicking on the sound name under the channel buttons and using a context menu.

There is not much you can do to the sounds themselves except for crude tuning and volume adjustments (see sections 2-1, 4-5 and 4-6).



Channel Mix

The original *Drumtraks* has one mono sum output plus six individual (mono) channel outputs. Thus, you need an external mixer to get a nice stereo mix. In contrary, the *DrumTraqs* plug-in features a stereo sum and six optional stereo channel outputs. Furthermore, the channel outputs have additional volume and pan controls.

² This is a unique feature of the *DrumTraqs* plug-in.

³ Note that the two different Tom sounds are in fact one sample with two different tunings!

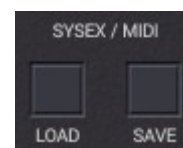
Patterns and Songs

Like many other drum machines, *DrumTraqs* is pattern-based which means that you can build *songs* out of various building blocks, the *patterns*. How to do this is described in the *Original Drumtraks Manual* (sections 4 to 7) below.

Up to 99 patterns and 99 songs – numbered from 00 to 98 – are available. Pattern 99 and song 99 are always “empty” (they are used as stop or ending markers). Interestingly, there is almost no limit to the size of a pattern, but you have to respect the fact that *DrumTraqs* can store at most 3289 “notes” (or events – whatever that means). It is also possible to program each sound with its own tuning and volume *per note* – very cool.

Loading And Saving

DrumTraqs does not feature the Cassette interface of *Drumtraks*. Instead you can load or save SysEx data chunks from/to files. A *Drumtraks/DrumTraqs* SysEx chunk consists of all songs and patterns of the whole machine – loading a SysEx file will replace the whole content of your current *DrumTraqs* instance.



Another option is to load and save songs and pattern individually as SNG or PTN files. And it is possible to load one song or pattern from an existing SysEx file. This way you can load all your favorite songs and patterns into one single chunk.

Tempo Control

In contrast to the hardware, *DrumTraqs* adds a tempo knob to control your beats-per-minute. I think the original *Drumtraks* way of changing the tempo using only the two SLOWER and FASTER buttons is a bit too clunky (of course you still can use them the intended way...).



Note that there are only 127 different tempo values (bpm) available. The selection of possible bpm is documented in the *Original Drumtraks Manual* section 7-9.

Finally you have the possibility to synchronize *DrumTraqs* to the host tempo: Just activate the SYNC button. Fun fact: *DrumTraqs* internally generates MIDI Timing Clock as well as MIDI Start/Stop messages from the host clock and sends them to the simulated Z80 system.

MIDI

Drumtraks was one of the very first MIDI-equipped instruments. According to today's standards, the original MIDI implementation is a bit crude, but it is working quite well. You can play the several drum instruments using a MIDI keyboard or sequencer (see the *Original Drumtraks Manual* section 11-2).

Drumtraks OS 0.5 features a nice option (not described in the manual) to play the 16 different tunings of an instrument via the keyboard. Therefore you first have to "select" the drum instrument you want to play via its respective MIDI note. Now you can play it using the note from F4 (MIDI note #65) to C6 (MIDI note #84).

MIDI Import And Export

The *DrumTraqs* plug-in features MIDI export of patterns and songs to MID files and MIDI import from MID files to patterns. This way you can immediately load your favorite MIDI drum pattern into the plug-in.

Note that *DrumTraqs* will also send MIDI notes (except for the AU version!) including velocity information. However, like the original *Drumtraks*, the plug-in will not take into account whether a channel instrument is played with or without *Accent* (which would make the instrument played a bit louder). When exporting MIDI, the *DrumTraqs* adjusts the velocity values of the exported notes to respect *Accent*. Thus, the exported MIDI data will sound "less loud" than the original pattern/song when not *Accent* is programmed.

Tuning Information

Another peculiarity is playing back a MIDI file with a varying tuning (0-15) of a drum instrument. *Drumtraks* encodes this information by sending a MIDI Note On message for a "tuning note" F4 to C6 (see previous section) followed by a Note On and Off for the instrument to play. Finally it sends the Note Off message for the tuning note. However, this all happens *at the same MIDI time offset*.

When playing a MIDI file exported from the *DrumTraqs* plug-in, some DAWs like Reaper get it right: They emit the MIDI bytes in the *exact same sequence* it was written into the MIDI file. But some other DAWs (I won't do finger pointing...) mix the MIDI data up: They do send the MIDI messages for the correct time offset *but not in the correct order*. Thus, the tuning information gets lost when fed back into the *DrumTraqs* (or *Drumtraks*).

To circumvent this problem I added another way of encoding tuning information when exporting, importing or playing back MIDI files: *DrumTraqs* understands Poly Aftertouch messages and interprets them as tuning for the respective instrument. While it does not make very much sense to use Poly Aftertouch when playing a drum instrument on the keyboard (because when you start to press, the drum sound has already been played), it is the simplest unambiguous solution using standard MIDI commands.

In the *Options Menu* you can select if you would like to use the standard "MIDI tuning note" or my unambiguous "Tuning Poly Aftertouch" when exporting MIDI files.

Plugin Handling

The *DrumTraqs* plug-in has some other features/functions hidden in the ominous *Options Menu* which will be explained in this section.



Options Menu

This menu opens when you click the MENU button in the top section.

Reset Channels	Resets all channels settings
Reset Z80 CPU	Resets the simulated Z80 CPU ("Power Off+On")
Clear DrumTraqs	Clears all the patterns and songs as well as the internal state and resets the Z80 CPU
Send MIDI Notes	Set if <i>DrumTraqs</i> should send MIDI Note messages
Send MIDI Clock	Set if <i>DrumTraqs</i> should send MIDI Clock messages
Send/Export Tuning Notes	Set if <i>DrumTraqs</i> should send MIDI Note messages for instrument tuning information
Send/Export Tuning Poly Aftertouch	Set if <i>DrumTraqs</i> should send MIDI Poly Aftertouch messages for instrument tuning information
MIDI Thru	Set globally if MIDI data sent to <i>DrumTraqs</i> should be sent through to its MIDI output
Ignore Program Change	Set globally if MIDI Program Change data sent to <i>DrumTraqs</i> should be ignored
Default Path for SysEx Files...	Sets the default path for SysEx, PTN and SNG files
Reload Configuration	Reload the <i>DrumTraqs's</i> configuration file (see section <i>The drumtraqs.ini Configuration File</i>)
Save Configuration	Save the <i>DrumTraqs's</i> configuration file (see section <i>The drumtraqs.ini Configuration File</i>)
Window Size...	Change the window size of <i>DrumTraqs</i>
Save Window Size	Stores the current window size to the configuration file so that it will be restored next time you load <i>DrumTraqs</i>
Check Online for Update	When connected to the Internet, this function will check if a newer version of <i>DrumTraqs</i> is available at fullbucket.de
Visit fullbucket.de	Open fullbucket.de in your standard browser

The *drumtraqs.ini* Configuration File

DrumTraqs is able to read some settings from a configuration file (*drumtraqs.ini*). The exact location of this file depends on your operating system and will be displayed when you click on "Reload" or "Save Configuration".

Control DrumTraqs Via MIDI

It is possible to fully control *DrumTraqs* by MIDI controllers, or more precise: Each MIDI controller (except *Modulation Wheel* and *Sustain Pedal*) can control one of *DrumTraqs*'s parameters or buttons. The mapping is defined in the `drumtraqs.ini` for example like this:

```
[MIDI Control]
CC7  = 0  # Master Volume
CC65 = 81 # Run/Stop button
CC71 = 3  # Tempo
...
```

The syntax is straight forward:

```
CC<controller number> = <parameter/button ID>
```

Given the above example, controller 7 directly controls the overall *Master Volume* parameter, controller 65 the RUN/STOP button etc. As you can see, comments are introduced by the Pound sign (#); they are here just for description purposes and completely optional. Note that the *controller number* can run from 0 to 110, with the exception of 1 (*Modulation Wheel*) and 64 (*Sustain Pedal*); the latter two are simply ignored.

MIDI Learn

The easiest way to (re)assign MIDI controllers to *DrumTraqs* is to use the *MIDI Learn* function. To activate MIDI Learn, click on the LEARN button and wiggle both the MIDI controller and *DrumTraqs*'s parameter or button that you want to link. If you want to unlearn the assignment, right-click the LEARN button (the label now reads "UNLEARN") and activate it. Now wiggle the MIDI controller or the parameter that you want to unlearn.

In Case Something Goes Wrong

There are three panic functions in the *Options Menu* when getting into real trouble:

- **Reset Channels**
This option will reset all the settings of the channels (drum sound, volume and panorama).
- **Reset Z80 CPU**
This is like switching the unit "off" and "on" again. The (simulated) Z80 CPU might get stuck somewhere in Spaghetti code, and that's the first option to solve the problem.
- **Clear DrumTraqs**
This is a brute force attack. It does everything of the above options plus clears the whole *DrumTraqs* memory. Be aware that all you song and pattern data will get erased so make sure to have a backup at hand

Another way to clear the *DrumTraqs* memory is to press 7,8,9, INC and DEC all together – see the *Original Drumtraks Manual*, section 13.

