SEQUENTIAL

PATTERN

Pattern Number
Metronome
Error Correct
Erase Instrument
Record Mode — Improv
Stack
Rename
Single Step — Insert
Delete
Number of Measures
Time Signature
Copy/Append to
Erase Pattern

Function Select

SONG

Song Number
Pattern Number
Sub Song Number
Start Repeat
Build Song — End Repeat/Number
Tempo Change
Volume Change
Cue Point
Delete
Start at Cue
Human Factor
Copy/Append to
Erase Song

CONTROL

Instrument Tuning
Instrument Volume
Instrument Pan
Percent Memory Free
Load from Tape
Save to Tape
External Clock In
Clock Out
Channel Select
Data Dump
MIDI — Send Die/En
Omni/Poly
Special Modes

Master Volume

Tempo

1 2 3 4 5 6 7 Trigger Out

TOM

TOM
OPERATION MANUAL

SEQUENTIAL

MODEL 420
TOM
DIGITAL DRUM MACHINE

OPERATION MANUAL

by Rick Davies

MODEL 420
TOM

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by Rick Davies

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Preface

The Model 420 TOM is a digital drum machine capable of playing digitally-sampled instrument sounds either live from the TOM's front panel, via MIDI control, or by playing patterns created with the TOM's built-in instrument event recorder. Patterns can be linked together to form complete percussion arrangements.

The TOM contains eight on-board percussion sounds, but if other sounds are needed for a specific application, rather than replace the TOM's on-board sounds, Sequential offers alternate sound cartridges, providing an additional seven sounds which can be recorded into patterns along with the factory presets.

Other features which set the TOM apart from other digital drum machines are its ability to record all drum tunings, volumes and stereo pannings (in "real time" or in "single step"), play drum sounds backwards, and unique recording possibilities through MIDI. (Operation of the Model 420 with MIDI is detailed in the TOM MIDIGUIDE.)

For an overview of the TOM's operation, see the General Block Diagram on page ix.

When instrument sounds are played live, from the front panel or over MIDI, instrument events are sent to the Instrument Sound Decoding Circuitry, MIDI OUT, and the Event Recorder. Each instrument event consists of:

    1) The instrument number.
        This selects one instrument sound from Sound Memory. The TOM's on-board instrument sounds are numbered 1-8. The cartridge sounds are numbered 9-15. This method of addressing instrument sounds allows any combination of on-board and cartridge sounds to be played simultaneously. Instrument #16 is not stored in sound memory, but when selected, causes a 5-V trigger to be output for driving external electronic instruments.

    2) The instrument tuning.
        Instruments can be tuned to any of thirty-two distinct pitches (0-31).

    3) The instrument volume.
        Instrument sounds can play at any of eight volumes (0-7). A volume of zero produces no sound at the audio outputs.

    4) The direction in which the instrument should play.
        Instrument sounds can be played forwards or reversed.

    5) The "improv" status.
        Instrument events can be recorded as "improvised" notes which do not play on every loop through a pattern. The improv status has no effect on events played "live."

6) The channel in which the instrument sound should play.

The TOM can play four events at once, and has four undedicated channels each of which carries one instrument sound to the four-into-two mixer. The TOM decides which instrument events are played, and on which channels.

7) The audio output(s) on which the instrument sound should appear.

Instrument events can appear at either or both of the audio outputs.

To create instrument events from the front panel, first you set up the instrument controls (see page 2-5), then play the instrument switches. If a MIDI keyboard is connected to the TOM, designated keys allow instrument events to- be played with live control of instrument tunings, volumes and other instrument controls. (For details on the TOM's MIDI implementation, see the TOM MIDIGUIDE.)

Upon receipt of an event, the instrument sound decoding circuitry reads data from sound memory, and converts it into an audio signal which appears at either or both audio outputs. The left and right audio signals can be monitored as discrete outputs suitable for a mixer or headphones, or as a single monophonic mix output of the two signals.

If the event recorder is recording, events are stored in pattern memory. When the pattern loops, recorded events are combined with live events, then played by the instrument sound decoding circuitry. This allows live and recorded notes to be played simultaneously. (All events, live and recorded are also sent over MIDI, allowing control of other MIDI equipment from the TOM.)

The record and playback tempos are normally controlled by the event recorder's internal clock, but if desired, patterns can also be clocked from either an external 5-V clock, or by incoming MIDI clocks. The event recorder's **Clock Out** allows external sequencers, or other drum machines to be played in sync with the TOM's patterns.

For quick scanning, instructions in this manual are indented from the text, and references to the TOM's switches, jacks, and functions appear in **bold**. For quick reference, use the TOM CONTROLS AND INDICATORS card (CN420-1) and INSTRUCTION CARD (CN420-2).

FRONT
PANEL

LIVE EVENTS

MIDI
OUT

MIDI
IN

EVENT RECORDER

ALL EVENTS

RECORDED EVENTS

INSTRUMENT #, CHANNEL #,
BACKWARDS, TUNING
AND VOLUME

PANNING
DATA

AUDIO
OUTPUTS

INSTRUMENT

SOUND

DECODING

MIX/
PAN
4→2

L

R

EXTERNAL
CLOCK IN

INTERNAL
CLOCK

PATTERN
MEMORY

CLOCK
OUT

ADDR

DATA

CHANNELS 1-4

SOUND MEMORY

FACTORY
PRESETS

CARTRIDGE
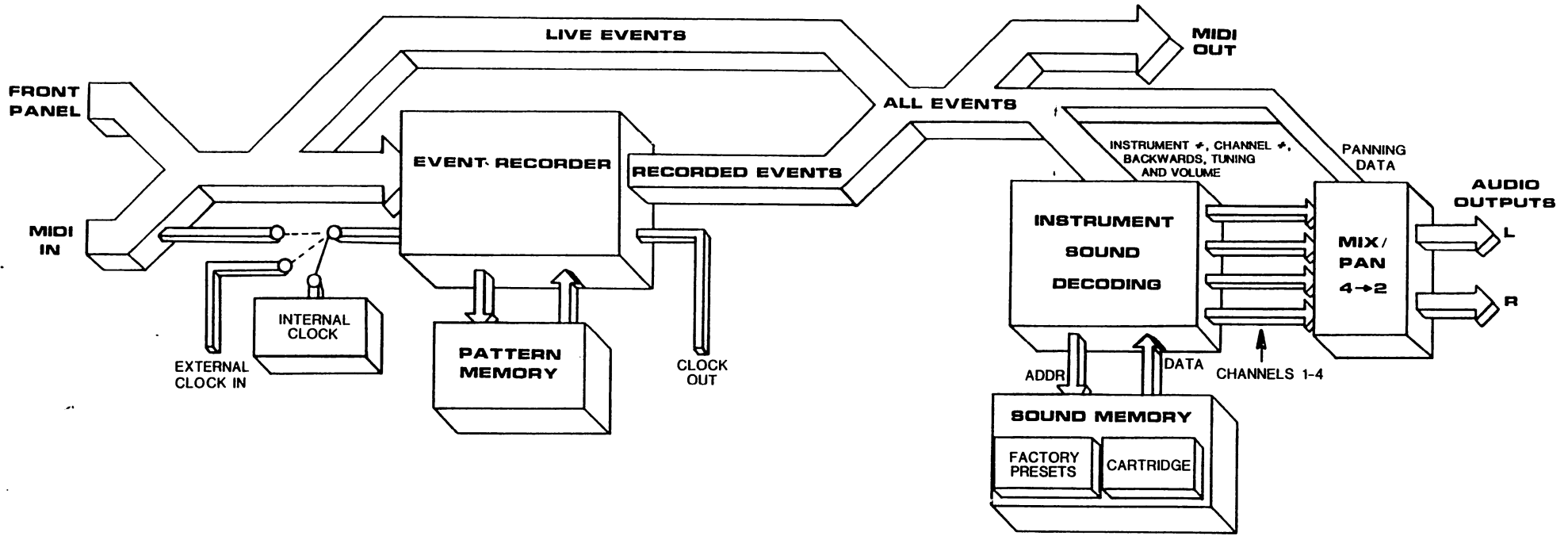
GENERAL BLOCK DIAGRAM

WARNING! Before connecting or disconnecting anything, make sure all equipment is turned off.

1-1 CONNECTION
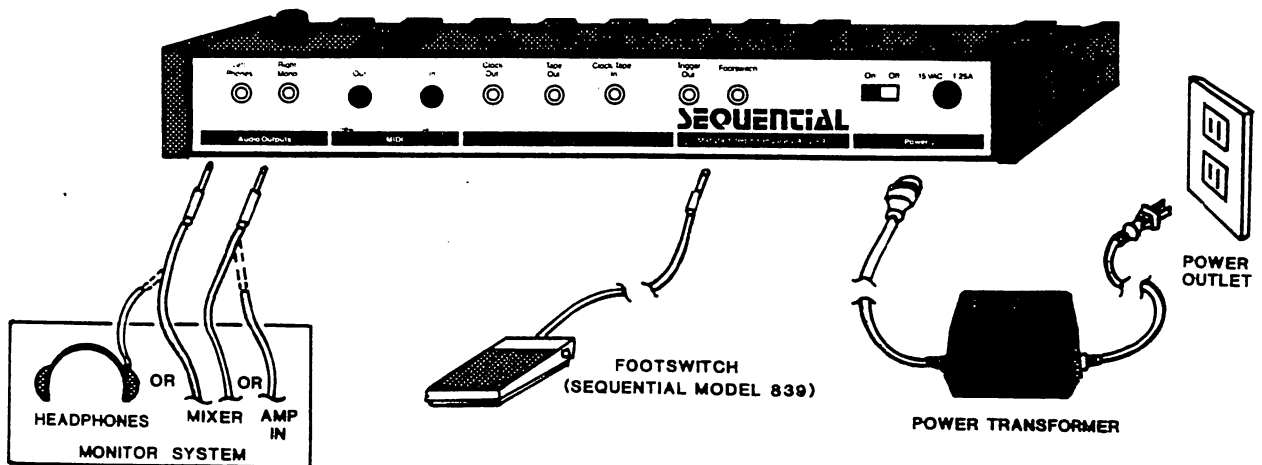
Figure 1-1
Set-up Diagram

Connect the Model 420's audio output to the monitor system. (See connection diagram above.)

For discrete left and right outputs, connect **Left/Phones** and **Right/Mono** to two inputs of the monitor system.

For a mono mix of both audio outputs, connect **Right/Mono** to one input of the monitor system.
(If anything is plugged into **Left/Phones**, only the right audio channel appears at **Right/Mono**.)

To drive stereo headphones, plug the headphones into **Left/Phones.**
If anything is plugged into **Right/Mono**, only the left audio channel appears at **Left/Phones.**

Connect the optional footswitch (Sequential Model 839) to the back panel **Footswitch** input.

If used, insert the optional Sequential sound cartridge (such as the Models 261 or 262) into the front panel slot. See Figure 1-2, below.

CAUTION! Always switch power off before removing or inserting cartridge.
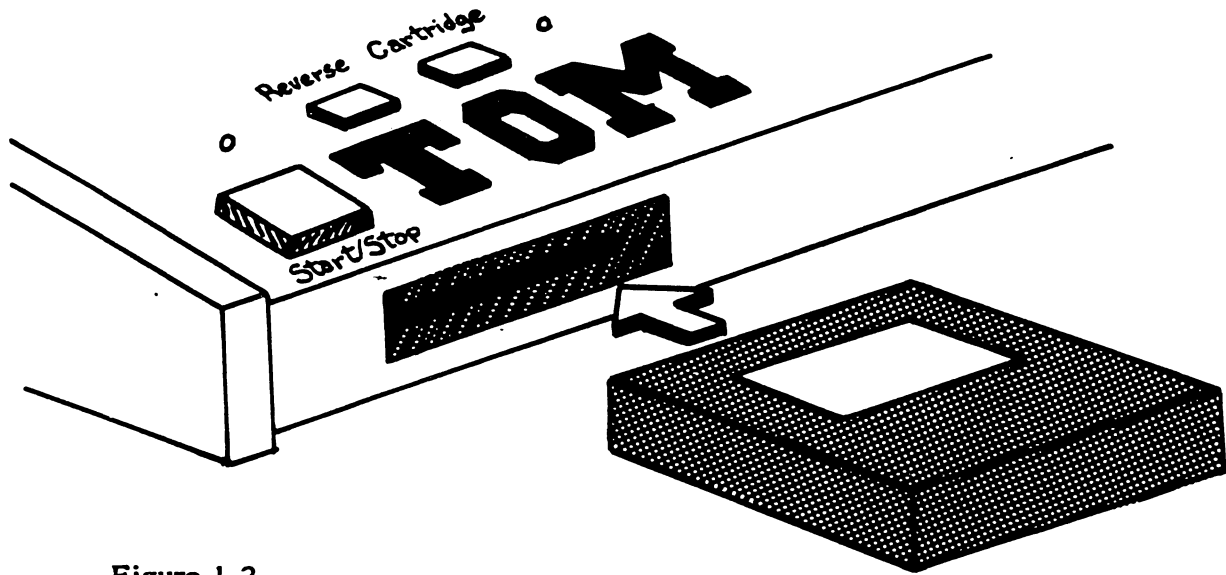
Figure 1-2
Cartridge Insertion

Connect the TOM's power transformer.

Connect the transformer's six-pin connector to the TOM's **15 VAC** input.

Plug the transformer into a power outlet. (The transformer requires no grounding,)

1-2 POWER-UP

Check that the TOM's **Master Volume** is turned all the way down, then switch the TOM's power on.
The **PATTERN** LED should light, and the right display should read "00."

Check that the monitor system master volume is turned all the way down, then switch the monitor system power on.

WARNING! When the TOM is not in use, turn power off, and unplug the transformer from the power outlet, or if plugged into a "power strip," turn off or unplug the power strip.

Adjust volume settings.

Turn the TOM's **Master Volume** to about half of full volume.

Play the instrument switches as you gradually increase the monitor system volume(s) to the desired level.

<u>Note:</u> For best signal-to-noise performance, set the TOM's **Master Volume** as high as possible without causing distortion in the monitor system. To give the TOM a more "live" sound, add a touch of reverb (if possible) to the audio outputs.

The following sections cover basic operation of the TOM and introduce the front panel function groups.

2-1 BASIC PLAYBACK

The TOM comes from the factory with many interesting sample patterns which demonstrate its capabilities. The following pages introduce the front panel controls and playback functions.

Selecting Functions

All of the TOM's functions are divided into three function groups: **PATTERN, SONG,** and **CONTROL.** When a function group is selected, the LED at the top of the group lights. The **Function Select** switches are used to step up or down through the functions, while the thirteen LEDs on the left indicate which function is active in the selected group.

Note: For the general case, all operations in this manual begin with pressing a function group switch. If the appropriate function group LED is already lit, it will not be necessary to re-select the function group.

Now that the Model 420 is up and running, for a demonstration of its recording capabilities, listen to some of the factory-recorded patterns, and get familiar with some of the front panel controls.

Pattern Playback

Note: If for some reason memory is empty, you will have to first record some patterns before you can play them. (See page 2-3.)

Press **PATTERN.**
The top function LED lights, identifying **Pattern Number** in the **PATTERN** function group. The right display shows the current pattern number.

If desired, to select a different pattern, enter two digits on the ten-key pad.

To start pattern playback, press **Start/Stop** (front panel or footswitch).
If the selected pattern is empty, nothing is heard.

While the pattern plays, hit the instrument switches.
You are in playback mode, so what you play is not recorded.

While the current pattern is running, select another pattern number.

The next pattern starts in perfect time. If the new selection is an empty pattern, the current pattern stops at its end (rather than loop).

6. To stop the pattern, press **Start/Stop** or the footswitch.

7. To continue playback of the pattern from the point at which it was stopped:

Hold **PATTERN.**

Press **Start/Stop.**

Playback is resumed.

Adjust Playback Tempo

Playback tempo is adjustable from 40 to 240 beats per minute.

To speed up playback, press the upper **Tempo** switch.

The current tempo (in beats per minute) is displayed for a moment before increasing. The longer the **Tempo** switch is held, the more the tempo changes.

To slow down playback, press the lower **Tempo** switch.

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

2-2 BASIC RECORDING AND ERASING

Before recording new patterns, locate some erased ("empty") patterns. (To make more room for your own patterns, feel free to erase any of the factory patterns.)

Erase Pattern

To erase a pattern:

Press **PATTERN**.

Press the upper **Function Select** switch once.
   This selects **Erase Pattern** from the **PATTERN** function group. The **Execute** LED blinks.

Press **0**.
   The pattern is now erased, and **Pattern Number** is selected.

Record Basic Pattern

To record a basic, one-measure long, 4/4 drum pattern:

Press **PATTERN**.

Enter the number of an empty pattern.
   To check it is empty, press **Start/Stop.**

Press the lower **Function Select** switch once.
   This selects **Metronome** from the **PATTERN** function group. The display reads "on 4," meaning the metronome is switched on, and set to a quarter-note rate.