Plug-In Parameters And Buttons

Parameters

parameter	id	description
<i>Master Volume</i>	0	Master (overall) volume
<i>Metronome Volume</i>	1	Metronome volume
<i>Tempo</i>	2	Programmed tempo in bpm
<i>Sync to Host</i>	3	Synchronize tempo to host (On/Off)
<i>Channel 1 Volume</i>	4	Volume of Channel 1
<i>Channel 2 Volume</i>	5	Volume of Channel 2
<i>Channel 3 Volume</i>	6	Volume of Channel 3
<i>Channel 4 Volume</i>	7	Volume of Channel 4
<i>Channel 5 Volume</i>	8	Volume of Channel 5
<i>Channel 6 Volume</i>	9	Volume of Channel 6
<i>Channel 1 Panorama</i>	10	Panorama of Channel 1
<i>Channel 2 Panorama</i>	11	Panorama of Channel 2
<i>Channel 3 Panorama</i>	12	Panorama of Channel 3
<i>Channel 4 Panorama</i>	13	Panorama of Channel 4
<i>Channel 5 Panorama</i>	14	Panorama of Channel 5
<i>Channel 6 Panorama</i>	15	Panorama of Channel 6
<i>Bass Sample</i>	16	Sample (<i>Bass, Linn Kick</i>)
<i>Snare Sample</i>	17	Sample (<i>Snare, Rim[shot], Linn Snare</i>)
<i>Rim Sample</i>	18	
<i>Tom Sample</i>	19	Sample (<i>Tom, Talking Drum, Timpani, Oberheim Timbale, Linn Tom, Oberheim Electric Tom</i>)
<i>Crash Sample</i>	20	Sample (<i>Crash, Ride</i>)
<i>Ride Sample</i>	21	
<i>Open Hihat Sample</i>	22	Sample (<i>Closed Hi Hat, Open Hi Hat, Linn Hihat</i>)
<i>Closed Hihat Sample</i>	23	
<i>Claps Sample</i>	24	Sample (<i>Claps, Tamb[ourine], Cowbell, Cabasa, Conga Slap, Agogo, Woodblock, African Bell, Mouth, Snaps</i>)
<i>Tamb Sample</i>	25	
<i>Cowbell Sample</i>	26	
<i>Cabasa Sample</i>	27	
<i>Instrument Volume</i>	28	Position of the <i>Instrument Volume</i> knob
<i>Instrument Tuning</i>	29	Position of the <i>Instrument Tuning</i> knob

Buttons

button	id	description
<i>SLOWER</i>	63	Tempo control – press both together to see current tempo bpm in the LED display
<i>FASTER</i>	64	
<i>SELECT SONG FUNCTIONS</i>	65	Song # → Erase Song → Copy/Append To → Build Mode ↳ Pattern # → Vol. Change → Tempo Change → Insert → Delete
<i>ENTER</i>	66	Enter/Select command for song editing
<i>0 - 9</i>	67 - 76	Buttons 0 to 9
<i>DEC (<)</i>	77	Decrement button
<i>INC (>)</i>	78	Increment button
<i>SELECT PATTERN FUNCTIONS</i>	79	Pattern # → Record Mode ↳ Erase Instrument → Error Correct ↑ Swing % → Time Signature → # Of Measures → Erase Pattern → Copy/Append To
<i>RUN / STOP</i>	81	Starts or stops the sequencer
<i>ACCENT</i>	82	Accent for the current instrument played
<i>BASS</i>	83	Play the respective sample
<i>SNARE</i>	84	
<i>RIM</i>	85	
<i>TOM 1</i>	86	
<i>TOM 2</i>	87	
<i>CRASH</i>	88	
<i>RIDE</i>	89	
<i>CLOSED HI HAT</i>	90	
<i>OPEN HI HAT</i>	91	
<i>CLAPS</i>	92	
<i>TAMB</i>	93	
<i>COWBELL</i>	94	
<i>CABASA</i>	95	

Frequently Asked Questions

How do I install DrumTraqs (Windows VST2 32 bit version)?

Copy the files `drumtraqs.dll` from the ZIP archive you have downloaded to your system's or favorite DAW's VST2 plug-in folder. Your DAW should automatically register the *DrumTraqs* VST2 plug-in the next time you start it.

How do I install DrumTraqs (Windows VST2 64 bit version)?

Copy the file `drumtraqs64.dll` from the ZIP archive you have downloaded to your system's or favorite DAW's VST2 plug-in folder. Your DAW should automatically register the *DrumTraqs* VST2 plug-in the next time you start it.

Note: You may have to remove any existing (32 bit) `drumtraqs.dll` from your VST2 plug-in folder or else your DAW may screw the versions up...

How do I install DrumTraqs (Windows CLAP 32/64bit version)?

Copy the file `drumtraqs32.clap` (32 bit) or `drumtraqs64.clap` (64 bit) from the ZIP archive you have downloaded to the `C:\Program Files\Common Files\CLAP` folder. If your DAW supports the CLAP format, it will automatically register the *DrumTraqs* CLAP plug-in the next time you start it.

How do I install DrumTraqs (Windows VST3 64 bit version)?

Copy the file `drumtraqs.vst3` from the ZIP archive you have downloaded to your system's or favorite DAW's VST3 plug-in folder. Your DAW should automatically register the *DrumTraqs* VST3 plug-in the next time you start it.

How do I install DrumTraqs (Windows AAX 64 bit version)?

Copy the file `drumtraqs_AAX_installer.exe` from the ZIP archive you have downloaded to any of your system's folder and run it. Your AAX-enabled DAW (Pro Tools etc.) should automatically register the *DrumTraqs* AAX plug-in the next time you start it.

How do I install DrumTraqs (Mac)?

Locate the downloaded PKG package file in Finder (!) and do a right- or control-click on it. In the context menu, click on "Open". You will be asked if you really want to install the package because it comes from an "unidentified developer" (me 😊). Click "OK" and follow the installation instructions.

What is the plug-in ID of DrumTraqs?

The ID is `dt r q`.

Come on, Bucketeer, yet another boring simulation?

Yup, nostalgia. If you get bored, don't download it. The trash bin is your friend, too.

The Original *Drumtraks* Operation Manual by Stanley Jungleib

This part contains an OCR-ed copy of the original *Drumtraks Operation Manual* No. CM400A written by Stanley Jungleib and; art assistance was by Jay Oglevee. © Sequential Circuits 1983.

I updated the manual with images of the *DrumTraks* plug-in, marked the respective passages that are not applicable for the plug-in, and re-linked the sections.

No copyright violation of the original manual is intended!

About the Model 400 Drumtraks and this Manual

In the tradition of SCI's fully-programmable performance synthesizers, the Model 400 Drumtraks simplifies the creation of highly complex and convincing rhythmic arrangements. The design strikes a remarkable balance between ease of use and depth of functions. In addition to enabling its thirteen digitally-stored percussion sounds to be recorded, overdubbed and edited with perfect timing, this flexible, multi-track rhythm sequencer easily programs the variations which keep things rhythmically interesting: individual instrument volume and tuning, "swing" balance, accents, and tempo changes. Yet the Drumtraks price is a fraction of the price of the equivalent real instruments and multi-track recorder.

Each instrument is playable with its own key: Bass, Snare, Rim, Tom 1, Tom 2, Crash Cymbal, Ride Cymbal, Closed Hi-Hat, Open Hi-Hat, Claps, Tambourine, Cowbell, Cabasa. The instruments have already been professionally-recorded for studio-quality sound and a character that records well on tape.

As a digital recording instrument, the Drumtraks can do things which are impossible with tape. Multi-tracking, mixing, editing, copying, and erasing can be done without re-recording, splicing, or accumulating noise and distortion through the processes of "mix-down" and "bouncing" parts between tape tracks. The Drumtraks contains a programmable mixer with a monophonic output (which can drive stereo headphones). For control by external mixers or processors, six audio channels (plus the metronome) are available at the back panel through standard 1/4-inch phone jacks (see Section 9).

The Drumtraks has two primary modes: pattern and song. Basically, songs are made by chaining patterns together. The memory capacity of 3289 notes can be allocated to up to 99 different patterns, any of which can be up to 100 measures long in any time signature. Tempo range is 40 – 250 beats-per-minute. Each overdub of a pattern can be recorded with a different instrument volume or tuning, in real time (exactly as played), or auto-corrected to one of eight levels of resolution. Any part of an instrumental track can be erased. Patterns can be copied and added together (appended).

Up to 99 songs can be defined, which can consist of up to 100 steps. Steps specify how the song is built by selecting patterns and inserting volume or tempo changes. Songs, too, can be edited, copied and appended.

The Drumtraks memory is retained even when power is off thanks to a backup battery with a ten-year life. For permanent storage and reprogramming, the built-in interface can be used to store the contents of memory on a common Cassette.

All functional information is displayed on four eight-segment LEDs. For performance, two jacks for optional footswitches⁴ allow "hands-free" starting and stopping of songs, pattern or song selection, and pattern repetition. There are two built-in interface systems. For older sequencers or rhythm units and sync-to-tape there is a selectable 24, 48 or 96 pulse-per-quarter note clock input, and a 24- or 48-pulse clock output. For operation with computer-controlled sequencers, the new MIDI interface is also included. This enables the Drumtraks to synchronize to SCI's new Model 610 Six-Trak multi-timbral synthesizer/sequencer, or any other MIDI-equipped instrument. (For example, the Drumtraks can be played with full velocity control from the keyboard of the Prophet-T8.)

The Drumtraks has several levels of operation, allowing you both to learn how to use it immediately and to later explore its many options. For example, to start recording your own two-measure patterns, you simply select a pattern number, select record mode, then press RUN. An internal metronome provides the basic beat. As the pattern repeats itself (or, "loops") you can overdub any of the percussion instruments.

After becoming familiar with basic operation, you can change the number of measures in the pattern, the time signature (to any value), accents, error correct and swing Parameters.

This manual begins with basic setup (Section 1), followed by the simplest operation, pattern playback (Section 2). After showing how to play patterns, the manual covers how to record and edit your own patterns (Sections 3 and 4). You can then build (Section 5) and play (Section 6) songs using pre-programmed or custom patterns. Then try some of the more advanced song functions (Section 7).

To keep instructions as stream-lined as possible, most explanatory material has been organized under Details (Section 14). Refer also to the enclosed card which contains brief instructions and descriptions of all controls and indicators.

4 Note that the *DrumTraqs* plug-in does not support a physical "footswitch" but MIDI CCs.

1 BASIC SET-UP

1-1 Connections and Power On

[Not applicable to the *DrumTraqs* plug-in.]

1-2 Master Volume

You can now "play" the Drumtraks by hitting any instrument key.

CAUTION: To protect speakers (and ears), first lower MASTER VOLUME all the way, then raise it to desired level while playing the instruments.

For best signal-to-noise ratio, raise MASTER VOLUME as far as possible (without causing distortion) while reducing the amplifier gain.



1-3 Instrument Volume

To change the instrument, adjust PER INSTRUMENT VOLUME as desired, while holding down the instrument key. The knob will adjust the volume to one of sixteen levels. While the key is held and the knob turned, the level number (00 – 15) will be displayed on the Left. The resulting instrument mix will be retained through all patterns and songs until you specifically change it in this way (or until a song with programmed volume changes is run).



1-4 Accent

If ACCENT is held, playing any instrument key will accent that instrument.

1-5 Instrument Tuning

The tuning of any instrument can be adjusted in the same way as volume. Adjust PER INSTRUMENT TUNING as desired, while holding down instrument key. The knob will adjust the tuning to one of sixteen pitches. While the key is held and the knob turned, the pitch number (00 – 15) will be displayed on the Left.

As with volume, this instrument tuning will stay the same through all patterns and songs until you specifically change it.