Press **Start/Stop** or the footswitch.
   The metronome starts, accenting the first beat of each measure. When the pattern loops, all lit LEDs blink.

Play the instrument keys.
   The instruments are included on the next loop through the pattern.

Erase Events

To erase instruments from the pattern without stopping recording:

Press the lower **Function Select** switch twice.
   The fourth function LED lights, indicating **Erase Instrument** is selected from the **PATTERN** function group.

On the beat of the undesired event, press the switch of the instrument to be erased.
    On the next loop through the pattern, the instrument is removed from the pattern.

If desired, to erase more instruments from the pattern, press other instrument keys.

To return to pattern recording, press the upper **Function Select** switch twice.
    This selects **Metronome** again.

To stop recording, press **Start/Stop.**

Note: While recording a pattern, you can only select functions in the **Record Mode** section of the **PATTERN** function group (see RECORD MODE FUNCTIONS, page 3-3.), or the instrument control functions in the **CONTROL** function group (see following pages).

2-3 INSTRUMENT CONTROLS

Before going into more detail about the TOM's recording capabilities, you should get familiar with the instrument controls.

Some of the TOM's instrument controls have dedicated switches, while other controls are treated as functions, selected by pressing **CONTROL**, then specifying with the **Function Select** switches. (Remember, the function LEDs indicate which function is selected from the current function group.)

Each time an instrument is played, it is called an "event." Each event consists of:

The instrument number.
> Although there are only eight instrument switches on the TOM's front panel, there are sixteen instrument numbers. This allows patterns to play the TOM's on-board and cartridge sounds simultaneously.

The instrument tuning.
> Instruments can be tuned to 32 pitches (00-31). This allows a pattern to contain several tunings of one instrument.

The instrument volume.
> Instruments can be played at eight volumes. Patterns can feature instruments with changing dynamics, giving a more "human" feel to the pattern.

The instrument stereo pan.
> Instruments can be output on the left, right, or both audio outputs. To give the impression of motion, instruments can be recorded into a pattern with several pannings.

Direction.
> Instruments can be played forwards or backwards.

Improv status.
> Instruments can be recorded as either regular, or "improvised" events. (For details, see page 3-7.)

Each of these controls can be set independently for each instrument. When an instrument is recorded, the event contains that instrument's current control settings. The instrument's controls can then be adjusted without affecting the settings of events which have already been recorded.

Operation of the instrument controls is described on the following pages. For some applications of these controls, see ADVANCED PATTERN RECORDING, on page 4-1.

Playing Instruments On Cartridge

The Model 420 features a sound cartridge slot, increasing the number of instrument sounds playable from the front panel or patterns from 8 to 15.

CAUTION! Do not insert or remove a sound cartridge while the TOM's power is on.

> Check that the sound cartridge is secured in the TOM's front panel slot, label-side up.

> Turn power on.

> Play the instrument keys.
> > The TOM's eight built-in sounds play.

> Press **Cartridge**.
> > It lights.

> Play the instrument keys.
> > Instrument keys 1 through 7 play corresponding sounds from the Sequential cartridge.

Note: Although pressing the **Trigger Out** instrument key produces no sound (while Cartridge is lit), a trigger is produced from the back-panel jack which can trigger external sequencers or other electronic drums. (For details see TRIGGER OUT, on page 8-2.)

To record a pattern with the cartridge instrument sounds:

> Press **PATTERN**.

> Enter the desired erased pattern number.

> Press **Start/Stop**.

> Play the instrument switches.
> > The cartridge instrument sounds are recorded into the pattern.

> To stop recording, press **Start/Stop**.

> Press **PATTERN**.

<u>To play the TOM's built-in sounds and cartridge sounds</u>
<u>simultaneously:</u>

      Press **Cartridge** again.
         The LED turns off.

      Play the instrument keys.
         The TOM's built-in drum sounds return.

      To start playback, press **Start/Stop.**
         If the selected pattern contains any cartridge sound events,
         the cartridge sounds are played, even though **Cartridge** is
         now not lit.

      To stop playback, press **Start/Stop.**

For more information on recording patterns with the TOM's on-board
and cartridge instrument sounds, see RECORDING PATTERNS, on
page 3-1.

Set Instrument Tunings

Real drum kits often include several similar drums and cymbals of differing sizes for tom-tom rolls, and other effects. Each of the TOM's instrument sounds can be tuned to one of 32 pitches for similar effects. (As there are only eight instrument keys on the TOM, each instrument key can play only one tuning at a time.)

To set the TOM's instrument tunings:

Press **CONTROL.**
    The top function LED is lit, indicating Instrument Tuning is selected. The left display reads "T."

Play the desired instrument key.
    The right display shows the instrument's tuning value (00-31).

To raise or lower the selected instrument's tuning, press **INC** or **DEC.**

Play the instrument key again.
    It plays at the new tuning.

If desired, repeat for other instruments.

If desired, set instrument volumes and pannings (see below).

Note: It is possible to change instrument tunings while recording a pattern. (See page 4-2.)

Set Instrument Volumes

To give the TOM's drum patterns a more "human" feel, drum dynamics may be recorded with each event. The TOM's instrument sounds can each be played at eight volume levels (0-7). (It is also possible to program instrument volume levels from a velocity-sensitive MIDI keyboard. For more information, see the TOM MIDIGUIDE, MG420.)

To program the TOM's instrument volumes:

If not already lit, press **CONTROL.**

Select **Instrument Volume** with the **Function Select** keys.
    The left display reads "V."

Play the desired instrument key.
    The right display shows the instrument's current volume (0-7).

To raise or lower the selected instrument's volume, press **INC** or **DEC.**

Play the instrument key again.
 It plays at the new volume.

If desired, repeat for other instruments.

If desired, set instrument tunings (see above), or pannings (see below).

Note: It is possible to change instrument volumes while recording a pattern. (See page 4-2.)

Set Instrument Panning

The TOM features programmable panning, allowing you to program the audio output in which each instrument plays. Each of the TOM's instruments can be positioned left, right, or center (left <u>and</u> right), with distinct tuning or volume settings.

To set the TOM's instrument pan positions:

If it is not selected, press **CONTROL.**

Select **Instrument Pan** with the **Function Select** keys.
 The left display reads "P."

Play the desired instrument key.
 The right display shows the instrument's current position (L, r, or C).

To pan the instrument to the left audio output, press **DEC.**
 The right display reads "L."

To pan the instrument to the right audio output, press **INC.**
 The right display reads "r."

To place the instrument on both audio outputs, press **0.**
 The right display reads "C."

Play the instrument key again.
 It plays on the selected audio output(s).

If desired, repeat for other instruments.

If desired, set instrument tunings or volumes (see above).

Note: It is possible to pan instruments while recording a pattern. (See page 4-2.)

Combining Instrument Control Changes

Press **CONTROL**.
> This selects **Instrument Tuning**.

Hit the desired instrument switch.
> The right display shows the selected instrument's tuning value.

If desired, adjust the instrument tuning with **INC** and **DEC**.

Select **Instrument Volume** with the **Function Select** switches.
> The selected instrument's volume level is displayed.

If desired, adjust the instrument's volume with **INC** and **DEC**.

Select **Instrument Pan** with the **Function Select** switches.
> The selected instrument's current panning is displayed.

If desired, pan the selected instrument left, center, or right with **DEC, 0,** or **INC.**

Hit the instrument switch again.
> It plays with all the new control settings.

If desired, repeat for other instruments.

Playing Reversed Sounds

This may not be the sort of thing that drummers tend to practice live, but in the recording studio, producing backwards instrument effects generally requires time and patience. The Model 420, however, offers a simple switch to produce this unique effect.

Press **Reverse**.

Play the instrument keys.
> All played instrument sounds play backwards.

Select a pattern for playback (see page 2-1), then press **Start/Stop.**
> The pattern plays. Notice that the recorded instruments, unlike the instrument keys, are not affected by **Reverse**.

Press **Reverse** again.
> The live instruments are returned to normal.

To record patterns with forward and reversed sounds, see RECORDING MODE FUNCTIONS, on page 3-3.

Auto Repeat

This feature allows drums to be continuously retriggered without your having to repeatedly play the instrument keys. The Auto Repeat rate is determined by the Error Correct rate (see below). To use Auto Repeat, you must be recording a pattern, or playing back a pattern or song. Use of Auto Repeat in playback follows. (Use in recording is described in RECORDING PATTERNS, on page 3-14.)

To turn Auto Repeat on:

Press CONTROL.

Select **Auto Repeat** with the **Function Select** switches.
The left- display reads "Ar." The right display reads "OF" (off).

Press 0.
The right display reads "on."

Press **PATTERN**.

Enter the desired pattern number.

Press **Start/Stop**.
Playback begins.

Hold any instrument key.
The instrument is played repeatedly.

To adjust the Auto Repeat rate:

Press **Start/Stop**.
The pattern stops.

Select **Error Correct**.

Adjust the displayed error correct rate with **INC** and **DEC**.

To exit Record Mode, press **PATTERN**.

To resume playback, press **Start/Stop**.

To turn Auto Repeat off:

Press CONTROL.

Select **Auto Repeat** with the **Function Select** switches.

Press 0.
The right display reads "OF" (off).

Note: It is possible to play patterns which contain no instrument events, but which have not been erased with the Erase Pattern function. Such "empty" patterns can be created by erasing a pattern (see page 3-1), entering Record Mode (see page 3-3), then stopping recording without first hitting any instrument switches. When empty patterns are played, the RUN LED indicates playback, and Auto-Repeat can be used. (For details on "erased" and "empty" patterns, see page 3-1.)

Basic playback, erasing, and recording of basic drum patterns were described in Section 2. The following pages explain all functions used in pattern recording in more detail.

Patterns are recorded either by recording over an existing pattern (overdubbing), or by starting with an erased pattern and defining the pattern time signature and number of measures. (Unless you change them, the pattern's time signature is 4/4 and its length is one measure.)

3-1 ERASE PATTERN

Before recording a pattern, it is possible to define the time signature and number of measures. To do this, you must select an "erased" pattern.

To erase a pattern:

Press **PATTERN**.

Select **Erase Pattern** with the **Function Select** switches.
The displays go blank.

Enter the number of the pattern to be erased.
When the second digit is entered, the pattern is erased.
Pattern Number is selected.

If desired, set the time signature and number of measures for the pattern (see next page).

This is the only way to erase a pattern. If, after recording a pattern, all instrument events are deleted, the pattern becomes "empty," but its time signature and number of measures (which are set when the pattern first enters Record Mode, see page 3-3) can only be changed after first erasing the pattern.

It is possible to play an "empty" pattern, even though no instrument sounds are played, whereas attempting to play an erased pattern causes playback to stop. Erased patterns are used in songs to automatically stop song playback (see page 5-4).

3-2 TIME SIGNATURE AND NUMBER OF MEASURES

If an erased pattern is selected for recording, unless you specify otherwise, the result is a one-measure long, 4/4 pattern. If you want the pattern to be in another time signature, or more than one measure long, you must first specify these parameters <u>before</u> entering Record Mode.

> Press **PATTERN.**
>> The top function LED lights, indicating **Pattern Number** is selected.
>
> Enter the desired pattern number on the ten-key pad.
>
> Erase the selected pattern (see previous page).

<u>To set the time signature:</u>

> Select **Time Signature** with the **Function Select** switches.
>
> Enter two-digit number for numerator (beats-per-measure).
>> Variable from 01 to 63.
>
> Use **INC** or **DEC** to select denominator (beat value).
>> Possible settings are 2, 4, 6, 8, 12, 16, 24, and 32.

<u>To set the number of measures:</u>

> Select **Number of Measures** with the **Function Select** switches.
>> The right display reads "01."

<u>Note:</u> If the **Execute** LED flashes, the selected pattern is not erased, and the number of measures cannot be increased, but can be decreased. (For details, see TRUNCATING PATTERNS, page 4-4.)

> Enter two-digit number (01-99) on the ten-key pad, or use **INC** or **DEC.**

<u>Note:</u> The time signature and number of measures can be re-selected and changed until the pattern is put into Record Mode (see next page).

3-3 RECORD MODE FUNCTIONS

Any of the following Record Mode functions (including Single Step functions) may be selected to begin pattern recording, whether starting from scratch, or overdubbing an existing pattern. Once recording is started, only Record Mode functions, or instrument controls (to adjust tunings, volumes, stereo pan, or Auto Repeat) can be selected.

Note: While in Record Mode, do not turn power off as this can affect the TOM's memory.

To start recording:

Press **PATTERN.**

Enter the desired pattern number (00-98).
For Pattern #99 is a permanently erased pattern, used for ending songs (see page 5-4).

If desired, set time signature and number of measures.
For instructions, see previous page.

Select any of the Record Mode functions with the **Function Select** switches.
For simplicity, recording functions are described on the following pages in the order in which they appear on the TOM's front panel.

Press **Start/Stop.**
The metronome starts (unless switched off). The metronome accents the first beat of each measure. Each time the pattern loops, all lit LEDs blink.

If desired, adjust **Tempo.**

To record instrument events, play the instrument switches.
On the next loop through the pattern, the instrument events are included.

To record reversed instrument sounds:

Press **Reverse.**

Play the instrument switches.

When finished recording the reversed instruments, press **Reverse** again.

To record the cartridge instrument sounds:

Press **Cartridge.**
The LED lights.

Play the instrument switches.
Notice that only instrument switches 1 through 7 play the cartridge sounds. For information on **Trigger Out**, see page 8-2.

When finished recording cartridge instrument events, press **Cartridge** again.
The LED turns off.

Select other Record Mode functions as desired.

To stop recording, press Start/Stop.
The metronome stops. The last selected Record Mode function is still selected.

Note: Instruments may be recorded into patterns while any of the Record Mode functions are selected except **Erase Instrument** or **Single Step Delete.**

Metronome

The metronome is an audible click which appears at the TOM's audio outputs, indicating the tempo of a pattern, producing a louder click on the first beat of each measure. The metronome can be adjusted to several rates to suit your application.

On power-up, the metronome is set to sound every quarter-note.

To adjust metronome:

Select **Metronome** with the **Function Select** switches. (The pattern does not have to be running.)
Unless changed, the left display reads "on." The right display reads "04," indicating the metronome sounds on every quarter-note.

To turn the metronome off, press **0**.
The display reads "OF" (off).

To turn the metronome on, press **0** again.

To adjust the metronome rate, use **INC** and **DEC**.
Possible settings are 2, 4, 6, 8, 12, 16, 24, and 32.

Note: If you adjust **Metronome**, it remains at the new rate until you change it again, or power is switched off.

Error Correct

This function determines how accurately the TOM's instrument sounds are recorded in time with the metronome. For example, if Error Correct is set to 16, the TOM allows sounds to be recorded only on sixteenth notes. If an instrument is played slightly ahead or behind a sixteenth note, on the next loop through the pattern, the instrument is played back exactly on the nearest sixteenth note. Setting Error Correct to 96 selects 96th-note error correction, the finest resolution possible on the TOM.

Error correct also affects the Auto Repeat function by determining the rate at which events are repeated.

On power-up, the Error Correct is set to sixteenth notes. If you intend to record patterns featuring fast drum rolls, set Error Correct to a higher resolution (96th note maximum).

To adjust error correct:

Select **Error Correct** with the **Function Select** switches. (The pattern does not have to be running.)
The left display reads "1-."Unless error correct is adjusted, the right display reads "16."

Select the desired error correct value with **INC** (to raise), or **DEC** (to lower).

The following table shows the possible error correct values and the corresponding note values.

Error Corect Value	Note Value
2	half-notes
4	quarter-notes
6	quarter-note triplets
8	eighth notes
12	eighth-note triplets
16	sixteenth-notes
24	sixteenth-note triplets
32	thirty-second notes
48	thirty-second-note triplets
96	ninty-sixth notes (equivalent of error correct off)

Note: The new error correct resolution takes effect after the pattern finishes playing through the current measure. It then remains at the new rate until you change it again, or power is switched off.

Erase Instrument

Often, patterns are composed while recording, so it can be just as important to easily remove instruments from a pattern as it is to insert them. The TOM allows you to erase instruments either while the pattern is running (see below), or by stepping up to the undesired instrument event, then deleting it (see SINGLE STEP, on page 3-11).

To erase instruments while the pattern plays:

Check that **PATTERN** is lit, and the pattern is stopped.

Select **Erase Instrument** with the **Function Select** switches.

Press **Start/Stop.**

If you want to erase a cartridge sound from the pattern, select **Cartridge.**

To delete a specific instrument event from the pattern, press the instrument switch when the undesired event occurs.
So long as the instrument switch is held, every occurence of that instrument is erased.

To delete more instrument events, press other instrument switches.

When finished erasing instruments, to return to pattern recording, select the desired Record Mode function.

Note: When **Erase Instrument** is selected, all occurrences of an instrument are erased while the instrument switch is pressed, regardless of the tunings, volumes, stereo pan, or whether the sound is reversed or not.