2 PLAYING PATTERNS

The Drumtraks comes pre-programmed with a few patterns (and songs), which can be played immediately by following these instructions. If you are operating a display unit keep in mind that someone may have altered or erased these "factory" patterns. To create your own patterns, see Section 4.

2-1 Pattern Run and Stop

To playback a pattern, PATTERN # must be on. If it is not on, use SELECT PATTERN FUNCTIONS.



If power has just been turned on, pattern 00 is automatically selected. This (or the current pattern number) is indicated in Right display.



Press RUN.

If selected pattern is empty, the RUN LED will go off immediately.

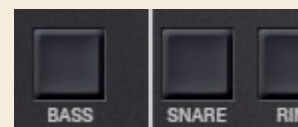


An existing pattern will start and repeat automatically ("loop"). RUN will light.

The front panel will blink on the first beat of each loop.



While the pattern is running you can play any of the instruments normally, without this playing being added to the programmed pattern.



PER INSTRUMENT VOLUME and TUNING can be adjusted by pressing the desired instrument key.



To stop pattern, press STOP.

If you press RUN again, the pattern will restart from its beginning (rather than from the point at which it was stopped).

2-2 Selecting Patterns

While stopped, select another pattern number by entering two digits (00-98). (99 is always empty.)

Or press Increment or Decrement (DEC < or INC >).

2-3 Cueing Patterns

To have one pattern stop and another start automatically, you can "cue" the next pattern:

While the current pattern is running, select the next pattern number. When the current pattern finishes its current loop, the new pattern which you selected will start, in perfect time.

If the new selection is pattern 99 (which is always empty) or any other empty pattern, the current pattern will stop at its end (rather than loop). This can be used to obtain endings precisely at the pattern end (rather than at whatever point STOP happens to be pressed.)

2-4 Playback Tempo

When power is first applied, Tempo is set to 100 beats-per-minute. Unless you adjust TEMPO, patterns will play at this speed.

To change speed, press TEMPO SLOWER or FASTER. The changing tempo value will be displayed following a "T."

To display current tempo without changing it, hold both TEMPO switches.

All patterns will play at the selected tempo until you change it (or play a song which has tempo changes).



Example



2-5 Swing Value

To adjust swing value of a pattern, the Drumtraks must be stopped.

Select SWING % with SELECT PATTERN FUNCTIONS switch. The swing value is shown in Right display. The value is set by default to 50, but may be changed to 54, 58, 62, 66, or 70% with INC/DEC.

The pattern will always play with the selected swing, until it is changed again.

If RUN is pressed, the function will automatically return to PATTERN # and the pattern will start.

Note that SWING % can only be changed when the time signature beat value (denominator) is 4. (For more information, see Details at the back.)



2-6 RUN/STOP Footswitch

[Not applicable to the *DrumTraks* plug-in.]

2-7 NEXT/REPEAT Footswitch

[Not applicable to the *DrumTraks* plug-in.]

3. OVERDUBBING PATTERNS

The section covers basic overdubbing of existing patterns. For more pattern functions, see Section 4. Only patterns can be overdubbed, not songs. Overdubbing a pattern will affect all songs which contain that pattern.

Select PATTERN # (using SELECT PATTERN FUNCTIONS switch).



Select desired pattern.

If desired, RUN pattern and adjust TEMPO, PER INSTRUMENT VOLUME or TUNING. STOP.



Example

Select RECORD MODE (using SELECT PATTERN FUNCTIONS switch).



Press RUN.

The selected pattern will play and the metronome will click on the beat of the time signature. (For example, in 4/4 time it clicks on every quarter note.)



Adjust METRONOME VOLUME as desired. The metronome will be accented each time the pattern loops.

Anything you play on the instrument keys will be recorded as part of the pattern.

As the edited pattern loops, the front panel will blink and your overdubbing will be included.



Note: Playing will be error-corrected to the default value of 1/16-notes. To learn how to use Error Correct and Erase Instrument, see page 27.

To stop editing, press STOP.



4 RECORDING PATTERNS

The Drumtraks can store 99 patterns, numbered 00-98. (Pattern 99 cannot be recorded. It is reserved for use as a "stop" function.)

This section first covers simple recording with the following "default" values for the pattern:

ERROR CORRECT	1/16
SWING	50%
TIME SIGNATURE:	4/4
# OF MEASURES	1

It then discusses how to change these and other options.

Note: If it is desired to save the factory patterns using the cassette interface, do so now, before erasing or recording (see Section 8).

4-1 Erase Pattern

Before a pattern can be recorded under a number, the location must be cleared with the ERASE PATTERN function. This protective arrangement helps prevent you from accidentally recording over a desired pattern.

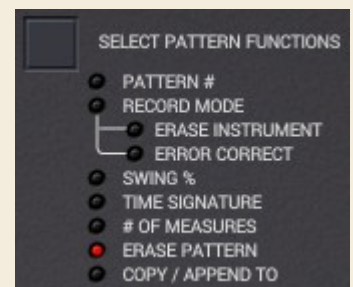
Use SELECT PATTERN FUNCTIONS switch to advance to ERASE PATTERN #

Enter two digits of pattern number to be cleared.

Note: Be sure to enter the right numbers or you may accidentally erase a valuable pattern. If you entered the wrong first digit, you can escape by pressing SELECT twice (before the second digit is entered).

When the second digit is entered the pattern will be cleared.

The function will automatically return to PATTERN #.



Erased pattern

4-2 Basic Recording

Check that desired, empty PATTERN # is displayed. (Pattern 99 cannot be recorded.)

Select RECORD MODE.



When you press RUN, recording will start. The metronome will play on the beat specified by the time signature (for example, on each quarter note for 4/4). On the first beat of each loop the metronome is accented and the front panel blinks.



Adjust METRONOME VOLUME as desired.



Adjust TEMPO as desired.



To play on the first beat, you can either play immediately after pressing RUN, or wait for the next loop.

Any instrument parts can be recorded with or without accents.



When done recording, press STOP. The function will automatically return to PATTERN #.



To playback, press RUN.

4-3 Time Signature

Unless the default value of 4/4 is desired, TIME SIGNATURE must be set before recording. It can only be adjusted when the pattern is empty (erased as explained on page 22).

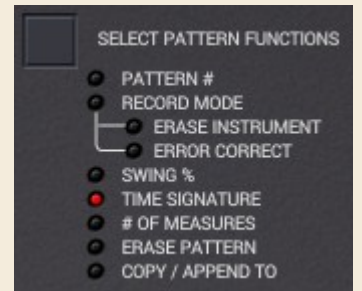
Select PATTERN #.

Select desired empty pattern number.



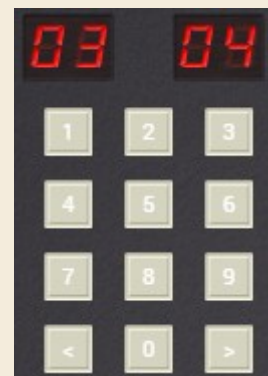
Example

Select TIME SIGNATURE.



Enter two-digit number for numerator (beats-per-measure). (The display will not accept more than two digits. If you make a mistake, continue.)

Use INC/DEC to select the denominator (beat value).



Select next function (usually # OF MEASURES or RECORD MODE).

(If you made a mistake entering the DECREMENT INCREMENT beats per measure, reselect TIME SIGNATURE function to enter correct number of beats per measure.)

4.4 # of Measures

Unless the default value of one measure is desired, # OF MEASURES must be set before recording. It can only be adjusted when the pattern is empty (erased as explained above).

Select PATTERN #.

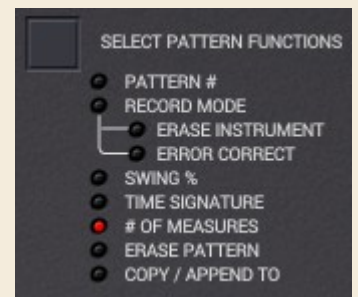


Select desired empty pattern number.



Example

Select # OF MEASURES, Enter two-digit number or use INC/DEC.



Select next function (usually PATTERN # or RECORD MODE).

4-5 Instrument Volume

After defining the time signature and number of measures, you may want to program the instrument volumes so that whenever this pattern is played, it will always have the same mix.

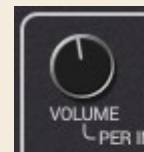
If you do not program instrument volume, the pattern will always play with whatever basic mix happens to be set.

To program instrument volume:

Select PATTERN #.



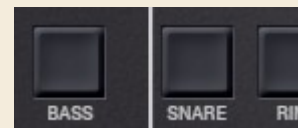
Adjust PER INSTRUMENT VOLUME as desired.



Select RECORD MODE.



Play each instrument once by running your finger down the row of instrument keys. Or, just hit the keys to be recorded at this time. This records the current volume setting of each instrument with the pattern.



4-6 Instrument Tuning

You may also want to program instrument tuning so the pattern will always play with the same tunings. This can be done similarly to instrument volume.

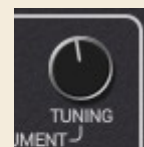
If you do not program instrument tuning, the pattern will always play with whatever basic tuning happens to be set.

To program instrument tuning:

Select PATTERN #.



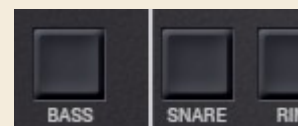
Adjust PER INSTRUMENT TUNING as desired.



Select RECORD MODE.



Play each instrument once by running your finger down the row of instrument keys. Or, just hit the keys to be recorded at this time. This records the current tuning of each instrument with the pattern.



4-7 Error Correct/Erase Instrument

With the instrument volumes and tunings programmed (or not, as desired) you are now ready to start editing. This paragraph explains how the ERROR CORRECT and ERASE INSTRUMENT functions are typically used.

ERROR CORRECT is used to eliminate subtle timing errors from the pattern. The degree of error-correction is represented by a note value from 1/2 to 1/96, with 1/2 note being maximum correction and 1/96 being highest resolution. The general principle for error correction is to use the lowest resolution required to record the note in the desired place.

ERASE INSTRUMENT is used to remove playing errors from a pattern. In this mode, the instrument keys will not produce sound.

Notes always play error-corrected to the value which happens to be selected when the notes are recorded. If you wish to change their correction, erase the part, set ERROR-CORRECT as desired, then overdub the part back in, as explained below:

Select PATTERN #.

Select desired pattern #.



Select RECORD MODE.

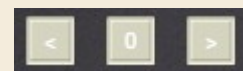
Press RUN. The metronome will start.



Press SELECT twice to light ERROR CORRECT. The current value will be displayed with "I-" on the Left and the note value, e.g. "16," on the Right.



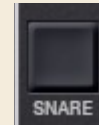
Assume, for example, that the BASS is to be played only on quarter-note beats. Use DEC to lower the ERROR CORRECT value from its 1/16 default to 1/4.



Now play the BASS near the quarter-note metronome beats, and observe on the next loop how it has been recorded in perfect time.

4-7 Error Correct/Erase Instrument cont'd

In preparation for recording a SNARE part, for example, you might raise ERROR CORRECT to 1/8. Play the SNARE.



While the pattern loops, you might raise ERROR CORRECT to 1/16 and try some TOM rolls.



This should give you the idea of how ERROR CORRECT is used.

If it seems that a part isn't recording right where you want it, press SELECT FUNCTIONS twice to activate ERASE INSTRUMENT. "Er" (for erase) will show in the Right display.



With ERASE INSTRUMENT on, pressing any instrument key will clear notes recorded for that instrument, while the key is held. Be sure to press the right key or you may clear wrong instrument from the pattern.



If desired, an erased instrument can be overdubbed back in. Switch ERASE off by pressing SELECT once (which lights ERROR CORRECT).



To stop editing, press STOP.



4-8 Overdub with Programmed Volume or Tuning

Suppose that you have a pattern complete with programmed volume and tuning. Over this pattern it is possible to overdub additional notes programmed with a different volume or tuning than are already in the pattern:

While the pattern plays, adjust volume and tuning of the instruments to be used in the overdub.



Stop the pattern.



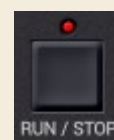
Select RECORD MODE.



Hit the instrument keys to program them to the current volume and tuning settings.



Run the pattern.

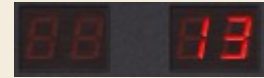


Overdub the instruments, which will record with their new volume and tuning values.



4-9 Copying a Pattern

To copy, first erase the destination pattern (see page 22).



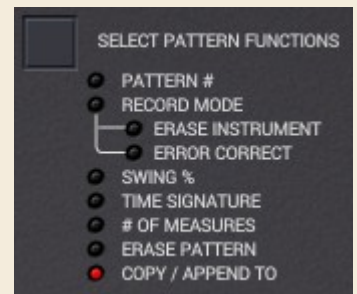
Empty destination

Select the number of the pattern to be copied.

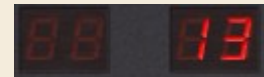


Pattern to copy

Select COPY/APPEND TO (Pattern).



Enter destination number digits. The pattern will be copied when the second digit is entered.



Destination

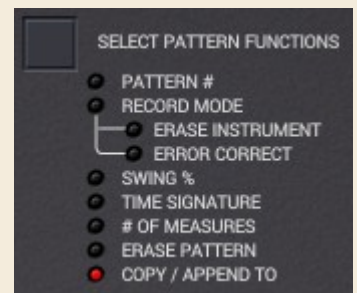
4-10 Appending

Select the number of the pattern you want to be at the end.



End pattern

Select COPY/APPEND TO (Pattern).



Enter the number of the pattern to which you want the first pattern appended. The first pattern will be appended to the second pattern when the second digit is entered.



Beginning pattern

(To multiply its length, a pattern can be appended to itself.)

If the destination is empty, this is the same as COPY.

Note: More than one pattern can be appended. Also the patterns need not have the same time signature, For example, you can append a 7/8 pattern to one in 4/4. The total length of the new pattern would be four quarter notes plus seven eighth notes, although the displayed time signature will still be 4/4.

4.11 Memory Management

The Drumtraks has a maximum capacity of 3289 notes. However, every programmable accent, volume change, or tuning change takes additional memory, reducing the overall capacity.

Whenever the Drumtraks is stopped, the percentage of memory used can be read from the Left display by pressing both the INC and DEC switches.

When recording, if capacity is reached, the display will blink "FULL." If the METRONOME VOLUME is raised, a "beep" will also be heard. No further recording will be allowed.

To create more memory space, erase undesired patterns and songs.



Hold DEC and INC

*% Memory
remaining*



5 BUILDING BASIC SONGS

The Drumtraks can store 99 songs, numbered 00-98. (Song 99 is always blank, for use a "stop" function.) Basically, songs are chains of pattern selections. Each song can contain 100 steps. Steps are directions which tell the song to switch patterns, volumes, tempo. This section covers simple pattern chaining. Other song functions are covered in Section 7.

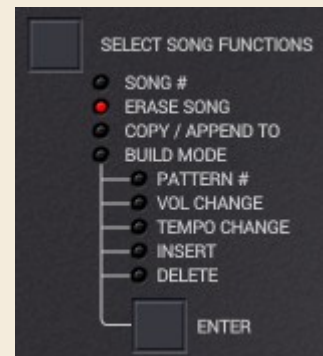


Note: Whenever SONG # is on, the song number is always displayed on the left.

5-1 Erase Song

Before a song can be recorded under a number, the location must be cleared with the ERASE SONG function. This protective arrangement helps prevent you from accidentally recording over a desired song.

Advance to ERASE SONG, using SELECT SONG FUNCTIONS switch.

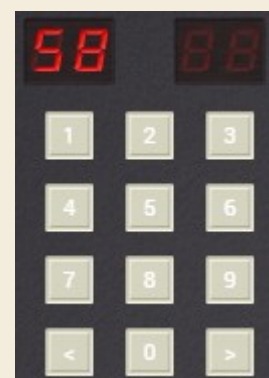


Enter two digits of song number to be cleared.

Note: Be sure to enter the right numbers or you may accidentally erase a valuable song. If you entered the wrong first digit, you can escape by pressing SELECT twice.

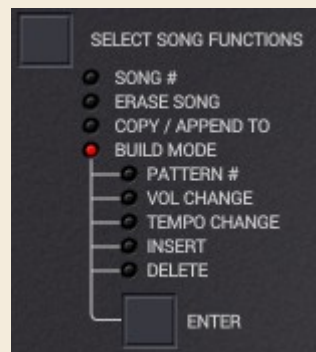
When the second digit is entered the song will be cleared.

The function will automatically return to SONG #.



5-2 Build Song

There are five functions plus one ENTER switch associated with Build Mode.



Whenever you wish to access Build Mode by hitting the SELECT SONG FUNCTIONS switch until BUILD MODE lights. At this point you must press the ENTER switch located below BUILD MODE. You are now in Build Mode. By pressing the SELECT SONG FUNCTIONS switch you can cycle through the five functions available in Build Mode.

Suppose we want to build a simple song consisting of an AABA form. For example, in song 45 we want pattern 32 to play twice, switch to pattern 17, then replay 32. This song will contain five steps: four pattern selections plus an ending. The steps will be numbered 00-04.

(See example on next page.)

First, advance SELECT SONG FUNCTIONS to SONG #. Then:

	Song Function	Displays	
	<u>LEDS</u>	<u>Left</u>	<u>Right</u>
Enter two-digit song number, or use INC/DEC.	SONG #	45 (song)	blank
Select BUILD MODE	BUILD MODE	45	"
ENTER	BUILD MODE/ PATTERN #	00 (step)	E (current end)
32	"	00	32 (1st A pattern)
ENTER	"	01	E (current end)
32	"	01	32 (2nd A pattern)
ENTER	"	02	E
17	"	02	17 (B pattern)
ENTER	"	03	E
32	"	03	32 (last A)
ENTER	"	04	E
ENTER	SONG #	45 (song)	

(Function automatically returns to SONG #.)

Song 45 has now been built as follows:

<u>Step #</u>	<u>Entry (Pattern #)</u>
00	32
01	32
02	17
03	32
04	E (end command--press ENTER twice)

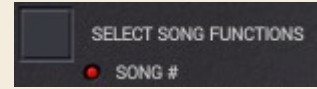
To view the steps that build song #45, enter BUILD MODE again.

At this point, PATTERN # (under BUILD MODE) should be lit.

Press the INC or DEC switches. These will change the step number as displayed on the left. On the right will be displayed the pattern number for each step.

6-1 Run/Stop

If no song functions are on, press SELECT SONG FUNCTIONS switch.



SONG # will be automatically selected and the Left display will indicate 00 (or the last song selected).



Enter desired song #.



Press RUN. The selected song will start. (If selected song is empty, or the first pattern in the song is empty, the RUN LED will go off immediately.)



While a song is running, the step number is displayed on the Left and the pattern number (or tempo or volume change) is displayed on the Right.



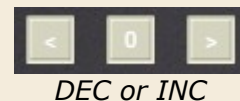
The front panel will blink on the first beat of each pattern.

If the final step of the song is an empty pattern (such as #99), the song will stop by itself.

Otherwise the song will loop until stopped (or an empty song number is selected—see "Cueing," next page.)

6-2 Selecting Songs

While stopped, select another song number by entering two digits, or using INC/DEC.



6-3 Cue/Stop

While running, select a different song number. It will be shown in the Left display.



Current song

When the current song finishes its current loop, the new song which you "cued-up" will automatically start.



Press "9" twice

Cueing can be used to make a song stop instead of loop: while the song plays, select #99 or another empty song number.



Song stops at end

6-4 Tempo

A basic song will play at whatever tempo happens to be selected when it is run.



However, the initial starting tempo of the song can be programmed, as can "relative" tempo changes (see page 45).



6-5 RUN/STOP Footswitch

[Not applicable to the *DrumTraqs* plug-in.]

6-6 NEXT/REPEAT Footswitch

[Not applicable to the *DrumTraqs* plug-in.]

7 ADVANCED SONG FUNCTIONS

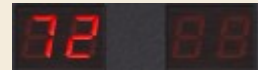
7-1 Copying a Song

To copy, first erase the destination song (see page 32).



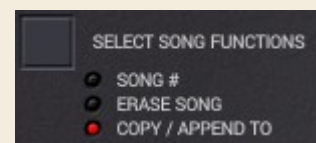
Empty destination

Select the number of the song to be copied.



Song to copy

Select COPY/APPEND TO (Song).



Enter destination number digits. The song will be copied when the second digit is entered.



Copied song

(If initial tempo has been programmed in the song, it will be copied with the song.)

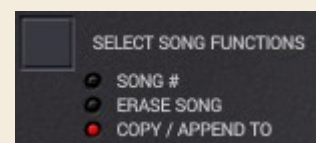
7-2 Appending Songs

Select the number of the song you want at the end.