Improv

This unique feature of the Model 420 allows patterns to be recorded which, on playback, occasionally "drop in" drum fills of your own (not random) design. All events recorded on the TOM are either "normal" or "improv" events. "Normal" events are played back as recorded, while "improv" events are played only a certain percentage of the time. This percentage is programmable, and independent for each pattern.

For example, if a pattern has an "improv value" of 27, then all notes which are recorded as improv events are played back 27% of the time.

Note: For every loop through the pattern, either all the "improv" notes are played back, or none of them are.

To record "improv" events:

>   Select **Improv** with the **Function Select** switches.
>   The left display reads "OF" (off). The right display shows the current improv value.
>
>   To switch improv on, press **DEC.**
>
>   If necessary, to start recording, press **Start/Stop.**
>
>   Play the instrument switches.
>   The events recorded are "improv" events. The events are not played on every loop through the pattern.
>
>   To make the "improv" events play more often, enter a two-digit number on the ten-key pad higher than the displayed improv value.
>
>   To make the "improv" events play less often, enter a two-digit number on the ten-key pad lower than the displayed improv value.

To return to recording "normal" events:

>   If necessary, select **Improv.**
>
>   To switch improv off, press **DEC.**
>   The left display reads "OF."

<u>To hear only the "improv" events:</u>

If necessary, select **Improv.**

Press **INC.**
      The right display's decimal point lights. All "normal" events
      are muted. The improv value is still in effect, however, so
      enter 99 on the ten-key pad if you want to hear the "improv"
      events as "normal" events.

To un-mute the "normal" events, press **INC.**
      The decimal point turns off.

To hear only the "normal" events, enter 00 on the ten-key pad.
      All "improv" events are muted.

<u>Note:</u> Unless you want to continue to record "improvised"
instruments, check that **Improv** is off.

Stack

Referring to the General Block Diagram (page ix), the TOM's sound-
generating circuitry is capable of producing four sounds at once.
When an instrument is played, the sound is produced on one of the
four channels, then panned left, right, or center. If before the entire
sound is played, it is played again, the first signal is cut off, then re-
started, so only one channel is used by the instrument. This effect is
particularly noticable when long sounds, such as the crash cymbal,
are played several times quickly.

When the TOM operates in "stack" mode, however, any instrument
can occupy more than one channel. For example, when the crash
cymbal is played, it may be assigned to channel 1. When it is played a
second time, it is played on channel 2, leaving the signal on channel 1
unaffected. Each time the cymbal is played, it is assigned to a new
channel. This produces the effect of several crash cymbals played
simultaneously, rather than that of one cymbal being retriggered.

<u>To switch stack mode on:</u>

Press **PATTERN.**

Select **Stack** with the **Function Selct** switches.
      The left display reads "ST." The right display reads either
      "on" or "OF."

To switch stack mode on or off, press 0.
      The right display shows the current stack status ("on" or
      "OF").

Play the crash cymbal several times quickly.
Notice that when Stack is on, the sound produced is fuller than when Stack is off.

Hit other instrument switches.
Notice that Stack is more noticeable on longer sounds than on shorter ones.

Flanging

The above example demonstrates how sounds can be stacked when played live. Switching Stack on or off in Record Mode determines whether sounds are to be stacked or not. Because of error correct, however, it is possible to record any instrument twice on the exact same beat. Rather than just play louder, a slight delay caused by the instrument sound generating circuitry creates a flanging effect. The more times (four maximum) an instrument is recorded on one beat, the "heavier" the flanging (equivalent of increasing a flanger's "regeneration," or feedback).

To record a pattern in stack mode:

Select an empty pattern.

Select **Stack.**

Switch **Stack** on (see above).

Press **Start/Stop.**

Record a simple pattern with any one instrument sound (for example, the snare sound.)

When the pattern loops, overdub the pattern on top of itself.
The next time the pattern loops, the recorded instrument events are doubled, creating a flanging effect.

Stack mode can also be turned on or off after a pattern has been recorded.

It may be tempting to record all patterns with stack mode on, but remember that stacking instruments may limit the number of different instruments which can be played at once. For example, if the snare is "doubled," only two other sounds can be played on the same beat as the snare.

Note: When all four channels are occupied, new instrument events are assigned to whichever channel has less remaining sound to generate.

When the TOM is played from a MIDI-equipped keyboard, "special" keys allow instrument sounds to be flanged live. (For details, see the TOM MIDIGUIDE, MG420.)

Reframe

Reframe allows you to redefine the starting point of a pattern. For example, after creating a complex pattern, if the pattern has a good "feel" to it, but on playback does not start at the correct point, use Reframe to shift the pattern's start to the intended beat.

<u>To redefine the starting point of the current pattern:</u>

      Select **Reframe** with the **Function Select** switches.
          The left display reads "rF." The **Execute** LED flashes.

      If the pattern is not running, press **Start/Stop.**

      When the intended starting point of the pattern occurs, press **0.**

<u>To check the new starting point:</u>

      Stop the pattern by pressing **Start/Stop.**

      To restart playback, press **Start/Stop.**
          The pattern now begins from the new starting point.

<u>Note:</u> The accuracy with which Reframe can adjust a pattern's start is determined by the current Error Correct setting (see page 3-5).

Single Step

When a pattern consists of many instrument events played quickly, recording and erasing instruments requires caution or events may be recorded on the wrong beat, and then be difficult to remove without deleting other nearby events of the same instrument. Single Step functions allow you to stop the normally clocked flow of events, select any one beat of a pattern, then add or delete instrument events, audition the "new" beat, then continue recording.

Single Step can be used to either edit existing patterns, or to create new patterns too difficult to be entered "live."

Note: The error correct rate determines the size of the pattern steps.

To record a pattern in Single Step:

Press **PATTERN**.

Enter the desired pattern number (erased or not).

If desired, adjust Time Signature and Number of Measures.
For details, see page 3-2.

If necessary, to adjust the pattern step size (power-up default is sixteenth notes):

Select **Error Correct** with the **Function Select** switches.
The right display shows the current step size.

Adjust the step size with **INC** and **DEC**.
Adjustable from half-notes to 96th notes.

Select **Single Step Insert** or **Delete** with the **Function Select** switches.
The left display reads "01." This indicates the first measure of the pattern is selected. The right display is blank.

Press **Start/Stop**.
The left display shows the current measure. The right display shows the current pattern step.

Select pattern steps, then insert or delete instrument events as desired (see below).

To step through the pattern:

Press **INC**.
The right display's readout is incremented. If any events are recorded on the selected step, they are played.

To hear the current step without inserting or deleting any events, press **0**.

To insert instrument events at the current pattern step:

Select **Single Step Insert** with the **Function Select** switches.

To record instrument events on the current pattern step, play the instrument switches.

To audition the instruments recorded on the current step, press **0.**

To delete instruments from the current step:

Select **Single Step Delete** with the **Function Select** switches.

Play the switch(es) of the instrument(s) you want to remove from the current pattern step.

To audition the instruments recorded on the current step, press **0.**

To exit Single Step, either:

Press **Start/Stop.**
You can now playback the recorded pattern.

or

Select another Record Mode function (other than the Single Step functions).
The pattern returns to Record Mode, with the internal clock running.

When long patterns require Single Step editing, it can be inconvenient to have to select the desired step by pressing INC, so Single Step can be entered while in Record Mode (see below).

To "fast forward" to the desired pattern step:

Select any of the Record Mode functions other than **Single Step Insert** or **Delete.**

Press **Start/Stop.**
The pattern runs.

When the desired step of the pattern approaches, select **Single Step Insert** with the **Function Select** switches.
The pattern stops.

Step to the desired event with **INC.**·

Insert or delete instrument events as desired.
For details, see above.

3-4 COPY/APPEND

This function allows you to make copies of patterns, so that while the copy is edited, the original is preserved. The original is not lost following an edit. It also allows you to append a pattern to another pattern (to create one longer pattern), or to itself (doubling its length). In either case, you first specify the pattern you wish to copy or append, then enter the number of the pattern to which the pattern is to be copied, or appended.

To copy/append a pattern:

Press **PATTERN**.

Enter the number of the pattern you wish to copy on the ten-key pad.

Select **Copy/Append** with the **Function Select** switches.

To copy the current pattern, enter the number of the erased pattern you want to copy it into.
    The pattern is copied, and the new pattern is selected, ready for playback.

To append the current pattern, enter the number of the pattern on to which you want to append it.
    This can be the same or another pattern number. The appended pattern is selected, ready for playback.

Note: Appending does not work if:

1) The first pattern is erased (see page 3-1).

2) The two patterns are in different time signatures.

3) The total number of measures of the two patterns exceeds 99.

3-5 AUTO REPEAT

This function allows instruments to be played at a steady rate, without having to repeatedly play the instrument switch. Use of Auto Repeat as a playback function is covered on page 2-11.

To record patterns with Auto Repeat:

If necessary, to turn Auto Repeat on:

Press **CONTROL.**

Select **Auto Repeat** with the **Function Select** switches.

To turn Auto Repeat on, press **0.**

Press **PATTERN.**

Enter the desired pattern number.

Select **Error Correct.**

Press **Start/Stop.**
The metronome starts (unless turned off).

Hold any instrument switch.
The instrument is played repeatedly. When the pattern loops, the auto repeated instrument events are included.

To adjust the auto repeat rate, select and adjust **Error Correct.**

Use other Record Mode functions (for example, **Erase Instrument,** or **Improv**) as necessary.

To stop recording, press **Start/Stop.**

For interesting results, try combining Auto Repeated instruments set to different rates. For example, try Auto Repeating the Hi Hat on sixth notes (error correct = 6), and bass drum on quarter notes (error correct = 4). Another interesting effect is produced when the instrument tuning is adjusted while recording with Auto Repeat (see page 4-2.

ADVANCED PATTERN RECORDING

The following pages cover several applications for the controls and functions described in the previous sections. All operations assume an understanding of the TOM's controls, and provide guidelines rather than step-by-step instructions.

4-1 TOM ROLLS

The ability to create tom rolls is one of the most popular aspects of programmable tuning on drum machines as, although several tunings are available for each instrument sound, there is not the added cost of extra instruments.

The following are three methods for programming multiple drum tunings into a pattern.

Overdubbing Tunings

This method requires several keystrokes for each new tuning, but is recommended for recording carefully-planned patterns.

Record a pattern with the instruments which are to have only one tuning, volume, or pan.

Stop recording.

Adjust the tunings, volumes, and stereo pannings of the instruments which are to have several control settings.

Enter Record Mode and play the instruments with the current control settings.

For more tunings, volumes, or pannings, repeat the previous three steps.

For greater accuracy, use Single Step Insert to enter instrument events.

Note: This method allows each instrument tuning to have a different volume and stereo pan, so when tom rolls are recorded, the drums can pan from left to right as tunings change.

Adjusting Instrument Controls while Recording

The following method is very quick, and is especially useful for creating spontaneous patterns during the recording process.

Select the desired pattern (empty or not) for recording.

Select the desired Record Mode function.

Press **Start/Stop.**

To adjust the instrument controls while the pattern is recording:

Press **CONTROL.**
The **CONTROL** LED lights. The top function LED lights, indicating **Instrument Tuning** is selected.

Adjust instrument tunings as desired.
For details, see page 2-8. Remember that every time you press the instrument switch, it is recorded into the pattern.

Select **Instrument Volume** or **Instrument Pan** with the **Function Select** switches, then adjust values as desired.

Note: If **CONTROL** is lit while recording, the **Function Select** switches only select **Instrument Tuning, Instrument Volume, Instrument Pan,** and **Auto Repeat.**

For interesting effects, use Auto Repeat while adjusting tunings.

Select **Auto Repeat** with the **Function Select** switches.

To turn **Auto Repeat** on, press 0.

Select **Instrument Tuning.**

To display the current tuning, press the desired instrument switch.

To set the tuning to its highest value, hold **INC** until "31" is displayed.

To step the tuning down while auto repeating the desired instrument:

Hold **DEC.**
The displayed tuning value begins to decrease.

As the tuning drops, hold the desired instrument switch.
The instrument is auto repeated as the tuning drops.

To raise the tuning, hold **INC,** then hold the instrument switch.

MIDI

MIDI allows all of the TOM's functions to be operated from external equipment. For example, from a five-octave keyboard you can play any instrument sound--internal or on cartridge--at any volume, tuning or stereo pan, forward or reverse, without having to select any functions from the TOM's front panel, speeding up the process of recording of complex patterns.

All operations involving MIDI are covered in the TOM MIDIGUIDE (MG420).

4-2 TRUNCATING PATTERNS

If a pattern has several measures, but not all of them produce the intended results, to avoid re-recording the pattern, you may want to remove selected measures. The TOM allows patterns to be shortened (truncated) by simply changing **Number of Measures** <u>after</u> recording the pattern. (For information on **Number of Measures,** see page 3-2.)

If the pattern "excerpt" you wish to preserve is not at the beginning of the pattern, before adjusting **Number of Measures,** use **Reframe** to move the desired measure(s) to the beginning of the pattern. (For more information on **Reframe,** see page 3-10.)

Remember that after truncating a pattern, you can add to it with **Copy Append.**

<u>To truncate a pattern:</u>

> Press **PATTERN.**
>
> Enter the number of the pattern to be truncated.
>
> Select **Number of Measures** with the **Function Select** switches.
>> The current number of measures is shown in the right display. The **Execute** LED flashes.
>
> Adjust the number of measures with **INC** and **DEC.**
>
> When the desired number of measures is displayed, press 0.
>> The number of measures is now set. The pattern is truncated.
>
> Select one of the Record Mode functions (see page 3-3).
>
> Press **Start/Stop.**

<u>Important:</u>

> Allow the pattern to play through once, then press **Start/Stop.**
>> This makes the memory occupied by the discarded section of the truncated pattern available for recording more patterns.

When **Number of Measures** is adjusted after recording a pattern, it can only be lowered. Once lowered, it cannot be increased again, so making a copy of the original pattern before editing is recommended.

<u>Note:</u> Patterns can be shortened by entire measures only, so it is not possible to cut a single-measure pattern in half.

4-3 PROGRAMMABLE FOOTSWITCH

On power-up, the TOM's footswitch starts and stops recording and playback. If desired, the footswitch can also be programmed to supplement any of the TOM's front panel switches. For example, the footswitch could duplicate the bass drum instrument switch for recording.

To program the footswitch function:

Press **CONTROL.**

Select Programmable **Footswitch** with the **Function Select** switches.
> The display reads "FS ST," indicating the footswitch currently doubles as the **Start/Stop** switch. The **Execute** LED flashes.
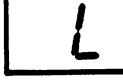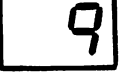
Press 0.
> The display reads FS --."

Press the desired front panel switch.
> The right display indicates which switch is selected. (Displays for each switch selection are shown below.) The **Execute** LED flashes again.

Start/Stop:	`5 r`	Reverse:	`r E`
Cartridge:	`C A`	PATTERN	`P`
SONG	`5`	CONTROL	`C`
Lower Function Select	`F d`	Upper Function Select	`F U`
Upper Tempo	`r U`	Lower Tempo	`r d`
DEC	`L`	INC	`r`
Ten-key pad	`0` through `9`		
Instrument switches	`d 1` through `d 8`		

To change the footswitch function, repeat the previous <u>two</u> steps.

To test the new footswitch function:

Press any function group switch (**PATTERN, SONG,** or **CONTROL**).

Press the footswitch.
This should cause the same effect as pressing the intended front panel switch.

To return the footswitch to the **Start/Stop** function, either reprogram for **Start/Stop,** or turn power off, then on again.

When recording or performing with drum machines, songs generally require more than one drum pattern in order to convincingly reproduce drum introductions and fills. To eliminate the need to manually cue up patterns during playback, lists of patterns may be assembled into songs.

Songs can also include volume and tempo changes, as well as a unique "human factor," which varies the volume and tuning of all song events for a variable portion of playback.

The TOM has 100 song locations, and although there may not be enough patterns in memory to allow creating 100 distinct, complete songs, the availability of these song locations becomes very useful when creating complex songs piece-by-piece. A particularly handy feature is being able to have songs select "sub songs" during playback.

5-1 SONG PLAYBACK

The TOM features some unique song-building functions. To demonstrate these functions, and to become familiar with the **SONG** function group, play some of the factory songs provided with the TOM.

To select a song for playback:

Press **SONG.**
The top function LED lights, indicating **Song Number** is selected from the **SONG** function group.

Enter the desired song number on the ten-key pad, or use **INC** and **DEC.**

Press **Start/Stop.**
The selected song plays. Some songs play repeatedly (loop), others stop when the song's end is reached. Whether a song loops or not depends on the final step in the song (see PATTERN NUMBER, page 5-4).

To stop song playback, press **Start/Stop.**

To continue playback of the song from the point at which it was stopped:

Hold **SONG.**

Press **Start/Stop.**

5-2 ERASE SONG

Before building a new song, find an erased song, or if desired, erase an existing song. Because songs do not contain any instrument events, but instead simply "point" to patterns (which do contain events), songs generally use much less memory than patterns.