Ending song

Select COPY/APPEND TO (Song).



Enter the number of the song to which you want the first song appended. The first song will be appended to the second song when the second digit is entered.



Beginning song

(If initial tempo has been programmed in the second song, it is ignored. However, relative tempo changes in the second song are still valid.)

Note: Songs can be appended to themselves.

7-3 Editing Songs

Let's suppose we have song 45 already given above (page 33) as an example:

<u>Step #</u>	<u>Entry (Pattern #)</u>
00	32
01	32
02	17
03	32
04	END

And we want to change it to an ABAB form, that is:

00	32
01	17
02	32
03	17
04	END

Advance SELECT to SONG #. Then:

EXAMPLE	Song Function	Displays	
	<u>LEDS</u>	<u>Left</u>	<u>Right</u>
Select song #	SONG #	00 (song)	
Press two-digit song number, or use INC/DEC.	SONG #	45 (song)	
Select BUILD MODE (If desired, program initial tempo--see paragraph 7-8.)	BUILD MODE	45	
ENTER	BUILD MODE/ PATTERN #	00 (step)	32 (current entry)
INC (>)	"	01 (step)	32 (current entry)
17	"	01	17 (edited entry)
ENTER	"	02	17 (current entry)
32	"	02	32 (edited entry)
ENTER	"	03	32 (current entry)
17	"	03	17 (edited entry)
ENTER	"	04	E (current entry)
(To check the steps, you can use INC/DEC.)			
To exit:			
ENTER	SONG #	45 (song)	

If only the first digit of a pattern number has been entered, pressing ENTER will leave the song unchanged and the function will return to SONG #.

7-4 Inserting Steps

Suppose you now have the following song, #45

<u>Step #</u>	<u>Entry (Pattern #)</u>
00	32
01	17
02	32
03	17
04	END

And you want to insert a short "fill" pattern, #66, in the middle to create an ABCAB form.

00	32
01	17
02	66
03	32
04	17
05	END

EXAMPLE

	Song Function	Displays	
		<u>Left</u>	<u>Right</u>
Select song #	LEDS SONG #	00 (song)	
Press two-digit song number, or use INC/DEC.	SONG #	45 (song)	
Select BUILD MODE	BUILD MODE	45	
ENTER	BUILD MODE/ PATTERN #	00 (step)	32 (current entry)
INC (>)	"	01 (step)	17 (current entry)
INC (>)	"	02	32
Select INSERT (using SELECT SONG FUNCTIONS)	BUILD MODE/ INSERT	02	32
Press ENTER (Inserts new step 2 and renumbers steps.)	BUILD MODE/ PATTERN #	02	(blank)
66		02	66
ENTER	"	03	32
ENTER	SONG #	45 (song)	

(If a step is inserted, but no value entered, the empty step will be ignored during playback.)

7-5 Deleting Steps

Suppose you now have the following song, #45

<u>Step #</u>	<u>Entry (Pattern #)</u>
00	32
01	17
02	66
03	32
04	17
05	E

And you want to take Pattern #66 out.

00	32
01	17
02	32
03	17
04	END

EXAMPLE

	<u>Song Function</u>	<u>Displays</u>	
	<u>LEDS</u>	<u>Left</u>	<u>Right</u>
Select song #	SONG #	00 (song)	
Press two-digit song number, or use INC/DEC.	SONG #	45 (song)	
Select BUILD MODE	BUILD MODE	45	
ENTER	BUILD MODE/ PATTERN #	00 (step)	32 (current entry)
INC (>)	"	01 (step)	17 (current entry)
INC (>)	"	02	66
Select DELETE (using SELECT SONG FUNCTIONS)	BUILD MODE/ DELETE	02	66
Press ENTER (Deletes step.)	BUILD MODE/ PATTERN #	02	32

7-6 Extending a Song

Suppose you have the following song, #45:

<u>Step #</u>	<u>Entry (Pattern #)</u>
00	32
01	17
02	32
03	17
04	E

And you want to add an ending to it, to produce:

00	32
01	17
02	32
03	17
04	24
05	E

EXAMPLE	Song Function	Displays	
		<u>Left</u>	<u>Right</u>
Select song #	LEDS SONG #	00 (song)	
Press two-digit song number, or use INC/DEC.	SONG #	45 (song)	
Select BUILD MODE	BUILD MODE	45	
ENTER	BUILD MODE/ PATTERN #	00 (step)	32 (current entry)
INC (>)	"	01	17
INC (>)	"	02	32
INC (>)	"	03	17
INC (>)	"	04	E
24	"	04	24
ENTER	"	05	E
ENTER	SONG #	45 (song)	

Note: If a song is extended with an empty pattern (such as pattern 99), the song will stop after one play, rather than loop.

7-7 Volume Change

As controlled by PER INSTRUMENT VOLUME, each instrument has sixteen volume levels. When a volume change is programmed into a song, all of the instrument volumes in the pattern following the change are decreased or increased by the number of volume steps in the change step.

For example, suppose you have the following song, #45:

<u>Step #</u>	<u>Entry (Pattern #)</u>
00	32
01	17
02	32
03	17
04	24
05	E

and you want all instrument volumes to drop by two levels for the second AB section. The song should then become:

00	32
01	17
02	U ₁ (The "U" actually signifies a "V" for volume change.)
03	32
04	17
05	24
06	E

which is done as follows:

(see example on next page)

7-7 Volume Change, cont'd

EXAMPLE	Song Function	Displays	
		<u>Left</u>	<u>Right</u>
Select song #	SONG #	00 (song)	
Press two-digit song number, or use INC/DEC.	SONG #	45 (song)	
Select BUILD MODE	BUILD MODE	45	
ENTER	BUILD MODE/ PATTERN #	00 (step)	32 (current entry)
INC (>)	"	01	17
INC (>)	"	02	32
Select INSERT	BUILD MODE/ INSERT	02	32
ENTER	BUILD MODE/ PATTERN #	02	(blank)
Select VOL CHANGE	BUILD MODE/ VOL CHANGE	U ¹	00
INC (>)	"	U ¹	01
DEC (<)	"	U ¹	00
DEC (<)	"	U ₁	01
DEC (<)	"	U ₁	02
ENTER	BUILD MODE/ PATTERN #	03	32
ENTER	SONG #	45 (song)	

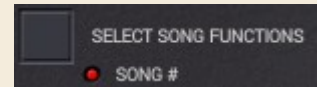
Volume range for each instrument is limited to the values 0 through 15. In other words you can't add two 10-level volume changes to get a volume change of 20.

Volume changes are always effective. That is, if the song ends with an overall decrease in volume, each loop will get quieter. Conversely, each loop will get louder (to the maximum value of 15 for each instrument) if it has an overall increase. To defeat this feature, add a compensating volume change (in the opposite direction) at the end of the song.

7-8 Initial Tempo

Pattern tempo is not programmable, but song tempo is. Songs will play at whatever TEMPO is set, unless you program the initial tempo as follows:

Select SONG #.

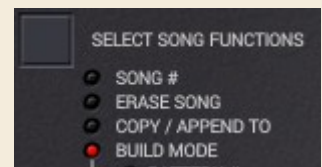


Select desired song.

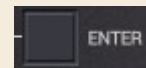


Selected song

Select BUILD MODE.



Press ENTER.



Select TEMPO CHANGE.



A TEMPO of 000 will be displayed. This signifies that there is no initial tempo.



Use SLOWER or FASTER to select tempo desired initial tempo.

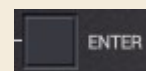


To clear initial tempo, press 0 on the keypad.



Select initial tempo

Press ENTER.



To exit BUILD MODE, press ENTER again.

Note: Song step 00 cannot be a tempo change.

7-9 Relative Tempo Change

Tempo changes which are relative to the starting tempo of the song can be programmed. The resulting tempo will be selected from the possible tempo values:

40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84		86	87		89
	91	92		94	95		97	98	
100		102	103		105		107		109
	111		113		115			118	
120		122			125			128	
130			133			136			139
			143			146			
150				154				158	
		162					167		
	171					176			
		182					187		
			193						
200							207		
				214					
		222							
	231								
240									
250									

TEMPO CHANGE steps are in the form, e.g., "up 9" or "down 12," meaning accelerating nine or decelerating twelve tempo values, respectively. For example if the song is at 105 bpm and is increased by nine tempo steps, the new tempo will be 125 bpm. Likewise, the step, down twelve, would change from 105 to 86 bpm. If the initial song tempo were changed to 94, the same tempo change steps would produce tempos of 109 and 78, respectively.

From song #45:

<u>Step</u>	<u>Entry</u>
00	32
01	17
02	U↓
03	32
04	17
05	24
06	E

To produce a four-level acceleration for the closing pattern:

00	32
01	17
02	U↓
03	32
04	17
05	T↑
06	24
07	E (see next page)

7-9 Relative Tempo Change, cont'd

EXAMPLE	Song Function	Displays	
		<u>Left</u>	<u>Right</u>
Select song #	SONG #	00 (song)	
Press two-digit song number, or use INC/DEC.	SONG #	45 (song)	
Select BUILD MODE	BUILD MODE	45	
ENTER	BUILD MODE/ PATTERN #	00 (step)	32 (current entry)
INC (>)	"	01	17
INC (>)	"	02	-2
INC (>)	"	03	32
INC (>)	"	04	17
INC (>)	"	05	24
Select INSERT	BUILD MODE/ INSERT	05	24
ENTER	BUILD MODE/ PATTERN #	05	(blank)
Select TEMPO CHANGE	BUILD MODE/ TEMPO CHANGE	T ¹	00
INC (>) (×4)	"	T ¹	04
ENTER	BUILD MODE/ PATTERN #	06	24
ENTER	SONG #	45 (song)	

Note also that since the maximum range of one tempo change step is +/- fifteen values, to achieve greater changes than this simply program two-or more successive tempo change steps.

After the first loop, the song ignores its initial tempo. Tempo changes are always effective. That is, if the song ends with an overall decrease in tempo, each loop will get slower. Conversely, each loop will get faster (to the maximum value of 250 bpm) if it has an overall increase. To defeat this feature, add a compensating tempo change (in the opposite direction) at the end of the song.

7-10 Ending Songs and Exiting Build Mode

As you build or edit songs, the ending step is automatically inserted following the last pattern selection, tempo or volume change.

To exit build mode select (BUILD MODE) PATTERN #.

With no values pending, hit ENTER. (A value is pending when two digits have been entered for a pattern #.)

8 CASSETTE

[Not applicable to the *DrumTraqs* plug-in.
Use the Load/Save/Import/Export functions instead]

9 USING CHANNEL OUTPUTS

[Not applicable to the *DrumTraqs* plug-in.
Use the built-in mixer instead]

10 CLOCK IN/OUT

[Not applicable to the *DrumTraqs* plug-in.
Use the SYNC function instead]

11 USING MIDI

Note: This section covers MIDI operation. For MIDI programming information see Section 16, MIDI IMPLEMENTATION.

11-1 Connection

[Not applicable to the *DrumTraks* plug-in.]

11-2 External Instrument Control

When power is switched on, an external (synthesizer) keyboard will key the Drumtraks instruments, as follows:

		37	39		42	44	46		49	51		54	56	58	
		RIM	CLAPS		CLSD. HI HAI	CLSD. HI HAT	OPEN HI HAT		CRASH	RIDE		TAMB	COW- BELL	CABASA	
BASS	BASS	SNARE	SNARE	TOM 1	TOM 1	TOM 2	TOM 2								
35	36	38	40	41	43	45	47	48	50	52	53	55	57	59	60

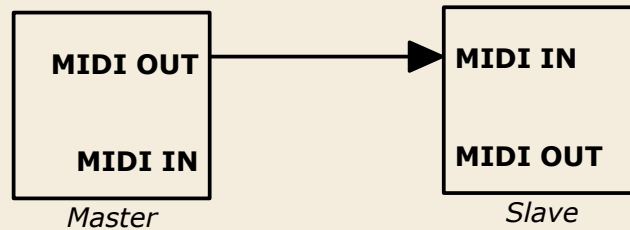
MIDI KEYBOARD INSTRUMENTS

Duplicate keys are provided for creating fast, realistic rolls—something that is impossible with the Drumtraks instrument keys alone.

When a velocity-sensitive synthesizer (such as SCI's Prophet-T8) is connected, its keyboard can be used to control the instrument volumes over the range covered by the PER INSTRUMENT VOLUME control. (In other words, accents can still be overdubbed.)

11-3 Using Two Drumtraks

To explain how the Drumtraks MIDI functions, in this paragraph we'll take the example of two 400s interconnected with MIDI.



400 Dual Control

The "master" is the primary Drumtraks from which the control selections are made. Assuming power has just been turned on:

Key Events

The master will not send its instrument key events to the slave unless you specifically enable this function, by:

Hold ENTER, press 4.

To switch off key event transmission:

Hold ENTER, press 5.

Whether you enable key events or not depends on what you are doing. If recording on the slave, you may or may not want key events from the master recorded.

Song Select

When a song is selected on the master, the slave (if stopped) will switch to the same song. Also, if the slave happens to have been in pattern mode, it will switch to song mode.

Run/Stop

If the slave is in song mode, when a pattern or song is started on the master, the slave will start.

(When the slave receives the start command, it automatically switches from any other selected clock to MIDI clock input.)

When the master stops or is stopped, the slave will stop.

(When the slave is stopped, it ignores MIDI clock inputs.)

Program Dump

A Drumtraks program is the set of all pattern and song data. There is an operation which is used to transfer Programs between Drumtraks units.

To load a pattern from the master to the slave, on the slave:

Hold ENTER, press 3,

respond by sending the entire contents of its memory to the Slave (erasing the slave's former program).

11-4 Use with Sequencer

The Drumtraks can be connected to the Model 610 Six-Trak, so multi-timbre sequences record, overdub, and Playback with the Drumtraks in synchronization.

The SCI Model 64 contains one set of MIDI connectors for use with a MIDI synthesizer. Rather than with MIDI, the Drumtraks interfaces to the Model 64 by way of the 24- or 48-PPQN clock interface. Since the Drumtraks contains its own extensive memory and editing facilities, the MIDI sequencer is not needed.

However, super-sequencers will inevitably appear that will link all MIDI instruments into one programmable system. In addition to the MIDI functions discussed above, the following applies to operation in future MIDI systems:

Mode

When power is switched on, the Drumtraks is set to Omni On mode. In this mode, it will ignore any channel designations, playing all received key events in the range of keyboard numbers to which it is sensitive (see Figure 11-2 for key numbers).

If the master sequencer sends an Omni Mode Off command to the Drumtraks, the Drumtraks will then listen for key events only on the MIDI channel to which it is set.

Channel

When it leaves the factory, the Drumtraks basic channel is set to Channel 15.

To display the channel number:

Hold both ENTER and 0.

To change the channel number:

While holding ENTER and 0, select channel (1-16) with INC/DEC.

If the channel number is changed it will remain changed even if power is switched off.

MIDI Clock

When a slave Drumtraks receives a start command over MIDI, it automatically switches itself to receives MIDI clocks. This switching can also be done manually:

Hold both TEMPO switches.

Press ENTER.

Press DEC three times, to move the decimal point all the way Left.

To switch back to internal clock mode, press ENTER again. (The decimal point will go off.)

12 DISPLAY SUMMARY

While operating the Drumtraks you will see several kinds of messages in the Left and Right displays. The message type is determined by the current mode of operation, which is indicated by one of the FUNCTION LEDs.

The various display formats are summarized below. For more information please refer to the appropriate paragraph in this manual.

PATTERN MODE

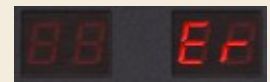
PATTERN

This display appears when power is switched on. Note that PATTERN # is on. It means that you are in PATTERN # mode and the first pattern (#00) is selected. Pattern numbers are always displayed on the Right.



ERASE INSTRUMENT

The display looks like this when ERASE INSTRUMENT is on. It means that pressing any instrument key will erase that instrument from pattern. (When erasing an entire pattern, this message does not appear.)



ERROR CORRECT

When ERROR CORRECT is on, the display looks like this. The Right display shows the note value selected for error correction.



SWING %

When SWING % is on, the display looks like this. The Right display shows that the current swing value is 50%. To select other values, use INC/DEC.



TIME SIGNATURE

When TIME SIGNATURE is on, the display looks like this. This example shows that the current time signature is 4/4.



OF MEASURES

When # OF MEASURES is on, the display looks like this. In this example, the pattern length is one measure. Patterns can be up to 99 measures long.



SONG MODE

SONG

When SONG # is on, the display looks like this. In this example, song 00 is selected.

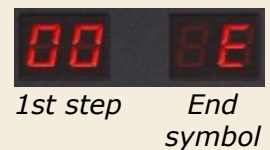


BUILD MODE

The following displays are only seen when BUILD MODE (under SELECT SONG FUNCTION) is on.

Empty Song

A display such as this indicates the first step of the selected song is an "Ending." (Both BUILD MODE and PATTERN # are on.)



*1st step End
symbol*

Built Song

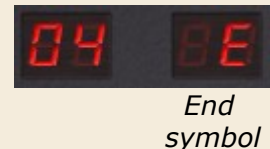
If the song has been built, the Left display shows that you are looking at the first step of the song. The Right display shows that this step is pattern #35. (Both BUILD MODE and PATTERN # are on.)



1st step Pattern#

Song Ending

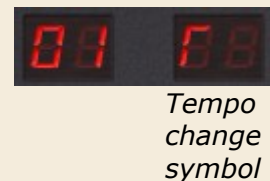
In this example, the display shows that the fifth step of the song is the "Ending." (Both BUILD MODE. And PATTERN # are on.)



*End
symbol*

Tempo Change Step

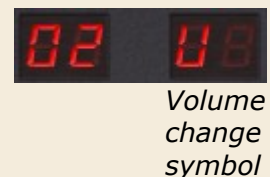
In this example a TEMPO CHANGE is shown at the second step of the song. The TEMPO CHANGE symbol is displayed on the Right at every step where a tempo change is programmed. Both BUILD MODE and PATTERN # are on. The direction and amount of the change is only shown when TEMPO CHANGE is on (see below).



*Tempo
change
symbol*

Volume Change Step

In this example a VOLUME CHANGE is shown at the third step of the song. The VOLUME CHANGE symbol is on the Right at every step where a volume change is programmed. Both BUILD MODE and PATTERN # are on. The direction and amount of the change is only shown when VOLUME CHANGE is on (see below).



*Volume
change
symbol*

Tempo Change Direction and Value

When BUILD MODE and TEMPO CHANGE are on, the TEMPO CHANGE symbol is moved to the Left display, which also includes an "arrow" pointing up or down for the direction of the change. The Right display will show the amount of the change in tempo values.



Tempo increase



Tempo decrease

Volume Change Direction and Value

When BUILD MODE and VOLUME CHANGE are on, the VOLUME CHANGE symbol is moved to the Left display, which also includes an "arrow" pointing up or down for the direction of the change. The Right display will show the amount of the change in volume values.



Volume increase



Volume decrease

Tempo Display

This display appears when both the TEMPO SLOWER and FASTER switches are held.



13 HIDDEN FUNCTIONS

In addition to normal control operations, certain lesser-used options are available by using the controls in other than normal ways. Some of the hidden functions have already been discussed. This section gathers them all together:

Memory Remaining

Hold INC/DEC simultaneously.
Read % remaining in left display.

Clear All Memory

Hold 7, 8, 9, INC, and DEC simultaneously.

Playback Clock Input

Hold both TEMPO switches.
Press ENTER.

To select clock, use INC/DEC:

Display decimal points:
 MIDI 96 48 24

[You can do that with the *DrumTraqs* plug-in, too, but only "MIDI" will work.]

Playback Clock Output

[Not applicable to the *DrumTraqs* plug-in.]

Program Dump Request

Do the following to send a MIDI Program dump request. If a MIDI device recognizes the request, it will dump a program (a set of patterns and songs) to the 400.

Hold ENTER.
Press 3.

MIDI Channel Select

Hold ENTER.
Press 0.
Read current channel number in display.
To select new channel (1-16), while holding ENTER and 0, use INC/DEC.

Enable Pads Out MIDI

Hold ENTER.
Press 4.

Disable Pads Out MIDI

Hold ENTER.
Press 5.

Clock Test

[Not applicable to the *DrumTraqs* plug-in.]

MIDI Test

For service only. ENTER + 7 connects MIDI IN to MIDI OUT. Halts if bad.

14 DETAILS

Accent In conjunction with an instrument key, the ACCENT switch is of course used to emphasize a part. While emphasis can also be programmed using PER INSTRUMENT VOLUME, this uses much more memory than does the ACCENT switch.