To erase a song:

Press **SONG.**

Select **Erase Song** with the **Function Select** switches.
The bottom function LED lights. Both displays go blank.

Enter the two-digit number of the song to be erased.
The song is erased, and **Song Number** is selected.

5-3 SET INITIAL TEMPO

Normally, patterns and songs play at whatever tempo is currently active on the front panel. To avoid having to adjust tempo manually before starting song playback, the initial tempo of the song can be entered before or after building the song.

To Set the initial tempo of the current song:

Select **Initial Tempo** with the **Function Select** switches.
The right display reads "OF."

To turn initial tempo on, press **0.**
The right display shows the default tempo of 100.

To adjust initial tempo, use **INC** and **DEC.**
Tempo ranges from 40 to 240 beats per minute.

To turn initial tempo off:

Select **Initial Tempo** with the **Function Select** switches.

Press **0.**
The display reads "OF" (off).

5-4 BUILD SONG FUNCTIONS

Songs are created either by building from an erased song, or by editing an exisiting song. The same Build Song functions are used in either case, and appear on the following pages in the order in which they appear in the **SONG** function group.

Songs are made up of song steps. Song steps can consist of codes other than pattern numbers, which represent tempo changes, volume changes, sub song numbers, and start and end points for repeat loops within the song. To generalize, the contents of a song step is called an "entry." When you master these functions, you will be able to easily build very complex songs.

To build a new song:

> Press **SONG.**
>> This selects **Song Number** from the **SONG** function group.
>
> Enter the two-digit number of the desired erased song.
>
> Select the desired Build Song function, then make the appropriate entry.
>> Instructions for each Build Song function appear on the following pages.

Note: In all Build Song functions, the left display always shows the step number, and the right display shows the contents of that step. An "E" in the right display indicates an empty step. When an empty step is reached in song playback, the song repeats.

> Select the next song step with **INC,** or "back up" to the desired step with **DEC.**
>
> To enter more song steps, repeat the previous two steps.
>
> To end song building and begin song playback:
>
>> Press **SONG.**
>>
>> Press **Start/Stop.**
>>> The song plays back.
>>
>> To stop song playback, press **Start/Stop.**
>
> If desired, to edit the song, select the desired Build Song functions, then insert or delete steps as necessary.

When a song step is entered, all following song entries are shifted down to the next step.

Note: When songs are built, no song step is erased from the song unless intentionally deleted with **Delete.** Otherwise, all song entries cause the following steps contents to be shifted down one step.

Pattern Number

When this function is selected, the TOM interprets the two digits entered as a pattern number. On playback, when the current step is reached, the TOM selects the pattern. When playback of the pattern ends, the next song step is selected.

If the step contains the number of an erased pattern, the song stops playback. If you want a song to stop playback, rather than loop, enter an erased pattern into the last song step. (Pattern #99 is "permanently erased" for stopping songs.)

To insert a pattern number while in Build Song Mode:

Select **Pattern Number** from the **SONG** function group with the **Function Select** switches.
The left display shows the current song step number.

Step to the desired song step with **INC** or **DEC.**

Enter the desired pattern number (00-99).

To select the next step, press **INC.**
Note that the step's previous contents have been shifted "down" the list to the next step.

If desired, to insert more pattern numbers, repeat the previous three steps.

If desired, select other Build Song functions (see following pages), or to delete song entries, see page 5-12.

Sub Song Number

When a step is reached in a song, the entry is interpreted in a number of ways. If the entry is a pattern number, then a pattern is selected, then played. If the entry is a "sub song," then another song is selected and played.

When the selected "sub song" finishes playing through once, the next step in the main song is selected.

<u>To insert a sub song:</u>

Select **Sub Song Number** with the Function Select switches.

Select the desired step number for the sub song with **INC** or **DEC.**

Enter the two-digit number of the desired song to be played at the song step shown in the left display.
    The sub song number is shown in the right display. The right display's decimal point lights to indicate the song step contains a sub song.

If the sub song contains an initial tempo (see page 5-2), the tempo changes to it when the sub song step is reached in playback. When the sub song finishes playing, the main song continues playing from the next step, but the original tempo is not restored. You can restore the original tempo by inserting the appropriate entries just following the sub song. (If a sub song contains an initial tempo but is otherwise empty, it can be inserted in a song to change the song tempo.)

<u>Note:</u> This method of tempo changing is sometimes more convenient than inserting tempo changes in a song, as these can only change the tempo by 25 beats per minute, maximum (see TEMPO CHANGE, page 5-10).

A sub song is no different from a normal song. It is only named differently to indicate that when it finishes playing once, rather than loop, the previous song continues playing.

An example of how this works is depicted below. (Letters represent pattern numbers.)

Step #	Song #1	Song #2
00	A	D
01	B	E
02	C	F
03	Sub Song #2	
04	G	
05	etc.	

When Song #1 is selected for playback, it plays patterns A, B, then C. When step #03 is reached, Song #2 is selected, so patterns D, E, then F are played. When Song #2 finishes playing once, the TOM returns to Song #1, step 4, then continues song playback.

In this example, Song #2 contains three patterns, which might constitute a drum part used at several points in a song. Rather than enter all three patterns several times in Song #1, selecting Sub Song #2 makes the entire song easier to build or edit.

Since a sub song is the same thing as a song, a sub song can also contain sub songs (see example below).

Step #	Song #1	Song #2	Song #3
00	A	D	F
01	B	E	G
02	C	Sub	
		Song #3	H
03	Sub		
	Song #2	I	
04	J		
05	etc.		

In this case, song #1 plays patterns A, B, and C, then selects song #2, which, after playing patterns D and E, selects song #3. When Song #3 finishes playing patterns F, G, and H, Song #2 plays pattern I, then returns to step 04 of Song #1. This method of using sub songs is called "nesting." In the above example, Song #2 is nested inside Song #1, and Song #3 is nested inside Song #2. A song can contain a maximum of seven nested songs in <u>any one step.</u> (This does not mean that a song cannot contain, for example, ten sub song entries.) For example, if you have:

Song #1	Song #2	Song #3	Song #4
A	B	C	D
Sub	Sub	Sub	Sub
Song #2	Song #3	Song #4	Song #5
O	N	M	L
P			

Song #5	Song #6	Song #7
E	F	G
Sub	Sub	H
Song #6	Song #7	I
K	J	

Song #7 cannot contain any sub songs, although Song #1 could contain any number of sub songs.

<u>Note:</u> Any song can contain any sub song, as long as the sub song does not contain the main song as a sub song. The following is an example of situations to avoid:

Song #4	Song #2
A	D
sub	
song #2	E
B	sub
	song #4
C	F

In this situation, song #4 selects sub song #2, then sub song #2 selects sub song #4. This would cause an endless loop. Similarly, the following situation has the same problem:

Song #4
A
B
sub song #4
C
D

A song should not select itself as a sub song.

If desired, a song can be broken down into several songs, then linked together into one main song, containing sub songs only.

Repeat Loops

Another method for simplifying the creation of long songs, is to build repeat loops. If a song contains several patterns which play several times in the same order, you can enter the patterns once inside a "loop, " then specify the number of times the loop is to play before continuing to the next song step. The following songs play identically:

Song #1	**Song #2**
A	A
B	B
C	Start Repeat
D	C
E	D
C	E
D	End Repeat 2
E	
C	
D	
E	

Song #2 requires fewer song steps than Song #1. If one more repeat of patterns C, D, and E is needed, changing Song #2's "End Repeat 2" to "End Repeat 3" is the same as adding three more pattern entries to Song #1.

To insert a Start Repeat in a song:

Select **Start Repeat** with the **Function Select** switches.
The **Execute** LED blinks.

If necessary, select the step where the repeat loop is to begin (use **INC** and **DEC**).

Press 0.
The left displays are blank. The right display shows a "(" to indicate the beginning of a repeat loop.

To create the repeat loop:

Select the step following the Start Repeat with **INC** and **DEC.**

Insert the desired song entries for the repeat loop, or step through the existing song entries to be repeated with **INC** and **DEC.**

To define the end of a repeat loop:

After entering the last entry in the repeat loop, select the next song step.

Select **End Repeat** with the **Function Select** switches.
The **Execute** LED flashes.

Press 0.
> The right display reads ")1." The "1" indicates the loop will repeat once (play twice).

Enter the number of times the loop is to be repeated on the ten-key pad.
> For example, entering "3" causes the loop to play four times.

Select the next song step with **INC** and insert other song entries.

Repeat loops can be nested inside another repeat loop as follows:

Song #1
Start Repeat
  B
  Start Repeat
    C
    D
  End Repeat 2
  E
End Repeat 3

This song plays the following pattern sequence four times:

  B
  C
  D
  C
  D
  C
  D
  E

If the last End Repeat is followed by "4," rather than by "3," the patterns would play through five, instead of four times.

A song can contain as many repeat loops as you can fit in the 100-step capacity, but loops can be nested only eight times, maximum.

Note: Every Start Repeat must have an End Repeat, or the repeat loop is ignored. For easy checking, write out your repeat loops before building a song, indenting each nested loop as in the above examples.

Tempo Change

Normally patterns play at the tempo currently selected on the front panel. It has already been explained how songs can contain an initial tempo, so that several songs of different tempos may be played consecutively without having to manually adjust the tempo in between songs. In some instances, you may also require the tempo to change in the middle of the song. To acheive this effect, the TOM's songs can be programmed to slow down or speed up by entering tempo changes in the song.

Tempo changes cause relative increases (or decreases) in tempo rather than simply selecting an absolute tempo. Relative tempo changes are not affected by the song's initial tempo, allowing songs to always speed up or slow down by the same relative amount, regardless of the initial tempo.

To speed up a song:

Select **Tempo Change.**

Select the song step where the tempo is to change.

Enter the desired relative tempo change (1-9, see below) on the ten-key pad.
The right display reads "T" and the relative tempo change.

The number entered represents one of nine possible tempo changes. The exact number of beats per minute corresponding to each tempo change value are as follows:

Tempo Change Value	# beats per minute
1	1
2	4
3	7
4	10
5	13
6	16
7	19
8	22
9	25

To make the tempo change slow down the pattern:

Press **0.**
The right display's decimal point lights, indicating a decrease in tempo.

To cause an increase in tempo, press 0 again.
The right display's decimal point turns off.

If a song contains both an initial tempo setting and relative tempo changes, when the song loops, the initial tempo returns.

Relative tempo changes (as described above) can cause a maximum tempo change of 25 beats per minute. For major tempo changes, multiple tempo changes can be strung together, or an absolute tempo change can be made by entering a sub song which only contains an initial tempo setting. For details on sub songs, see page 5-5.

Volume Change

During pattern playback, instruments are played at one of eight volume levels. In song playback, all instrument volumes may be simultaneously increased or decreased by relative volume changes. Volume changes are inserted as song entries, in the same manner as pattern numbers, sub songs, or tempo changes.

To insert a volume change:

Select **Volume Change** with the **Function Select** switches.

Select the desired song step with **INC** or **DEC.**
The volume change will affect all song entries starting from the selected step.

Enter the desired relative volume change value (1-6, see below) on the ten-key pad.
The right display reads "V" and the relative volume change.

Note: Unlike tempo changes, the number entered corresponds directly to the change in instrument volume. That is, entering 1 changes the volume by 1, entering 2 changes the volume by 2, and so on.

To make the instrument volumes decrease by the entered value, press **0.**
The right display's decimal point lights.

If the right display's decimal point is lit, to make the instrument volumes increase by the displayed amount, press **0** again.
The right display's decimal point turns off again.

Note: Relative volume changes never allow an instrument volume to reach 0, or go above 7.

For interesting "fading" effects, try including volume changes inside repeat loops (see page 5-8). Every time the repeat loop plays, the instrument volumes drop.

Step Number

When working on long songs, steps can be selected with either **INC** and **DEC**, or **Step Number**. When this function is selected, enter the desired step number on the ten-key pad. This function alows you to jump quickly to any part of a song.

Delete

When songs are built, entries can not be erased accidentally. Instead, inserting an entry into a song causes all following entries to shift <u>down</u> one song step.

To delete one step from a song:

      Select **Delete** with the **Function Select** switches.
        The **Execute** LED blinks.

      Select the undesired song entry with **INC** or **DEC**.

      To delete the displayed song entry, press **0**.
        The entry is deleted. All song entries are shifted "up" in the song one step. The **Execute** LED blinks.

      To delete more steps, repeat the previous two steps.

      When finished deleting song entries, select other Build Song functions, or to play the edited song, press **SONG**, then press **Start/Stop**.

5-5 HUMAN FACTOR

This feature, like Improv (see page 3-7) gives patterns a spontaneous "feel." Unlike Improv, which can be programmed into a pattern, Human Factor only affects songs. When a song's Human Factor is set to 00 (default), all pattern events play at their usual volumes and tunings. As Human Factor is increased,the instrument volumes and tunings are occasionally raised or lowered by one step. The higher the Human Factor setting, the more often the song plays instrument events at different volumes and pitches.

Press **SONG.**

Enter the number of the desired song.

Select **Human Factor** with the **Function Select** switches.
The display reads "HU 00." This indicates the default Human Factor of 00 is selected.

Enter the desired Human Factor value (00-99) on the ten-key pad, or adjust the displayed value with **INC** or **DEC.**

To build the song, see page 5-3.

On playback, the higher the Human Factor of the song, the more often the instrument event tunings and volumes vary. Notice that all instrument volumes and tunings are affected simultaneously.

To turn the Human Factor off, select **Human Factor**, then adjust the displayed value to 00.

5-6 COPY/APPEND SONG

If a song requires major editing, making a back-up copy is recommended, so in case the edit does not produce the intended results, the original song can be recalled.

To copy the current song to an empty song:

Press **SONG.**

Enter the number of the song to be copied.

Select **Copy/Append Song to** from the SONG function group (use the **Function Select** switches).
    The current song number appears in the right display.

Enter the two-digit number of the empty song into which you want to copy the current song.
    The song "copy" is selected. The top function LED lights, indicating **Song Number** is selected.

If the wrong first digit is entered, to "escape" the copy function, press **SONG**, or either of the **Function Select** switches, then repeat the previous two steps.

If desired, to check the copy, press **Start/Stop.**
    The song "copy" begins playback.

To append a song to another song:

Press **SONG.**

Enter the number of the song to be appended.

Select **Copy/Append Song to** from the SONG function group (use the **Function Select** switches).
    The current song number appears in the right display.

Enter the two-digit number of the song onto which you want to append the current song.
    The song to which the first song has been appended is now selected. The top function LED lights, indicating **Song Number** is selected.

If the wrong first digit is entered, to "escape" the append function, press **SONG**, or either of the **Function Select** switches, then repeat the previous two steps.

If desired, to check the new song, press **Start/Stop.**
    The new song begins playback.

If the TOM's display reads "FULL" while recording, no more instrument events can be recorded unless some patterns are erased. Songs can also be erased, but as there are generally fewer songs than patterns in memory at the same time, and because songs rarely require as much memory as patterns do, there is little gained by erasing a song, rather than a pattern.

To conserve memory, long patterns are best created in sections, then linked together as songs. Songs can also be linked together as "sub songs" (see page 5-5), so once the sub songs are created, building entire songs from them is no more complicated than building songs from patterns.

6-1 MEMORY STATUS

The TOM's **Memory Status** function lets you keep track of its memory and software version.

To select the **Memory Status** function:

    Press CONTROL.

    Select **Memory Status** with the **Function Select** switches.
        The left display reads "1." The right display shows the percentage of installed memory which is available for recording more patterns.

    If desired, select other **Memory Status** functions (see below).

Amount of Memory Used by Current Pattern

If there is not enough memory available to allow patterns to be recorded, you may want to erase one or two patterns, rather than save the current memory to tape. Some patterns require more memory than others, so to find out how much memory a specific pattern takes up:

    Select the desired pattern.

    Press CONTROL.

    Select **Memory Status.**

    Press INC once.
        The left display reads "2." The right display shows the percentage of memory the current pattern occupies.

Clear All Memory

<u>To erase all patterns and songs currently in the 420's memory:</u>

Switch power off.

Hold down **PATTERN, SONG,** and **CONTROL,** then switch power on.
All memory is cleared. The **CONTROL** LED is lit, and **Instrument Tuning** is selected.

Amount of Memory Installed

The TOM is shipped from the factory with a 2300-note capacity. If desired, the memory capacity can be expanded to 5000, 7700, or 10,400 notes by any authorized Sequential service center.

Select the **Memory Status** function (see above).

Press **INC** twice.
The left display reads "3."

If the right display reads "8," the TOM has 8K of memory for the standard 2,300-note capacity.

If the right display reads "16," the TOM has 16K of memory for a 5,000-note capacity.

If the right display reads "24," the TOM has 24K of memory for a 7,700-note capacity.

If the right display reads "32," the TOM has 32K of memory for a 10,400-note capacity.

Software Version

The TOM is shipped from the factory with TOM_1_0 software. In future there may be software updates, so to check the software level of your TOM:

Select **Memory Status** (see above).

Press **INC** three times.
The left display reads "4." The right display shows the software version.

STORAGE ON TAPE

When the TOM's memory fills (and it does), to record new patterns, existing patterns must be erased. To avoid losing patterns forever, store the current memory on tape, then reload the patterns later if necessary. You can also store patterns and songs over MIDI (see the TOM MIDIGUIDE, MG420).

There is no specific type of tape recorder recommended for tape storage operations. Most portable recording cassette decks feature automatic gain control of the input signal, so they are often preferred for their ease of use. Home stereo cassettes also work well, and may be more reliable than monophonic "portables."

7-1 CONNECTION
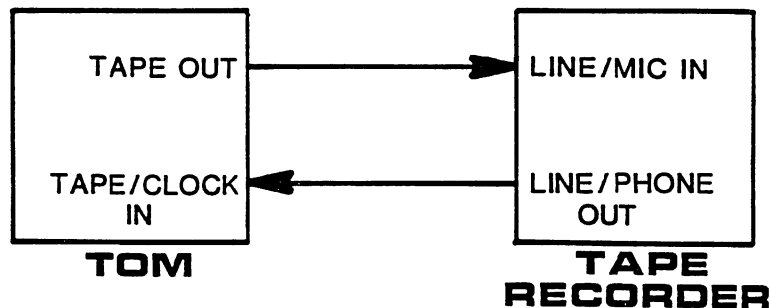
Figure 7-1
Connection for Tape Storage

Connect ¼" phone cable from the TOM's **Tape Out** to one of the tape deck's inputs. (If a portable monophonic cassette is used, connect **Tape Out** to the microphone input.)

Connect the tape recorder's output (earphone, headphone, or line output) to the TOM's **Clock/Tape In.**

Signal Level

The TOM puts out a 1-V signal when saving to tape. If the tape recorder in use has automatic gain control of the input, then no signal level adjustment is necessary. Most home cassette recorders have input level controls for each channel, and unless they are adjusted, the TOM's 1-V signal may not be properly recorded.

To adjust the tape recorder's input signal level:

Place a blank tape in the tape recorder, then rewind.

Prepare the tape recorder for recording, with the "pause" on.
   The tape recorder's level indicators should display the input
   signal.

On the TOM, press **CONTROL.**

Select **Tape Load/Save** with the **Function Select** switches.
   The fifth function LED lights. The displays read "LOAD."
   The **Execute** LED blinks.

Press **INC** once.
   The display reads "SAVE." The **Execute** LED blinks.

Press **0.**
   The TOM's leftmost display digit reads "S." The TOM starts
   sending the memory data over the tape interface. The tape
   recorder's level indicators should show the signal level.

Adjust the tape recorder's input level control(s) so the indicators
show a level slightly below 0dB (below the red).

Press **CONTROL.**
   The save operation is aborted. No memory is lost in the
   process.

7-2 SAVE TO TAPE

When saving to tape, all memory is saved.

Note: Before saving, check that the tape recorder is connected, and
that signal levels are adjusted correctly (see previous page).

On the TOM, press **CONTROL.**

Select **Tape Load/Save** with the **Function Select** switches.
   The fifth function LED lights. The displays read "LOAD."

To select the save function, press **INC** once.
   The displays read "SAVE." The **Execute** LED blinks.

Rewind the blank tape to its beginning.

If tape is not blank, but contains other TOM pattern data, wind
the tape to just after the last data file.

Start recording on the tape recorder.

Wait three or four seconds to allow the tape "leader" to pass,
then press **0.**
   The save begins.

Note: The time it takes to save depends on how much of memory contains patterns or songs. A 2,300-note capacity TOM takes approximately three minutes to save a completely-full 8K memory.

When the save is complete, the TOM selects the verify function (the displays read "VErY"), so you can check that the tape recorded the memory correctly. Although it is possible to "escape" the tape verify function, it is best to not assume the stored data is correct, and to compare the tape's contents with the TOM's memory using the verify function (see below).

7-3 VERIFY TAPE

Use this function to make sure a back-up tape's contents are correct. Even if a tape does not verify, the TOM's current memory is unaffected.

To select the verify tape function:
(Recommended, but not necessary following a save-to-tape operation.)

Press **CONTROL.**

Select **Tape Load/Save** with the **Function Select** switches.
The fifth function LED lights. The displays read "LOAD."

To select the verify function, press **DEC** or **INC** twice.
The displays read "VErY." The **Execute** LED blinks.

To verify the tape:

Rewind the tape to the beginning of the recorded memory data (must be the same memory as currently in the TOM).

Note: You need to hear the recorded signal, or see it on the tape deck's level indicators. If the tape deck does not have level indicators, unplug the deck's output and connect to a speaker, or headphone.

Start playing the tape.

Listen, or look for the "pilot tone."

If the cassette output is disconnected from the TOM:

When the pilot tone appears, pause the tape.

Reconnect the cassette deck to the TOM.

Restart tape playback.

On the TOM, press 0.

If the tape deck is connected to the TOM, when the pilot tone appears, press **0**.
> The pilot tone lasts approximately 12 seconds.

If the tape verifies, the **PATTERN** LED lights and pattern #00 is selected.

Verify Error

If the displays read "Err," an error has occured.

To reverify the tape:

Press **0**.
> The display reads "VErY." The **Execute** LED blinks.

Rewind the tape, then repeat the verify process.

7-4 LOAD FROM TAPE

Note: Before loading the TOM from tape, make sure you have a back-up tape of the current memory because loading overwrites all data currently in the TOM.

Press **CONTROL**.

Select **Tape Load/Save** with the **Function Select** switches.
> The fifth function LED lights. The displays read "LOAD."
> The **Execute** LED blinks.

Wind the tape to the beginning of the desired tape file.
> To be safe, wind the tape slightly into the pilot tone.

Start tape playback.

Press **0**.
> The leftmost display digit reads "L."

If the tape loads, the **PATTERN** LED lights and pattern #00 is selected.

Load Error

If a tape does not load, the displays read "Err." Load errors do not become apparent until after the entire tape file has played. Loading errors are usually caused by a bad tape, or a low signal level from the tape.

If a loading error occurs:

Press 0.
> **Pattern Number** is selected. All memory is cleared.

Reload the memory from tape, starting from scratch.

If the second attempt to load also poduces an error, adjust the tape output level (if possible), then reload the tape.

OPERATION WITH OTHER EQUIPMENT

The TOM's input and output jacks allow operation with most sequencers, multi-track tape recorders, and other drum machines. For these purposes, the TOM generates four types of signals:

1. Trigger Out.
   When the **Trigger Out** instrument key is played (**Cartridge** must be selected) a 5-V pulse appears at the TOM's **Trigger Out** jack. These 10-msec Trigger Out pulses are dc-coupled to trigger electronic drums, synthesizers, or to clock sequencers. Trigger Out pulses can be programmed into the TOM's patterns as an instrument event.

2. Clock Out.
   When patterns play, 5-V pulses are sent over the TOM's **Clock Out** at a rate set with the Clock Out function. These 10-msec pulses are dc-coupled to drive sequencers or other drum machines.

3. Tape sync pulses.
   When patterns play, these pulses appear at the TOM's **Tape Out** at a rate set with the Clock Out function. Unlike clock pulses, tape sync pulses are ac-coupled pulses of audio frequency, which can be recorded on tape for sync-to-tape.

4. MIDI.
   The TOM can be interfaced with any other MIDI equipment. Typically, the TOM can drive MIDI sequencer/synthesizers (such as the new Sequential Multi-Trak). Most important though, is that MIDI keyboards can expand the TOM's instrument controls, so that the TOM's on-board, or cartridge instrument sounds can be tuned and panned simultaneously while they are played. If the MIDI keyboard has PITCH and MOD wheels, or is velocity sensitive, the dynamics of each instrument event can be controlled at the same time as the tuning and panning.

The following pages describe each of these common applications in detail, with the exception of MIDI operations which are described in the TOM MIDIGUIDE (MG420).

When **Cartridge** is selected, and the **Trigger Out** instrument key is played, the TOM puts out a 5-V, 10-msec pulse, which can trigger sequencers (especially valuable for stepping through Pro-One sequences), or other electronic drums. Trigger Out can be recorded into the TOM's patterns just like any of the built-in, or cartridge sounds, so you can include other electronic instruments in the TOM's patterns and songs.

Figure 8-1 (below) shows how a Sequential Pro-One synthesizer can be connected to the TOM's **Trigger Out.**

```
┌──────────────┐            ┌──────────────┐
│              │            │              │
│              │            │              │
│              │            │              │
│ TRIGGER OUT  ├──────────▶ │  GATE IN     │
│              │            │              │
└──────────────┘            └──────────────┘
      TOM                      PRO ONE
```
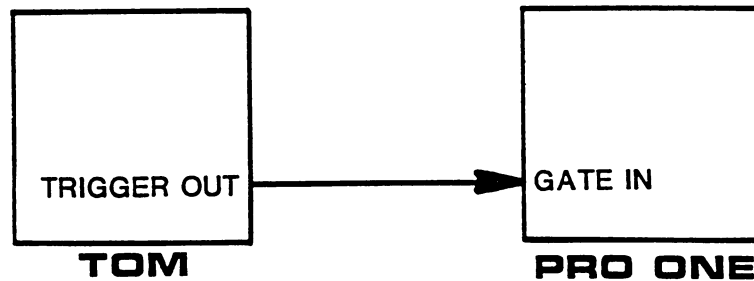
Figure 8-1
Driving a Pro-One with the TOM's Trigger Out

To Trigger the Pro-One with Trigger Out

Connect the TOM's Trigger **Out** (back panel) to the Pro-One's **Gate In.**

Press **Cartridge.**

Press the **Trigger Out** key.
    The Pro-One is triggered.

To change the pitch of the Pro-One, play the desired key.

Note: Although **Trigger Out's** tuning, volume, and stereo panning can be "adjusted" from the TOM's front panel, these controls do not affect the instrument being driven by **Trigger Out.** They do, however, affect instruments played through MIDI. (For details, see the TOM MIDIGUIDE, MG420.)

To Record a Pattern Using Trigger Out

Select the desired pattern (does not have to be empty).

Select **Metronome.**

Press **Start/Stop.**

Select **Cartridge.**

Play the **Trigger Out** key.
  Any instruments driven by **Trigger Out** are triggered.

If desired, for a repeating Trigger Out, use Auto Repeat (see page 3-14).

To Step Through a Pro-One Sequence with Trigger Out

Record a sequence into the Pro-One's sequencer.
  Don't bother recording "spaces" into the sequence, **Trigger Out** will control the timing of the notes.

Note: Remember that when **Gate In** is used, switching on the Pro-One's sequencer causes the first note of the sequence to be played, so record the last note of the sequence <u>before</u> the first (awkward but necessary).

Set the Pro-One's Sequencer switch to the recorded sequence number.
  The first note of the sequence plays.

On the TOM, select a pattern which uses **Trigger Out.**

Press **Start/Stop.**
  The pattern plays. Each time Trigger Out occurs in the pattern, the Pro-One sequence is advanced on step.

8-2 CLOCK OUT

Many sequencers feature MIDI primarily for receiving and replaying notes from a MIDI keyboard. In these cases, a 5-V clock is all that is required to synchronize with drum machines.

Connection

```
┌──────────────┐          ┌──────────────┐
│              │          │              │
│              │          │              │
│              │          │              │
│   CLOCK OUT  ├────────▶│  CLOCK IN    │
│              │          │              │
└──────────────┘          └──────────────┘
      TOM                   SEQUENCER
```
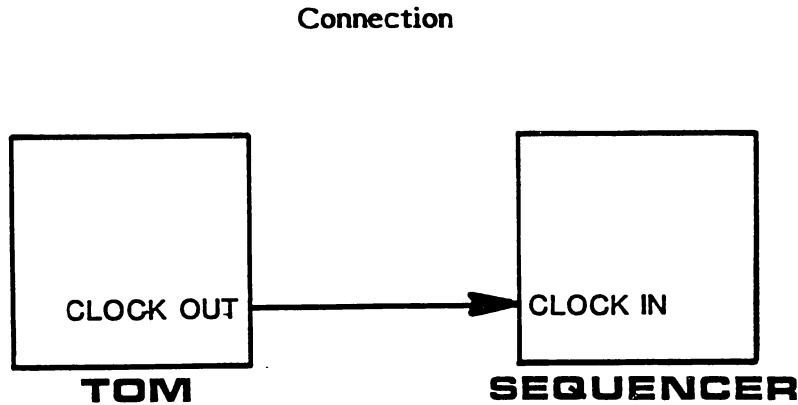
Figure 8-2
Driving Sequencers with Clock Out

The TOM outputs clocks only when patterns or songs run (playback or record).

Most sequencers or drum machines feature an internal clock, which must be disabled to allow external clock control.

The TOM outputs clocks at a variable rate (power-up default is 24 pulses per quarter-note). If the sequencer is a basic single-step type, like the Pro-One's built-in sequencer, it may be easier to clock it with the TOM's **Trigger Out.**

To clock a sequencer from the TOM:

> Enable the sequencer's external clock input.
> > For example, on the MULTI-TRAK, turn the **Speed** knob all the way down.

> Prepare the sequencer for recording or playback.
> > This operation varies from one sequencer to another.

> To adjust the TOM's output clock rate:

> Press **CONTROL.**

Select Clock **Out.**
> The left display reads "Co." The right display shows the
> current rate.

Adjust the displayed value with **INC** or **DEC.**
> Possible settings are 0.5, 1, 1.5, 2, 3, 4, 6, 8, 12, and 24
> pulses per quarter-note.

On the TOM, select the desired song or pattern for playback.

If necessary, adjust the TOM's **Tempo.**

Press the TOM's **Start/Stop.**
> The TOM pattern begins playback. Clock pulses are output,
> and the sequencer records or plays in sync with the TOM.

8-3 CLOCK IN

If the TOM is to be synchronized to another drum machine or clocking device, connect as follows:

```
┌──────────────┐              ┌──────────────┐
│              │              │              │
│              │              │   TAPE/       │
│  CLOCK OUT   ├───────────▶  │   CLOCK IN    │
│              │              │              │
└──────────────┘              └──────────────┘
     DRUM                          TOM
   MACHINE
```
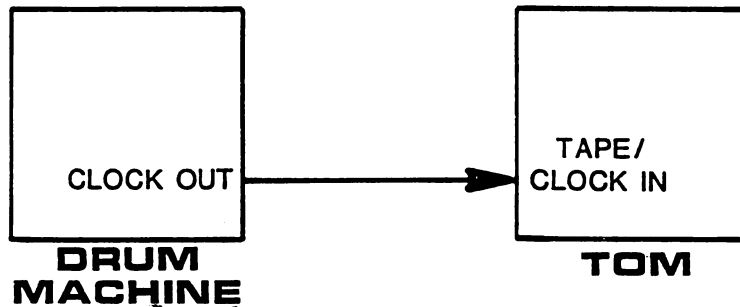
Figure 8-3
Driving the TOM with other Drum Machines

The TOM has an internal clock which controls the tempo of recording and playback. If an external clock is to control the TOM's tempo, the internal clock must first be disabled.

On the TOM:

Press **CONTROL.**

Select **Clock In** with the **Function Select** switches.
The left display reads "Ci." The right display reads "OF," indicating the external clock input is disabled.

To enable the external clock input, use **INC** and **DEC** to select between:

MIDI clock input (displayed as "nn").

24 pulses per quarter-note rate.

48 pulses per quarter-note rate.

96 pulses per quarter-note rate.

To play the TOM in sync with the external clock device:

Select the desired pattern or song for playback.

Press **Start/Stop.**
Playback does not start until the external clock starts.

Start the external clock.

The TOM's ability to synchronize with a "sync track" recorded on a multi-track tape recorder allows several drum songs to be recorded and processed separately. This does require dedicating one of the tape's tracks to the sync pulse, which is recorded from the TOM. A recommended procedure follows.

An advantage to recording a sync track to which all other tracks are synchronized is that if desired, the TOM drum parts may be changed, then re-recorded if they do not suit the rest of the recorded music. When other tracks are being recorded, the TOM itself, rather than the recorded drum part, can be monitored as it plays in sync with the tape. In such a case, regardless of the tape speed, the TOM's instrument sounds remain constant in tuning, although the tempo changes. Also, the audio drum track can be saved for last mix-down (for best fidelity).
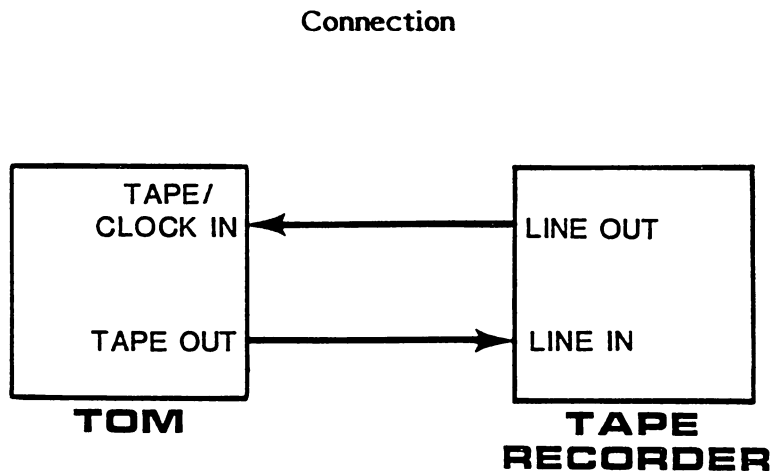
Connection

Figure 8-4
Connection for Sync-to-Tape

Connect the TOM's **Tape Out** to the desired input of the multi-track recorder.
> The selected track is dedicated to the sync track. To avoid possible crosstalk problems, record the sync track as far away from the drums themselves as possible.