Append To create a new pattern by adding one pattern to the end of another.

Copy To record an existing pattern or song under a second number.

Pattern copying can be a very handy tool. For example, you can have a set of basic patterns which can be copied to form the basis of more varied overdubs. As opposed to making a song of twelve identical patterns, you can easily generate twelve variations of one basic pattern.

CLK IN/OUT

[Not applicable to the *DrumTraqs* plug-in.]

Erase Instrument A feature which can be used to delete all or part of an instrument from a pattern (regardless of tuning). To erase selectively, hit the instrument key on (or just slightly before) the undesired note. To completely erase an instrument, hold its key throughout the pattern loop.

In RECORD MODE, this feature can be used to "thin out" a pattern which is being recorded (on tape). (If tape recording from AUDIO OUT with the Drumtraks in RECORD MODE, you would probably turn METRONOME VOLUME all the way down.)

Error Correct This feature allows you to create perfectly-timed patterns. Error correct ranges from 1/2 to 1/96, in ten values: 1/2, 1/4, 1/6 (quarter triplet), 1/8, 1/12 (eighth triplet), 1/16, 1/24 (sixteenth triplet), 1/32, 1/48, 1/96.

For example, error correct is set by default to 1/16. This means that as you record or overdub parts, the Drumtraks will only allow notes to fall exactly on sixteenth-note beats. With a value of 1/2, all "real-time" parts would be corrected to one of two places in the (4/4) measure. At the other extreme, a value of 1/96 would provide 96 recording points in the measure, which is virtually the same as "real-time." INC raises value, DEC lowers it.

While editing or overdubbing it is often useful to adjust the error-correct value to the way the instrument is used. For example, usually one overdubs percussion parts from lowest to highest. Use the lowest resolution for each part. Thus before recording the bass drum or snare you might set error correct to 1/4 or 1/8, to obtain a precise foundation. Then you might raise the value to 1/16 or 1/32 before adding any faster rhythms which you may not want to lie exactly on a beat, but played more nearly as you play them.

Error correct only affects current recording, it has no effect on previously-recorded parts.

Loop Each repetition of a pattern. Overdubbed parts are heard recorded in the next loop.

MIDI Musical Instrument Digital Interface. An emerging standard for interfacing computer-based musical instruments.

NEXT Footswitch

[Not applicable to the *DrumTraks* plug-in.]

Overdub Editing a pattern by adding instrument parts.

Pattern Segments of percussion music which can be modified, copied, and linked together by step instructions into a song.

For use as stop function, pattern #99 is always blank. Cueing it will cause the current Pattern to stop at its exact end.

The following pattern attributes are recorded in non-volatile memory:

- number of measures
- number of beats per measure (time signature "numerator")
- beat value (time signature "denominator")
- error correct value
- swing value
- instrument notes
 - time the note occurs
 - accented or not
 - which instrument
 - instrument volume
 - instrument pitch
- pattern ending

Real-Time Actual playback or recording tempo.

Song A set of steps which perform Pattern, tempo, or volume changes.

For use as stop function, song #99 is always blank. Cueing it will cause the current song to stop at the exact end of its last pattern.

The following song attributes are recorded in non-volatile memory:

- initial tempo, if any
- step type and value, can be:
 - pattern number
 - relative volume change
 - relative tempo change
 - empty
- end

Step An instruction which builds a song. A song can have up to 100 steps.

Swing Swing is a playback function only. However, the swing value is recorded with the pattern so that each time the pattern is selected, it will always play with the previously-selected swing value.

On playback of patterns with a beat value of a quarter note ($3/4$, $4/4$, $5/4$, etc.), by varying the swing value you can change the syncopation of the eighth notes. Swing represents a change in emphasis off of the precise eighth-note beat.

The Drumtraks swing value is set by default to 50%. This means that the two eighth notes which make a quarter note have equal! time. In other words they play exactly as written. Swing can be adjusted to 54, 58, 62, 66, or 70%. By changing the swing value, for example, to 66%, the first eighth note would be lengthened from $1/2$ to $2/3$ of a quarter note and the second would be shortened from $1/2$ to $1/3$ of the same duration.

In a song, selecting patterns with different swing values helps break up the monotony of perfect rhythm. (In this way it is the opposite of Error Correct.) Note that in a song, to change the swing of a pattern, you would actually first copy the pattern, change the swing of the copy, then in the song, select the original pattern then the copy.

Tempo Number of beats-per-minute (bpm). The Drumtraks ranges 40-250, with the values shown in the chart on page 45.

The maximum value for a single tempo change step is plus or minus 15. Therefore for tempo changes greater than this, simply put two or more successive tempo change steps into the song.

Although usually irrelevant to most drum machine work, it is sometimes handy to have at hand the classical names for tempo ranges:

Largo	40-60
Larghetto	60-66
Adagio	66-76
Andante	76-108
Moderato	108-120
Allegro	120-168
Presto	168-200
Prestissimo	200-208

Time Signature Time signature can only be recorded when the pattern is erased. You can't change the time signature after a pattern is recorded. When copying a pattern, the time signature of the Pattern being copied becomes the time signature of the copy.

Volume There are many sources of volume control. This is to explain how each of these sources are weighted.

The final volume of each instrument ranges from 0 (off) to 255 (maximum loudness). These values are "final volume units."

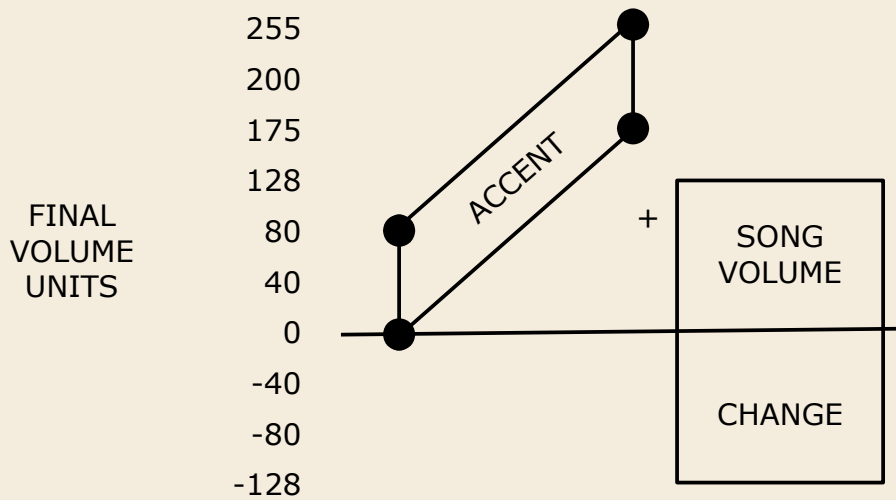
PER INSTRUMENT VOLUME adjustment covers the range 0-175. Each PER INSTRUMENT VOLUME level displayed (00-15) is actually equivalent to eleven final volume units.

The ACCENT key adds 80 final volume units to the PER INSTRUMENT VOLUME setting. Therefore ACCENT works even if the PER INSTRUMENT VOLUME is maximum (because $175 + 80 = 255$).

In a song, programmed volume changes operate over a range of +/-128 final volume units. In other words, each of the 32 song volume change levels (+/-16) is equivalent to eight final volume units.

When MIDI velocity input is present, it covers the range of PER INSTRUMENT VOLUME (0-175), also in sixteen levels of eleven final volume units each. This allows MIDI-input notes to be accented.

MASTER VOLUME is a Passive, analog control, covering the full range.



15 SPECIFICATIONS

General description

Fully programmable.

Non-volatile digital sequencer.

Thirteen actual percussion sounds stored in ROM.

Individual instrument volume and tuning controls.

Maximum capacity of 3289 notes.

Two basic modes: pattern and song. Patterns are chained together to form songs.

Cassette interface for non-volatile memory storage.

~~Clock interface (Input: 24, 48, or 96 PPQN. Output: 24 or 48 PPQN) for synchronization to sequencers, synthesizers, tape, or other drum machines~~

MIDI for external triggering, synchronization, and song selection.

~~Dual footswitch control.~~

Instruments

Channel 1 Bass

Channel 2 Snare
Rim

Channel 3 Tom

Channel 4 Crash Cymbal
Ride Cymbal

Channel 5 Closed Hi-Hat
Open Hi-Hat

Channel 6 Claps
Tambourine
Cowbell
Cabasa

Each instrument has its own performance Key.

Instrument levels are accentable and individually programmable.

Instruments are mixed monophonically to the AUDIO OUT jack.

Only one instrument in each channel can be played simultaneously.

Each channel has a separate output jack.

Pattern functions

Real-time recording and overdubbing of instrument keys or MIDI input.

Programmable instrument mix.

Programmable instrument tuning.

Programmable accent.

Programmable swing

Six "feels": 50, 54, 58, 62, 66, 70 %

Programmable time signature:

Beats-per-measure

1-99, infinitely variable

Beat notes

1/2, 1/4, 1/6 (quarter triplet), 1/8,
1/12 (eighth triplet), 1/16, 1/24 (sixteenth
triplet), 1/32

Error-Correct:

1/2, 1/4, 1/6, 1/8, 1/12, 1/16, 1/24, 1/32,
1/48, 1/96

Maximum number of patterns:

99

Maximum length:

100 measures

Pattern Functions, cont'd

Metronome/click track:	Plays on beat note of time signature. Mixed into AUDIO OUT during record. Separate volume control. Separate output jack.
Downbeat indication:	RUN/STOP blinks on first beat of pattern Metronome accent during record. Selective or entire part.
Erase	
Copy	
Append	A pattern can be copied to itself.
Ending:	Loop, or auto-start new pattern
Run/Stop footswitch:	Controls playback
Next/Repeat footswitch:	Cues next pattern

Song functions

Programmable initial tempo:	40-250 beats per minute
Maximum number of songs:	99
Maximum number of song steps:	100
Programmable relative tempo change.	
Programmable volume change.	
Downbeat indication:	RUN/STOP blinks on first beat of pattern
Erase song	
Copy	
Append	
Insert:	Pattern, Volume change, Tempo change
Delete:	Pattern, Volume change, Tempo change
Run/Stop footswitch:	Controls playback
Next/Repeat footswitch:	Repeats current pattern

Inputs

[Not applicable to the *DrumTraqs* plug-in.]

Outputs

[Not applicable to the *DrumTraqs* plug-in.]