Connect the multi-track recorder tape output (of the sync track) to the TOM's **Tape/Clock In.**

Connect the TOM's audio outputs to the desired inputs of the multi-track recorder.

Adjust the Sync Track's Signal Level

Many multi-track tape recorders do not feature input level controls, and as the TOM outputs 5-V (ac-coupled) sync pulses, a mixer or pre-amp may have to be connected between the TOM's **Tape Out** and the recorder's line input.

Select any pattern for playback on the TOM.

Press **Start/Stop.**
> The pattern plays, and sync pulses are sent to the multi-track recorder.

Adjust the recorder's input signal level to below 0dB.

Record the Sync Track

Select the completed drum song.

Check that Clock In is disabled on the TOM.

Set up the recorder for recording the sync track only.
> The drum parts themselves can be recorded afterwards.

Start the tape.

Press **Start/Stop.**
> The drum song plays as sync pulses are recorded onto the selected tape track.

When the drum song ends, rewind the tape and record other tracks with drum parts, or other instruments.

Record Drum Parts in Sync with the Sync Track

Rewind the tape to the beginning of the sync track.

Set up the recorder for playback of the sync track, and recording of the tracks assigned for the drum parts.

Enable the TOM's Tape/Clock Input.
> See page 8-6.

Select the drum song for the track.

Press **Start/Stop.**
> Since the TOM's Tape/Clock input is enabled, playback does not start until sync pulses are received.

Start the tape.
>   The drum part plays, and is recorded on to the assigned tracks.

To Record More Drum Parts from the TOM

Rewind the tape to the beginning of the sync track.

Set up the recorder for playback of the sync track, and recording of the tracks assigned for the next drum parts.

Select the next drum song for the track.

Press **Start/Stop.**
>   Since the TOM's Tape/Clock input is enabled, playback does not start until sync pulses are received.

Start the tape.
>   The new drum part plays, and is recorded onto the assigned tracks.

Note: To synchronize sequencers to the sync track, synchronize them to the TOM (see page 8-4), which then synchronizes with the sync track.

MODEL 420
TOM
CONTROLS AND INDICATORS

FUNCTION GROUPS
Functions are divided into three groups. To select a specific function, press the desired function group switch (the function group LED lights), then step through the functions with the **Function Select** switches.
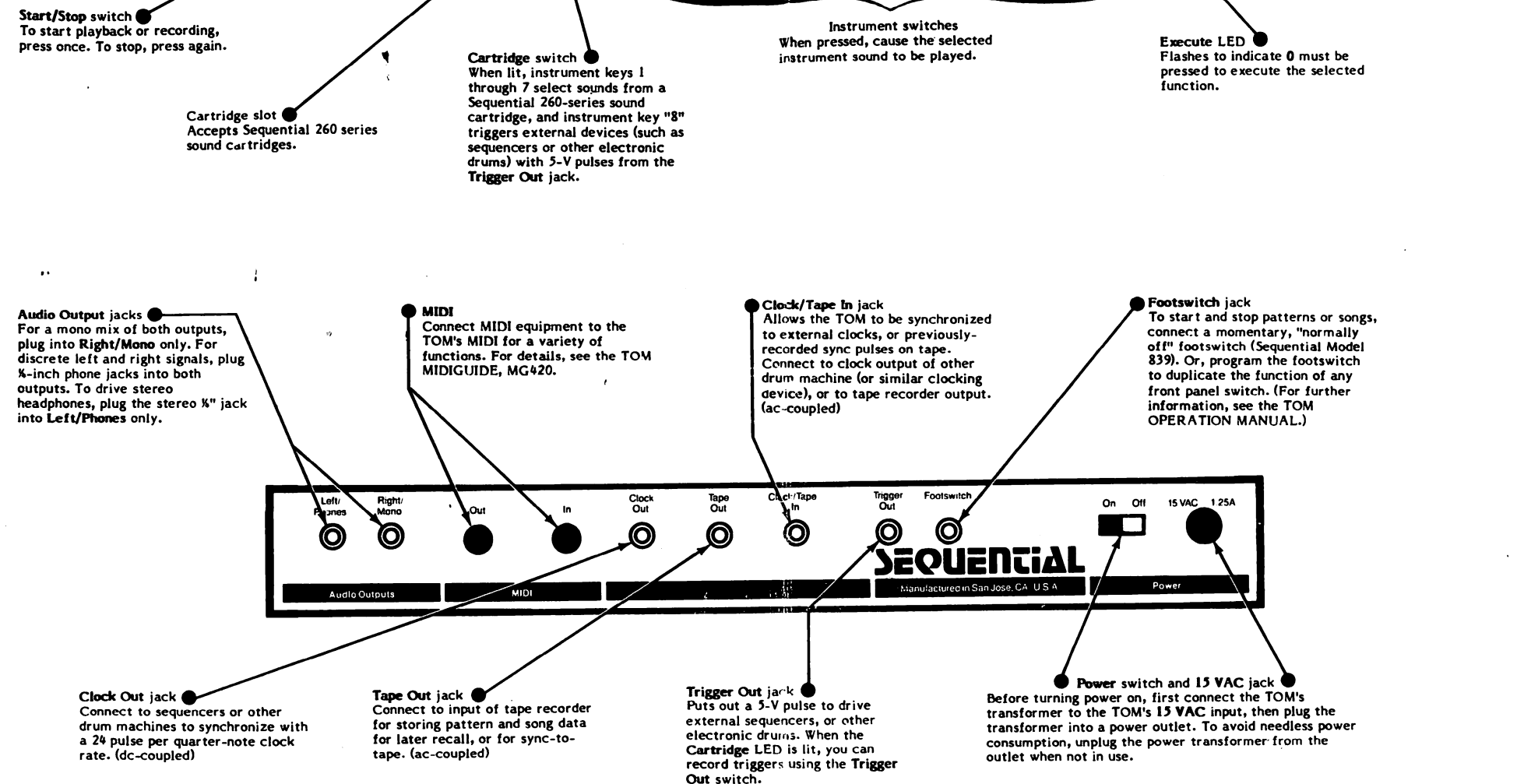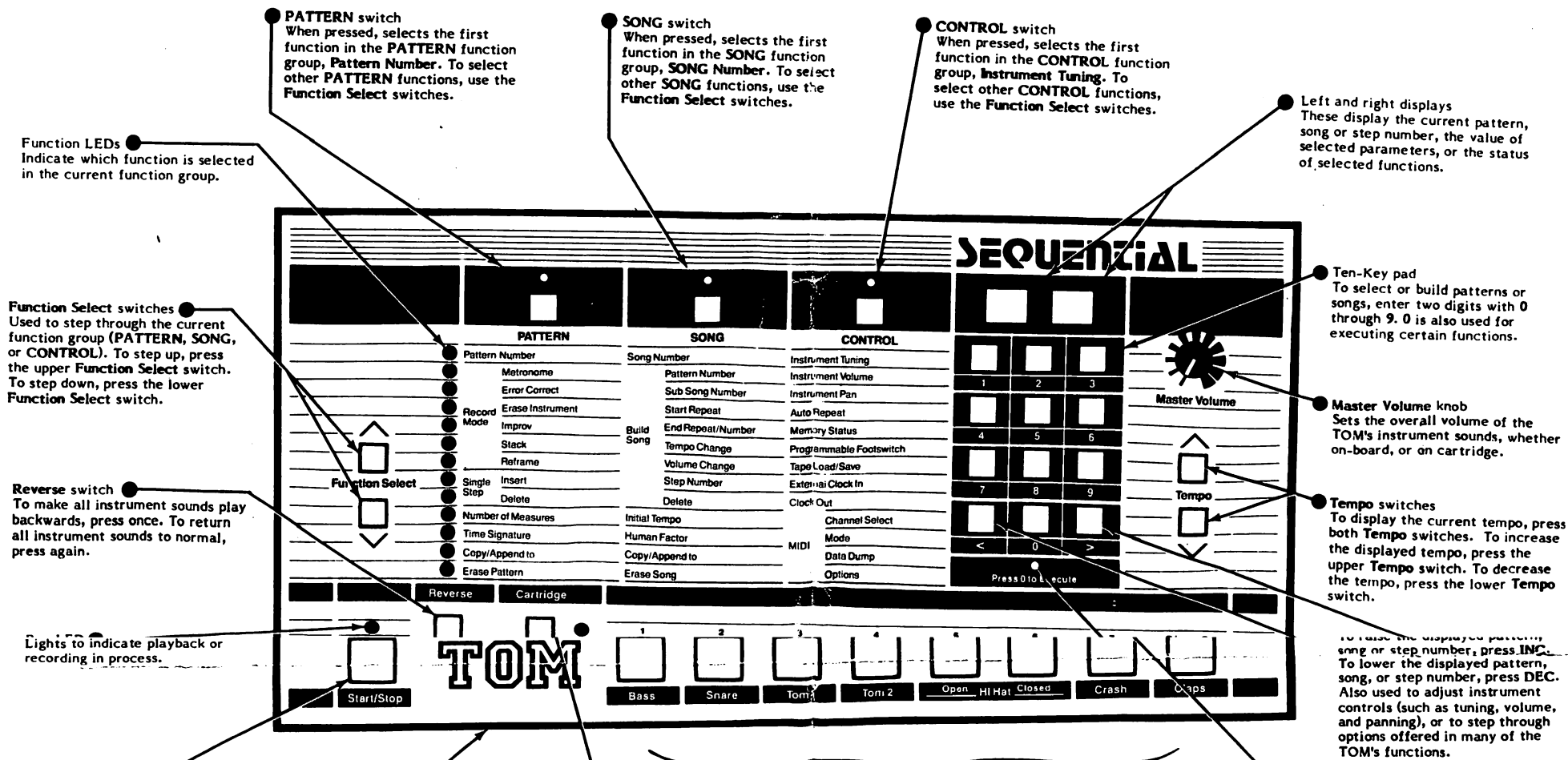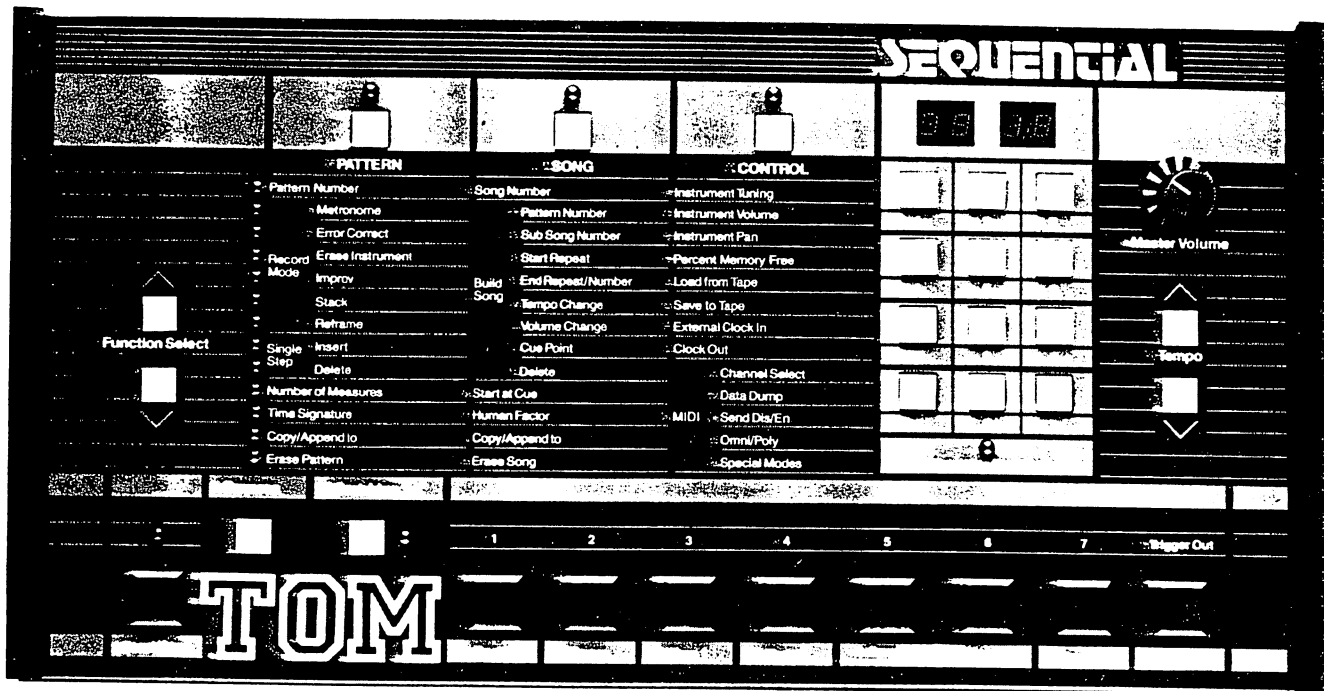
PATTERN switch
When pressed, selects the first function in the **PATTERN** function group, **Pattern Number**. To select other **PATTERN** functions, use the **Function Select** switches.

SONG switch
When pressed, selects the first function in the **SONG** function group, **SONG Number**. To select other **SONG** functions, use the **Function Select** switches.

CONTROL switch
When pressed, selects the first function in the **CONTROL** function group, **Instrument Tuning**. To select other **CONTROL** functions, use the **Function Select** switches.

Left and right displays
These display the current pattern, song or step number, the value of selected parameters, or the status of selected functions.

Function LEDs
Indicate which function is selected in the current function group.

Function Select switches
Used to step through the current function group (PATTERN, SONG, or CONTROL). To step up, press the upper **Function Select** switch. To step down, press the lower **Function Select** switch.

Reverse switch
To make all instrument sounds play backwards, press once. To return all instrument sounds to normal, press again.

Ten-Key pad
To select or build patterns or songs, enter two digits with 0 through 9. 0 is also used for executing certain functions.

Master Volume knob
Sets the overall volume of the TOM's instrument sounds, whether on-board, or on cartridge.

Tempo switches
To display the current tempo, press both **Tempo** switches. To increase the displayed tempo, press the upper **Tempo** switch. To decrease the tempo, press the lower **Tempo** switch.

To lower the displayed pattern, song or step number, press **DEC**. Also used to adjust instrument controls (such as tuning, volume, and panning), or to step through options offered in many of the TOM's functions.

Lights to indicate playback or recording in process.

Start/Stop switch
To start playback or recording, press once. To stop, press again.

Cartridge switch
When lit, instrument keys 1 through 7 select sounds from a Sequential 260-series sound cartridge, and instrument key "8" triggers external devices (such as sequencers or other electronic drums) with 5-V pulses from the **Trigger Out** jack.

Cartridge slot
Accepts Sequential 260 series sound cartridges.

Instrument switches
When pressed, cause the selected instrument sound to be played.

Execute LED
Flashes to indicate 0 must be pressed to execute the selected function.

Panel tables

PATTERN	SONG	CONTROL
Pattern Number	Song Number	Instrument Tuning
Metronome	Pattern Number	Instrument Volume
Error Correct	Sub Song Number	Instrument Pan
Record Mode — Erase Instrument	Start Repeat	Auto Repeat
Improv	End Repeat/Number	Memory Status
Stack	Tempo Change	Programmable Footswitch
Reframe	Volume Change	Tape Load/Save
Single Step — Insert	Step Number	External Clock In
Delete	Delete	Clock Out
Number of Measures	Initial Tempo	MIDI — Channel Select
Time Signature	Human Factor	Mode
Copy/Append to	Copy/Append to	Data Dump
Erase Pattern	Erase Song	Options

Reverse Cartridge

Function Select

Master Volume

Tempo

Press 0 to execute

TOM Start/Stop

Bass Snare Tom1 Tom 2 Open HI Hat Closed Crash Claps

SEQUENTIAL

Audio Output jacks
For a mono mix of both outputs, plug into **Right/Mono** only. For discrete left and right signals, plug ¼-inch phone jacks into both outputs. To drive stereo headphones, plug the stereo ¼" jack into **Left/Phones** only.

MIDI
Connect MIDI equipment to the TOM's MIDI for a variety of functions. For details, see the TOM MIDIGUIDE, MG420.

Clock/Tape In jack
Allows the TOM to be synchronized to external clocks, or previously-recorded sync pulses on tape. Connect to clock output of other drum machine (or similar clocking device), or to tape recorder output. (ac-coupled)

Footswitch jack
To start and stop patterns or songs, connect a momentary, "normally off" footswitch (Sequential Model 839). Or, program the footswitch to duplicate the function of any front panel switch. (For further information, see the TOM OPERATION MANUAL.)

Left/Phones Right/Mono Out In Clock Out Tape Out Clock/Tape In Trigger Out Footswitch On Off 15 VAC 1 25A

Audio Outputs MIDI SEQUENTIAL Manufactured in San Jose, CA U S A Power

Clock Out jack
Connect to sequencers or other drum machines to synchronize with a 24 pulse per quarter-note clock rate. (dc-coupled)

Tape Out jack
Connect to input of tape recorder for storing pattern and song data for later recall, or for sync-to-tape. (ac-coupled)

Trigger Out jack
Puts out a 5-V pulse to drive external sequencers, or other electronic drums. When the Cartridge LED is lit, you can record triggers using the **Trigger Out** switch.

Power switch and 15 VAC jack
Before turning power on, first connect the TOM's transformer to the TOM's 15 VAC input, then plug the transformer into a power outlet. To avoid needless power consumption, unplug the power transformer from the outlet when not in use.

SEQUENTIAL

PATTERN | SONG | CONTROL

Pattern Number
Metronome
Error Correct
Record Mode — Erase Instrument
Improv
Stack
Reframe
Single Step — Insert
Delete
Number of Measures
Time Signature
Copy/Append to
Erase Pattern

Song Number
Pattern Number
Sub Song Number
Start Repeat
End Repeat/Number
Build Song — Tempo Change
Volume Change
Cue Point
Delete
Start at Cue
Human Factor
Copy/Append to
Erase Song

Instrument Tuning
Instrument Volume
Instrument Pan
Percent Memory Free
Load from Tape
Save to Tape
External Clock In
Clock Out
Channel Select
Data Dump
MIDI — Send Dis/En
Omni/Poly
Special Modes

Function Select

Master Volume

Tempo

1   2   3   4   5   6   7   Trigger Out

TOM

TOM

MIDIGUIDE

SEQUENTIAL

MODEL 420
TOM
DIGITAL DRUM MACHINE

MIDIGUIDE

MODEL 420
TOM
DIGITAL DRUM MACHINE

MIDIGUIDE

Manual No. MG420A
Issued: March, 1985
Software Release: TOM_1_1

Table of Contents

This MIDIGUIDE provides more detailed information than is contained in the TOM Operation Manual (CM420).

The two most important applications for the TOM's MIDI are 1) for synchronizing external sequencers, and 2) for creating patterns using MIDI-equipped keyboards, eliminating the need to "overdub" different volumes and tunings.

The TOM's instrument volumes and tunings may be programmed from MIDI-equipped keyboards using the PITCH and MOD wheels, or with a new "pitch key" system.

MIDI Basics

MIDI is a flexible system which allows several pieces of equipment to communicate with very simple connections. The sort of things the equipment talk about? When to start playing a song or pattern, how fast to play it, which one, and so on. To coordinate operations between equipment, MIDI messages are sent. There are many common messages which are understood by most MIDI equipment, such as note events (allowing synthesizers to simultaneously play the same notes), or start and stop messages which control the playback of sequences or drum patterns.

For special applications, "system exclusive" messages may be sent which only are accepted by equpment of a specified manufacturer. (For example, compacted pattern data from a Model 420 can be sent to another manufacturer's instrument, but is not accepted because the message carries the Sequential ID code.)

MIDI Channels

If several pieces of equipment are connected, you have to be careful how you say things, or some equipment may interpret it incorrectly. For example, a drum machine and a synthesizer may both receive the same patttern (or program) select message, if you want only the drum machine to respond, you must "address" that drum machine only. In order to accomplish this, some MIDI messages are labeled with a

number indicating a MIDI Channel. If an instrument's channel matches the message label, the instrument knows the message should be accepted.

<u>To adjust the TOM's basic channel:</u>

Press **CONTROL.**

Select **Channel Number.**
The right display shows the current Basic Channel number.

Enter the desired channel two-digit number (01-16) on the ten-key pad, or adjust the displayed channel number with INC and DEC.

MIDI Modes

In some cases, you may not want the instrument to be so selective about which messages it accepts, so most instruments have MIDI "modes" which determine how it responds to MIDI messages. These modes are numbered 1, 3, and 4. (In fact there is a Mode 2 but it is rarely used, and on most Sequential instruments, this is a disallowed state.)

All four MIDI modes are the result of combining two of three other MIDI options; Omni, Poly, and Mono. Omni mode is either on or off, and either Mono or Poly mode may be selected. Descriptions of these modes are provided in the COMPLETE SCI MIDI (MIDI-3).

<u>To adjust the TOM's MIDI Mode:</u>

Press **CONTROL.**

Select **Mode.**
The right display shows the current MIDI Mode.

Adjust the displayed Mode number with **INC** and **DEC.**

Mode 1

When the Model 420 is in Mode 1 (Omni on/Poly on), it accepts MIDI commands transmitted on any of the sixteen channels. The Model 420 transmits messages on the basic channel.

Mode 3

When the Model 420 is in Mode 3 (Omni off/Poly on), it does not accept MIDI commands carrying any channel number other than the basic channel. The Model 420 transmits messages on the basic channel.

Mode 4

When the Model 420 is in Mode 4 (Omni off/Mono on), it accepts and transmits MIDI messages on all sixteen channels. Each of the 420's instrument sounds are assigned a MIDI channel, so the channel on which a message is received determines which instrument sound will be played.

When the Model 420 is connected with other MIDI equipment, the two main types of data which it sends are 1) event messages indicating which instrument sound is played, and 2) timing messages which tell other instruments when to start and stop playback, and provide timing clocks to ensure synchronized playback between instruments. The following examples show the differences between several common operations.

CAUTION: For all connections, use MIDI-specification cables (such as the Sequential Model 838). Five-pin DIN connectors used for audio applications may ¬not be reliable when handling MIDI data (which consists of pulses well outside the audio frequency range).

Synchronizing MIDI Sequencers and Drum Machines

Before MIDI, drum machines normally provided 5-V clock outputs which could control the playback of sequencers or other drum machines. Although this system was, and still is, very simple, there were often problems with differences in clock rates, and voltages, and output conditions. MIDI clarifies many of these problems by providing specific messages which are always interpreted in the same manner by all MIDI equipment.

When patterns are played or recorded on the TOM, a series of messages are sent out over MIDI.

1. Pattern or Song number.
   When a pattern or song is selected on the TOM, the numbers are sent out. It is possible to disable these messages (see Option 6) but for the time being, assume that they are enabled.

2. Start.
   When you start a pattern or song, a message is sent over MIDI, telling the other equipment to begin playback at the same time.

3. MIDI Clocks.
   As the Model 420 plays patterns or songs, MIDI Timing Clock messages are transmitted at a rate of 24 ppq (pulses per quarter-note). If receiving equipment recognizes MIDI Timing Clocks, they can be used to control playback speed following the MIDI Start message.

4. Stop.
   When the TOM's pattern or song is stopped, this message tells other equipment to stop at the same time.

5. Continue.
>If the TOM's pattern or song continues, rather than starts playback, this message is sent to all connected equipment so that playback resumes from where it was stopped, rather than from the beginning of the pattern (or sequence).

Using these specific messages improves the communication between the TOM and whatever equipment it clocks, and reduces the number of control operations required to make them work together.

OPERATION OF TWO MODEL 420s

CAUTION: Before connecting any equipment, make sure power is switched off.

Clocking Another TOM

Connect the master's MIDI OUT to the slave's MIDI IN.

Enable the slave's MIDI clock input:

>Press **CONTROL** on the slave.

>Select **External Clock In** with the **Function Select** switches.
>>The left display reads "Ci" (for Clock In). The right display shows the current status of the slave's external clock input ("OF," "nn," "24," "48," or "96").

>Adjust the displayed status with **INC** and **DEC** until "nn" (MIDI) is displayed.

The "master" 420 controls both itself and the slave. When the Model 420 is shipped from the factory, all MIDI messages are enabled to be transmitted. The following operations assume no changes have been made to the TOM's MIDI options. The TOM's MIDI clock output, unlike other MIDI messages or the 5-V clock output (see the TOM OPERATION MANUAL), is always enabled.

Pattern Functions:

>On the master, press **PATTERN.**

>Enter the desired pattern number.
>>The slave's display shows the same pattern number is selected.

>On the master, press **Start/Stop.**
>>Pattern playback begins on both 420s.

To stop pattern playback, press **Start/Stop.**
    Playback also stops on the slave.

To continue playback on both 420s, on the master, hold **PATTERN,** then press **Start/Stop.**
    Pattern playback resumes on both 420s from the point at which they were both stopped.

To adjust playback speed of both 420s, use the master's **Tempo** switches.
    Both 420s follow the tempo changes.

To stop pattern playback, press **Start/Stop.**

Note: Although the same pattern number is selected on both instruments, the patterns themselves may be different on each 420.

Song Functions:

On the master, press **SONG.**

Enter the desired song number.
    The same song number is selected on the slave.

To start song playback, on the master, press **Start/Stop.**
    Song playback on both 420s begins simultaneously.

Note: Although the song on the slave may contain an initial tempo, the slave's internal clock is currently disabled, so playback speed is controlled by the master.

To stop song playback, press **Start/Stop.**
    Playback also stops on the slave.

To continue playback on both 420s, on the master, hold **SONG,** then press **Start/Stop.**
    Song playback resumes on both 420s from the point at which they were both stopped.

Note: Although the same song numbers are selected on both instruments, the songs themselves--as well as the patterns they select--may be different on each 420. To load songs and patterns from one 420 into another, see below.

CAUTION: The following operation erases the current memory of the slave. If necessary, before proceeding, save the slave's memory to tape, or if using the Sequential Model 64 or Model 242 (MIDI cartridges for the Commodore 64 computer) with the Model 900A Dumptraks, save the slave's memory to diskette.

On the master, press **CONTROL.**

On the master, select **Data Dump.**
 The **Execute** LED flashes.

To initiate the data dump, press **0.**
 Execute remains lit while the master loads all pattern and song data to the slave. When the load is completed, the slave's memory will contain all the pattern and song data contained in the master.

Operation with the MULTI-TRAK

The Sequential Model 615 MULTI-TRAK is a new velocity-sensitive six-voice synthesizer which features a built-in sequencer. The following operations with the MULTI-TRAK demonstrate how to clock MIDI sequencers and how to control the TOM from MIDI keyboards.

CAUTION: Before connecting any equipment, make sure power is switched off.

Clocking the MULTI-TRAK

The Sequential Model 615 MULTI-TRAK's built-in sequencer can be clocked either from the Model 420's **Clock Out** (see the TOM OPERATION MANUAL, CM420), or with MIDI clocks.

Connect the 420's MIDI OUT to the MULTI-TRAK's MIDI IN.
 To enable the MULTI-TRAK's MIDI clock input, turn Speed all the way down.

The 420 controls the operation of both the MULTI-TRAK and itself. When the Model 420 is shipped from the factory, all MIDI messages are enabled to be transmitted. The following operations assume no changes have been made to the TOM's MIDI options. The TOM's MIDI clock output, unlike other MIDI messages or the 5-V clock output (see the TOM OPERATION MANUAL), is always enabled.

Pattern Functions:

On the 420, press **PATTERN**.

Enter the desired pattern number.
> The MULTI-TRAK's display shows the same <u>program</u> number is selected.

On the 420, press **Start/Stop**.
> Pattern playback on the 420, and sequence playback on the MULTI-TRAK begin simultaneously.

To stop playback, press **Start/Stop**.
> Playback stops on both instruments.

To continue playback on both instruments, on the 420, hold **PATTERN**, then press **Start/Stop**.
> Pattern playback resumes on both instruments from the point at which they were both stopped.

To adjust playback speed of both instruments, use the 420's **Tempo** switches.
> Both instruments follow the tempo changes.

To stop pattern playback, press **Start/Stop**.

Song Functions:

On the master, press **SONG**.

Enter the desired song number.
> If the song number is between 00 and 03, the same sequence number is selected on the MULTI-TRAK.

To start song playback, on the master, press **Start/Stop**.
> Song playback on the 420, and sequence playback on the MULTI-TRAK begin simultaneously.

Note: Although the song on the MULTI-TRAK may contain an initial tempo the slave's internal clock is currently disabled, so playback speed is controlled by the master.

To stop song playback, press **Start/Stop**.
> Playback also stops on the MULTI-TRAK.

To continue playback on both instruments, on the 420, hold **SONG**, then press **Start/Stop**.
> Song and sequence playback resume on both instruments from the point at which they were both stopped.

Playing the TOM with MIDI Keyboards

The TOM can select from eight or fifteen instrument sounds to play at any time, but as there are only eight instrument switches on the TOM's front panel, and as each instrument event can contain one of thirty-two tunings, eight volumes, three pan "positions," and be played forwards or reversed, recording patterns which take full advantage of these features may require many operations for each event. As a convenient alternative, a MIDI keyboard may be used as an extension to the TOM's front panel controls, to increase the number of instrument controls which can be adjusted spontaneously while recording.

The following basic operations may be used for playing the TOM live, or for recording patterns. The Sequential MULTI-TRAK is used in these examples, although other velocity-sensitive keyboards could also be used. For instructions on how to control the TOM's instrument tunings and other controls, see ADVANCED APPLICATIONS.

Playing the Instrument Keys

Connect the keyboard's MIDI OUT to the TOM's MIDI IN.

When the Model 420 is shipped from the factory, it is set up for operation with five-octave MIDI keyboards. The following operations assume the 420's MIDI options have not been altered.

The 420's instruments are assigned to the lower octaves of the MIDI keyboard as follows:
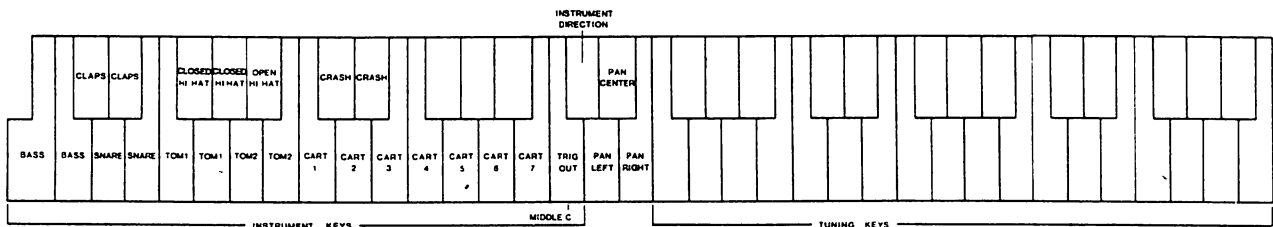
Instrument, Tuning, and "Special" Key Assignment

Play the instrument keys on the keyboard.
The instruments are played with the current instrument control (tuning, pan, etc.).

If the 420 does not respond, see Option 3, and Option 5.

If the MIDI keyboard is velocity-sensitive, the instrument volumes are controlled by the key velocity.

Tuning Keys

The TOM recognizes thiry-two "tuning keys" which, in conjunction with the instrument keys, control the tunings of each of the TOM's instruments.

To control instrument tunings with the instrument keys:

Hold down one instrument key.

Play the tuning keys.
The instrument plays at the tuning corresponding to the tuning key played.

If the keyboard is velocity-sensitive, the dynamics of the TOM's instruments are controlled by the touch of each tuning key.

The TOM's thirty-two instrument tunings can be distributed over the top octaves of MIDI keyboards in several configurations with the TOM's MIDI "options." (For details on the MIDI options, see ADVANCED APPLICATIONS.)

You can also hold any combination of four instrument keys (maximum) while playing the tuning keys. Or, if the TOM is in "stack mode" (see the TOM Operation Manual, CM420), then it is possible to hold down one instrument key, then play four tuning keys simultaneously.

Note: When the TOM is in MIDI Modes 1 or 3, the instrument and tuning keys are distributed as shown in the figure on the previous page. When in Mode 4, the tuning keys are distributed over the lower octaves of the keyboard, and instruments are instead selected by the keyboard's MIDI channel.

Special Keys

The TOM's instrument direction and panning can be controlled with four "special" keys. In Modes 1 and 3, the special keys are located as shown in the figure on the previous page.

Pressing the "instrument direction" key ($C\#_2$) has the same effect as pressing the **Reverse** switch on the TOM's front panel.

To control instrument panning with the special keys:

Hold down the desired instrument key.

To pan the selected instrument, play the desired "special" key (D_2, $D\#_2$, or E_2).

Note: When the TOM is in Mode 4, the special keys are located one octave higher than in Modes 1 and 3 ($C\#_3$-E_3).

Controlling Instrument Tunings with the PITCH Wheel

A method for adjusting instrument tunings in real-time, is to move your keyboard's PITCH wheel (if equipped with one) while holding one of the instrument keys in the keyboard's lower octaves (see above).

If necessary, enable your keyboard's wheels over MIDI (see your Sequential instrument's MIDIGUIDE or operation manual).

Play the instrument keys on your keyboard.