MIDI functions

Note On, each instrument, velocity divided to 16 volume levels. (Allows external triggering of instruments from synth keyboard or pads.)
 Mode control: Defaults to Omni mode. Can be switched to Poly mode.
 Song Position Pointer
 Song select
 Timing clock
 Start
 Stop
 Continue
 System Reset

Other

[Not applicable to the *DrumTraqs* plug-in.]

400 DRUMTRAKS MIDI IMPLEMENTATION

December 17, 1983

Unless otherwise specified, status/data bytes are given in binary, while numbers in descriptions are in decimal.

TRANSMITTED DATA

Status	Second	Third	Description	
1001 nnnn	0kkk kkkk	0vvv vvvv	Note On. Only sent when enabled.	
	kkk kkkk = K	(For key values, see Table 1.)		
		vvv vvvv (Velocity) = 1-127,	depending on programmed volume only (accent and song volume changes are ignored).	
	0kkk kkkk	0000 0000	Note Off. All Note Ons are followed immediately with a Note Off (V = 0), with no new Status byte, i.e., five bytes sent for each pad played.	
1111 0011	0sss ssss		Song Select. When song is selected, that song number (S = 00 - 99) is sent.	
1111 1010			Start. When playback of any song or pattern starts, this is sent immediately before the first Timing Clock.	
1111 0000 (SYS EX	0000 0001 SCI ID	0111 1111 PM	1111 0111 EOX)	Pattern Marker. Sent immediately after the first Timing Clock of each pattern, except at the start of a song or pattern.
1111 1000			Timing Clock. During playback of any song or pattern, this is sent at 24 per-quarter-note rate.	
1111 1100			Stop. Sent whenever a song or pattern is stopped.	

TRANSMITTED DATA

Status	Second	Third	Description
1111 0000 (SYS EX	0000 0001 SCI ID	0000 0110 400 ID	data 1111 0111 Program Dump. EOX)
data is 7680 song and pattern data bytes, formatted as 15,360 four-bit nibbles, right justified, LS nibble sent first. For data packing information, see Tables 2 through 6.			

RECOGNIZED RECEIVED DATA

1001 nnnn Okkk kkkk Ovzv vvzv Note On.

nnnn = Channel number. This is ignored if Omni On mode, and checked for match with channel number in Omni Off mode.

kkk kkkk, (For key values, see Table 1.)

vvzv vvzv (Velocity) = 1 - 127

vvv vvzv = 0, Note Off is ignored, as are all Note Offs.

1111 0011	0sss ssss		Song Select. Switches to song mode and selects song # (must be 00-98). Also must already be in either song stop or pattern stop modes.
1111 1010			Start. Only if in song mode, starts playback from start of current song. Selects MIDI playback clock.
1111 1000			Timing Clock. Recognized whenever in playback of a song or pattern, and MIDI clock is selected (either by front panel or by Start status.)
1111 1100			Stop. Stops song playback. MIDI clock inputs are ignored.
1111 nnnn	0111 1100		Omni Mode Off.
1111 nnnn	0111 1101		Omni Mode On.

RECOGNIZED RECEIVED DATA, cont'd

Status	Second	Third	Description	
1111 0000 (SYS EX	0000 0001 SCI ID	0000 0000 REQUEST ID	1111 0111 EOX)	Program Dump Request. will initiate a complete program dump of song and pattern data. See Tables 2 through 6.
1111 0000 (SYS EX	0000 0001 SCI ID	0000 0110 400 ID	data 1111 0111 EOX)	Program Dump Receive. data is 7680 song and pattern data bytes, formatted as 15,360 four-bit nibbles, right justified, LS nibble sent first. For data packing information, see Tables 2 through 6.

CODED FUNCTIONS**Select MIDI Clock**

1. Hold both TEMPO switches.
2. Press ENTER.
3. Press DEC three times, to move the decimal point all the way Left.
4. To switch back to internal clock mode, repeat steps | and 2. (The decimal point will go off.)

Enable Pad Out

To enable sending pad information (Note On), hold ENTER and press 4.

To disable sending pad, hold ENTER and hit 5.

Mode Select—Receive Only

The 400 always powers-up with Omni Mode On: the Basic Channel is set to 15 (N = 1110) at the factory.

The channel can be changed from the front panel by:

1. Hold both ENTER and 0. This will display the current channel number.
2. Select new channel number, if desired, using INC/DEC (1 through 16).

The channel is ignored with Omni Mode On and checked with Omni Mode Off. The Mode Change commands must be sent to the correct channel in either mode.

The channel number is non-volatile, that is, if the channel number is changed it will remain changed even if power is switched off.

TABLE 1
400 MIDI KEY ASSIGNMENTS

kkk kkkk = 35 – 58, instrument keys
(36 = lowest C on keyboard, see Figure1.)

- 35, 36 BASS
- 37 RIM
- 38, 40 SNARE
- 39 CLAPS
- 41, 43 TOM 1
- 42, 44 CLOSED HI-HAT
- 45, 47 TOM 2
- 46 OPEN HI-HAT
- 49 CRASH CYMBAL
- 51 RIDE CYMBAL
- 54 TAMB
- 56 COWBELL
- 58 CABASA

Transmit: Key 36,40,43,44,and 47 are sent for the duplicated sounds.

Receive: Keys not listed are ignored.

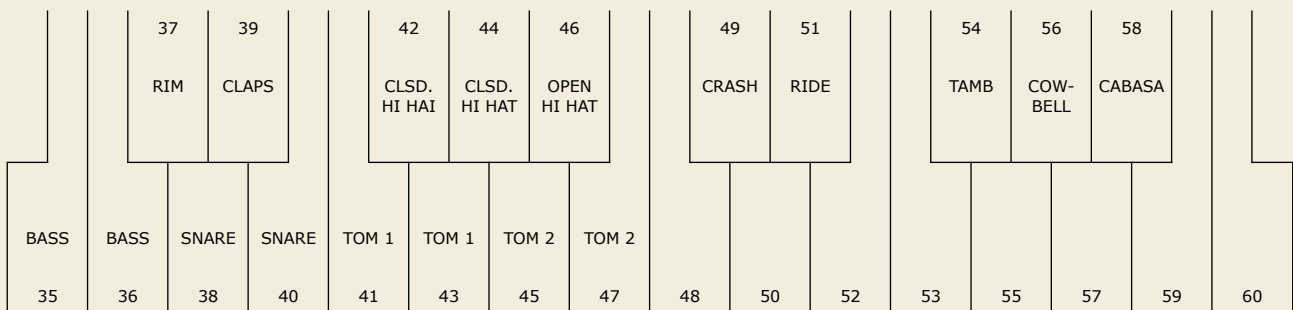


Figure 1
MIDI External Keyboard Percussion Keys

TABLE 2
400 Data Dump Format

<u>Bytes (Hex)</u>	<u>Description</u>
00 – C7	Song Pointers (see Table 3).
C8 – 18F	Pattern Pointers (see Table 4).
190 – 191	Pointer to Space After Song 99.
192 – n	Song Data (see Table 5).
n+1 -m-1	unused memory
m – 1DFF	Pattern Data (see Tables 6 and 7).

A dump in the 400 dumps all pointer tables, song data, pattern data, and unused memory. All data must be maintained correctly, or the 400 could "crash" (for example if song or pattern pointers are not updated when changes are made in the lengths of songs or patterns).

TABLE 3
Song Pointers

<u>Bytes (Hex)</u>	<u>Description</u>
0 – 1	Pointer to Song 00. Always equals 2392H. Pointer stored in LS – then – MS format.
2 – 3	Pointer to Song 01.
"	
"	
C6 – C7	Pointer to Song 99.

Note: Data memory for songs and patterns is from 2392H through 3FFFH, with songs at the start, patterns at the end, and unused memory in the middle.

TABLE 4
Pattern Pointers

<u>Bytes (Hex)</u>	<u>Description</u>
C8 – C9	Pointer to Pattern 00. Pointer is stored in LS – then – MS format.
CA – CB	Pointer to Pattern 01.
"	
"	
18E – 18F	Pointer to Pattern 99.

TABLE 5**Song Data**

Relative Byte Number	Byte	Description
0	0ttt tttt or 1000 0000	T = 0-127, initial absolute tempo for this song. no initial tempo
steps	0ppp pppp or 100v vvvv	P = 0-99, pattern number V = +/-15, relative volume change
	101t tttt or 11100000	T = +/-15, relative tempo change = Empty Step (deleted, but not reprogrammed)
END	1100 0000	End of Song.

Note: An empty song will still have two bytes programmed: the initial tempo (byte 0) and the END byte.

TABLE 6**Pattern Data**

Relative Byte Number	Byte	Description
0	d2nnn nnnn	N = 1-99, number of beats per-measure ("numerator" of time signature)
1	d1sss eeee	E = 0-9, Error Correct (see Table 7) S = 0-5, Swing (see Table 7)
2	d0mmm mmmm	M = 1-99, Number of Measures D = 0-7, beat value (see Table 7) ("denominator" of time signature)
{event storage}		
two-byte event (normal)		
	tttt tttt 00EA dddd	T = 0-255, Time (1/96 note, 24 PPQN) E = clock extend (time overflow) A = Accent on/off D = Drum number (see Table 7)
three-byte event (dynamic)		
	tttt tttt 01EA dddd vvvv pppp	same as above V = 0-15, Volume for this event P = 0-15, Pitch for this event.
END	tttt tttt 1000 xxxx	Time for End X = don't care

Note: An empty pattern will still have five bytes programmed: the three-byte prologue and two-byte END.

TABLE 7**Miscellaneous Parameter Tables****Error Correct**

<u>Value</u>	<u>Note</u>
0	1/2
1	1/4
2	1/6
3	1/8
4	1/12
5	1/16
6	1/24
7	1/32
8	1/48
9	1/96

Swing

<u>Value</u>	<u>%</u>
0	50
1	54
2	58
3	62
4	66
5	70

Beat Note (denominator)

<u>Value</u>	<u>Note</u>
0	1/2
1	1/4
2	1/6
2	1/8
4	1/12
5	1/16
6	1/24
7	1/32

Drum Number

<u>Number</u>	<u>Drum</u>
0	BASS
1	SNARE
2	RIM
3	TOM 1
4	TOM 2
5	CRASH CYMBAL
6	RIDE CYMBAL
7	CLOSED HI-HAT
8	OPEN HI-HAT
9	CLAPS
10	TAMB
11	COWBELL
12	CABASA