Move the PITCH Wheel.
A tuning value of 0-31 appears in the 420's left display, corresponding to the PITCH wheel position.

Play and hold some instrument keys.
The tunings of all instrument keys played and held are now set to the value which appears in the 420's left display.

Release all held instrument keys.
The display no longer shows the tuning. Any instruments played (other than those played in the previous step) still play at their original tuning.

After the PITCH wheel is moved, the 420 assigns the new tuning to all instrument keys played so long as they are all held.

ADVANCED APPLICATIONS

To make the Model 420 suitable for operation in as many situations as possible, many of its MIDI functions are adjustable. Rather than have these MIDI "options" default to a specific state on power-up, they are remembered when power is switched off. This way, if your applications differ from the initial settings, you need not adjust the MIDI options each time power is switched on.

When the Model 420 is shipped from the factory, its MIDI options are adjusted as follows:

Function	Setting
MIDI Mode	1
Basic Channel	1
Tuning Keys	Five-octave keyboard
MOD Wheel	Instrument Pan
Velocity	Enabled
Instrument Key Mute	Off
Pattern/Song # Receive	Enabled
Event Receive	Enabled
Event Transmit	Enabled
Special Keys	Enabled

Many of the operations on the following pages require the factory option settings to be altered.

<u>To adjust the MIDI options:</u>

To select MIDI Options:

Press **CONTROL.**

Select **Options** with **Function Select** switches.
The left display reads "1." This indicates Option #1 is selected. The right display shows the current option status.

Adjust selected MIDI option setting as necessary.
Each option is described on the following pages.

To select other MIDI options, use **INC** and **DEC.**
The left display shows the selected MIDI option number.

OPTION 1: TUNING KEY ASSIGNMENT

The TOM's thirty-two tuning keys can be distributed over MIDI keyboards in several configurations. Option 1 has three possible settings, each corresponding to a different tuning key assignment. These tuning key assignments are only effective when the TOM is in MIDI Modes 1 or 3.

Select Option 1.
The right display shows the current status of Option 1 (1-3).

Control from Five-Octave Keyboard

With Option 1 selected, press 0 until the right display reads "1."

The 420's 32 instrument tunings are distributed over the top octaves of the MIDI keyboard.

Tunings are controlled in the same way as described in Section 2.

Control from Four-Octave Keyboards

With Option 1 selected, press 0 until the right displays "1."

The 420's twenty lowest tunings are distributed over the top octaves of the MIDI keyboard (F_2 to C_4).

Tunings are controlled in the same way as described in Section 2.

<u>or</u>

With Option 1 selected, press 0 until the right displays "2."

The 420's twenty highest tunings are distributed over the top octaves of the MIDI keyboard (F_2 to C_4).

Tunings are controlled in the same way as described in Section 2.

<u>or</u>

With Option 1 selected, press 0 until the right displays "3."

The 420's even-numbered tunings (00, 02, 04....30) are distributed over the top octaves of the MIDI keyboard (F_2 to C_4).
This way the user can play the entire range of tunings, but only every other tuning.

Tunings are controlled in the same way as described in Section 2.

OPTION 2: MIDI VELOCITY DISABLE/ENABLE

When Option 2 is on, MIDI keyboards control instrument volumes with key velocity. When Option 2 is off, the TOM ignores MIDI velocity. Instead, instrument volumes may be controlled by the MOD wheel (depending on the status of Option 7). This is useful when playing the TOM from non-velocity-sensitive MIDI keyboards.

>   Select Option 2.
>   The right display shows the current status ("on" or "OF").

>   To switch Option 2 on/off, press **0**.

OPTION 3: INSTRUMENT KEY MUTE

When Option 3 is on, MIDI keyboards can play the TOM's instruments with the assigned instrument keys. When Option 3 is off, instruments can only be played by using the instrument keys in conjunction with the tuning keys (see Option 1, on previous page).

>   Select Option 3.
>   The right display shows the current status ("on" or "OF").

>   To switch Option 3 on/off, press **0**.

OPTION 4: PATTERN AND SONG SELECTION RECEIVE

When Option 4 is on, the TOM recognizes program and song selections as pattern and song selection (respectively). When Option 4 is off, these selections are disabled.

>   Select Option 4.
>   The right display shows the current status ("on" or "OF").

>   To switch Option 4 on/off, press **0**.

OPTION 5: EVENT RECEIVE

When Option 5 is on, all enabled MIDI messages are accepted (unless not recognized). When Option 5 is off, all received MIDI messages are disabled.

>   Select Option 5.
>   The right display shows the current status ("on" or "OF").

>   To switch Option 5 on/off, press **0**.

OPTION 6: EVENT TRANSMIT

When Option 6 is on, all enabled MIDI messages are transmitted. When Option 6 is off, all MIDI messages are disabled, <u>except</u> MIDI timing clocks.

Select Option 6.
The right display shows the current status ("on" or "OF").

To switch Option 6 on/off, press **0.**

OPTION 7: MOD WHEEL ASSIGNMENT

When Option 7 is on, MOD wheel changes received over MIDI control the TOM's instrument panning. Whe Option 7 is off, MOD wheel changes affect instrument volumes (unless velocity is enabled over MIDI, see Option 2).

Select Option 7.
The right display shows the current status ("on" or "OF").

To switch Option 7 on/off, press **0.**

OPTION 8: SPECIAL KEYS INPUT

When Option 8 is on, all "special" keys (instrument direction, pan left, pan center, pan right, and the four "flange" keys) are enabled over MIDI. When Option 8 is off, the special keys are disabled.

Select Option 8.
The right display shows the current status ("on" or "OF").

To switch Option 8 on/off, press **0.**

MODE 4 OPERATION

To put the TOM into Mode 4:

Press **CONTROL**.

Select **MIDI Mode** with the **Function Select** switches.
The current MIDI mode is shown in the right display.

Adjust the displayed mode to 4 with **INC** and **DEC**.

Tuning Keys

When the TOM is in Mode 4, each instrument sound is assigned to one MIDI channel. Instrument tunings are then distributed over the lower octaves of the MIDI keyboard (C_0-$F\#_2$).

To select the desired instrument:

Press **CONTROL**.

Select **MIDI Channel** with the **Function Select** switches.
The right display shows the current channel number.

Adjust the displayed channel number with **INC** and **DEC**.
For instrument MIDI channel assignment, see Table 3-1.

This configuration is particluarly useful when the TOM is used for playing MIDI synthesizers. The synthesizer's notes can be programmed as instrument tunings (limited to a thirty-two note range), then on playback, up to sixteen synthesizers can play independent lines by setting them to different MIDI channels.

Note: The TOM transmits a "Note Off" immediately following each "Note On," so the duration of all notes is the same, and depends entirely on the synthesizer's release.

Special and "Flange" Keys

The instrument direction key is located at $C\#_3$, and the "panning" keys are D_3-E_3. Operation of the "special keys" is the same as in Modes 1 and 3.

Four "flange" keys are located at F_3, G_3, A_3, and B_3 in Mode 4. These determine how many times instruments are "stacked" when played.

To use the "flange" keys:

Select **Stack**, then switch it on.

Play F_3 on the MIDI keyboard.

Play the tuning keys (C_0-$F\#_2$).
    The instrument plays as usual.

Play G_3 on the MIDI keyboard.

Play the tuning keys.
    The instrument is stacked on itself, causing a flanging effect.

For heavier flanging, stack instruments twice, or three times, by playing A_3 or B_3 (respectively), then playing the tuning keys.

MIDI IMPLEMENTATION
March, 1985

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

TRANSMITTED DATA

Status	Second	Third	Fourth	Fifth

Note On (only sent when "Event Transmit" is on.)

9NH	P	40H	K	V
1001 nnnn	0ppp pppp	0100 0000	0kkk kkkk	0vvv vvvv
	Pitch Key On			
		"Dummy" velocity byte.		
			Drum Key On	

Drum key velocity. V=01H-7FH, depending on programmed volume only (accent and song volume changes are ignored).

Sixth	Seventh	Eighth	Ninth
K	0H	P	0H
0kkk kkkk	0000 0000	0ppp pppp	0000 0000
Drum key Off (key On with velocity=0)			
	Zero velocity		

Pitch Key Off (Key On with velocity=0)

Zero velocity.

All Note Ons are followed immediately with a Note Off (V=0), with no new status byte, i.e., nine bytes sent for each note played.

Program (Pattern) Change

CNH	P
1100 nnnn	0ppp pppp
	P=00-99

Song Select

F3H	S
1111 0011	0sss ssss

When song is selected, that song number is sent.
S=00H-63H (0-99 decimal)

TRANSMITTED DATA

Status	Second	Third	Fourth	Fifth	Sixth

Start
FAH
1111 1010
When playback of any song or pattern starts, this is sent immediately before the first Timing Clock.

Continue
FBH
1111 1011
Sent when playback of pattern or song continues from the point at which it was stopped.

Timing Clock
F8H
1111 1000
During playback of any song or pattern, this is sent at 24 per-quarter-note rate.

Pattern Marker

F0H	01H	7FH	F7H
1111 0000	0000 0001	0111 1111	1111 0111
(SYS EX	SCI ID	PM	EOX)

Sent after the last clock of a drum pattern.

Stop
FCH
1111 1100
Sent whenever a song or pattern is stopped.

Program Dump.

F0H	01H	0EH	D	F7H
1111 0000	0000 0001	1110	Data	1111 0111
(SYS EX	SCI ID	420 ID		EOX)

Data is formatted as four-bit nibbles, right justified, LS nibble sent first.

RECOGNIZED RECEIVED DATA

Status	Second	Third	Fourth	Fifth	Sixth

Note On (no tuning information)

```
9NH        K          V
1001 nnnn  0kkk kkkk  0vvv vvvv
```
N is the channel number. This is ignored if Omni On mode, and checked for match with channel number in Omni Off mode.
        For key assignment, see Tables 1, 3, and 4.
                V (Velocity)=01H-7FH.

Note On (includes tuning information)

```
9NH        P          40H        K          V
1001 nnnn  0ppp pppp  0100 0000  0kkk kkkk  0vvv vvvv
           Pitch Key On.
           For key key assignment, see Tables 1, 3, and 4.
                      "Dummy" velocity byte.
                             Key On.
                                   Drum key velocity.
```

Sixth	Seventh	Eighth	Ninth

```
K          0          P          0
0kkk kkkk  0000 0000  0ppp pppp  0000 0000
Key Off (key On with velocity=0)
           Zero velocity
                      Key Off (Key On with velocity=0)
                             Zero velocity.
```


Note Off

```
9NH        K          00H
1001 nnnn  0kkk kkkk  0000 0000
                      Zero velocity.
```


Note Off

```
8NH        K          V
1000 nnnn  0kkk kkkk  0vvv vvvv
```

RECOGNIZED RECEIVED DATA

Status	Second	Third	Fourth	Fifth

Omni Mode On
FNH   7DH   00H
1111 nnnn   0111 1101   0000 0000
When received, Mode 1 (Omni On/Mono Off) is selected.

Omni Mode Off
FNH   7CH   00H
1111 nnnn   0111 1100   0000 0000
When received, Mode 3 (Omni Off/Mono Off) is selected.

Mono Mode On (Poly Mode Off - All Notes Off)
BNH   7EH   M
1011 nnnn   0111 1110   0vvv vvvv
                         M is ignored

Poly Mode On (Mono Mode Off - All Notes Off)
BNH   7FH   00H
1011 nnnn   0111 1111   0000 0000

Song Select
F3H   S
1111 0011   0sss ssss
             S=00H-62H.
Switches to song mode and selects song # (must be 00H-62H). Also must already be in either song stop or pattern stop modes.

Program Select
CNH   P
1100 nnnn   0ppp pppp
             P=Program Number (00-99)
Ignored while the 420 is in Record Mode.

Start
FAH
1111 1010
Only if in song mode, starts playback from start of current song. Selects MIDI playback clock.

Timing Clock
F8H
1111 1000
Recognized whenever in playback of a song or pattern, and MIDI clock is selected (either by front panel or by Start status.)

RECOGNIZED RECEIVED DATA

Status   **Second**   **Third**   **Fourth**   **Fifth**

Continue
FBH
1111 1011
Resumes playback from the point where playback was stopped with a MIDI "Stop." If playback was stopped from the TOM' RUN/STOP switch (or footswitch), Continue causes playback to start from the beginning.

Stop
FCH   -   -
1111 1100
Stops song playback. MIDI clock inputs are ignored.

Program Dump Request
F0H   01H   00H   F7H
1111 0000 0000 0001 0000 0000   1111 0111
(SYS EX   SCI ID   REQUEST ID   EOX)
This initiates a complete program dump of song and pattern data.

Program Dump Receive
F0H   01H   0EH   D   F7H
1111 0000 0000 0001 0000 1110 data   1111 0111
(SYS EX   SCI ID   420 ID   EOX)

Data is formatted as four-bit nibbles, right justified, LS nibble sent first.

MOD Wheel Change

BNH   01H   ·M
1011 nnnn 0000 0001 000m mmmm
Successive MOD wheel changes can be received without repeating the status byte.

PITCH Wheel Change

ENH   Vls   Vms
1110 nnnn 0vvv vvvv 0vvv vvvv
          LS byte
                    MS byte
Successive PITCH wheel changes can be received without repeating the status byte.

TABLE 1
MIDI Instrument Key Assignment (Modes 1 and 3)

Key	Key Number	Instrument
B, C_0	23H, 24H	Bass Drum
$C\#_0, D\#_0$	25H, 27H	Claps
D_0, E_0	26H, 28H	Snare
F_0, G_0	29H, 2BH	Tom 1
$F\#_0, G\#_0$	2AH, 2CH	Closed Hi-Hat
A_0, B_0	2DH, 2FH	Tom 2
$A\#_0$	2EH	Open Hi-Hat
C_1	30H	Cartridge 1
$C\#_1, D\#_1$	31H, 33H	Crash Cymbal
D_1	32H	Cartridge 2
E_1	34H	Cartridge 3
F_1	35H	Cartridge 4
G_1	37H	Cartridge 5
A_1	39H	Cartridge 6
B_1	3AH	Cartridge 7
C_2	3CH	Trigger Out

TABLE 2
Mode 4 MIDI Channel Assignment

MIDI Channel	Instrument
1	Bass
2	Snare
3	Tom 1
4	Tom 2
5	Open Hi-Hat
6	Closed Hi-Hat
7	Crash Cymbal
8	Claps
9	Cartridge 1
10	Cartridge 2
11	Cartridge 3
12	Cartridge 4
13	Cartridge 5
14	Cartridge 6
15	Cartridge 7
16	Trigger Out

TABLE 3
Tuning Key Assignment

Tuning Value	Option 1 Value (Modes 1 and 3)			Mode 4
	1	2	3	
00	F_2	$C\#_4$	F_2	C_0
01	$F\#_2$	D_4	N/A	$C\#_0$
02	G_2	$D\#_4$	$F\#_2$	D_0
03	$G\#_2$	E_4	N/A	$D\#_0$
04	A_2	F_4	G_2	E_0
05	$A\#_2$	$F\#_4$	N/A	F_0
06	B_2	G_4	$G\#_2$	$F\#_0$
07	C_3	$G\#_4$	N/A	G_0
08	$C\#_3$	A_4	A_2	$G\#_0$
09	D_3	$A\#_4$	N/A	A_0
10	$D\#_3$	B_4	$A\#_2$	$A\#_0$
11	E_3	C_5	N/A	B_0
12	F_3	F_2	B_2	C_1
13	$F\#_3$	$F\#_2$	N/A	$C\#_1$
14	G_3	G_2	C_3	D_1
15	$G\#_3$	$G\#_2$	N/A	$D\#_1$
16	A_3	A_2	$C\#_3$	E_1
17	$A\#_3$	$A\#_2$	N/A	F_1
18	B_3	B_2	D_3	$F\#_1$
19	C_4	C_3	N/A	G_1
20	$C\#_4$	$C\#_3$	$D\#_3$	$G\#_1$
21	D_4	D_3	N/A	A_1
22	$D\#_4$	$D\#_3$	E_3	$A\#_1$
23	E_4	E_3	N/A	B_1
24	F_4	F_3	F_3	C_2
25	$F\#_4$	$F\#_3$	N/A	$C\#_2$
26	G_4	G_3	$F\#_3$	D_2
27	$G\#_4$	$G\#_3$	N/A	$D\#_2$
28	A_4	A_3	G_3	E_2
29	$A\#_4$	$A\#_3$	N/A	F_2
30	B_4	B_3	$G\#_3$	$F\#_2$
31	C_5	C_4	A_3-C_5	G_2

TABLE 4
Special Key Assignment

Special Key	Key	
	Modes 1 and 3	Mode 4
Direction	$C\#_2$	$C\#_3$
Pan Left	D_2	D_3
Pan Center	$D\#_2$	$D\#_3$
Pan Right	E_2	E_3
Flange 1	N/A	F_3
Flange 2	N/A	G_3
Flange 3	N/A	A_3
Flange 4	N/A	B_3