



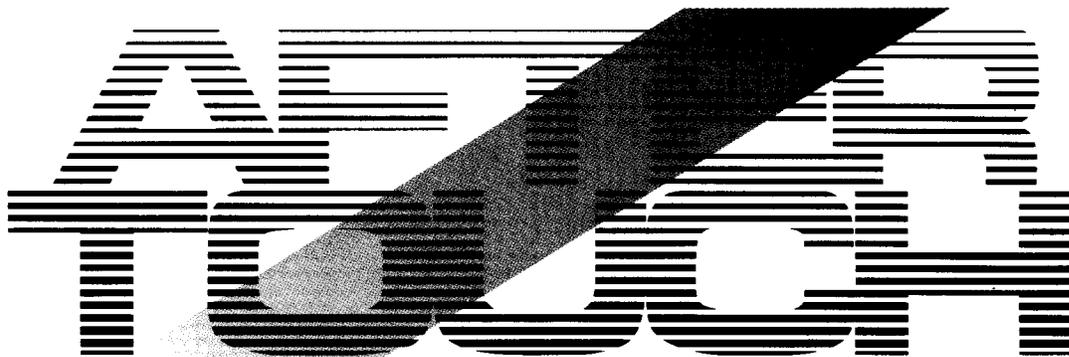
THE OFFICIAL PUBLICATION OF THE YAMAHA USERS GROUP

MCS2



APRIL 1986





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From The Editor

THERE ARE LOTS OF NEW THINGS coming in the near future for AFTERTOUCH. The next issue will contain a first: an Evatone Data Disk!

What is an Evatone Data Disk? Well, it is one of those floppy squares of black plastic-like substance. Usually, these items contain recorded material, which can be played on your turntable simply by placing them on top of a record and dropping the needle. The Data Disk, however, is a different matter: It contains Yamaha music *data*—the kind that is usually stored on a cassette (after being loaded there from a DX100, QX21, or the like).

In order to use the Evatone Data Disk, you simply play it on your turntable *and record the data onto a cassette*. From there, it can be loaded directly into your Yamaha instrument.

Next month's Evatone Data Disk will contain new voices for the DX100 (or DX27) and new voices for the TX7. In addition, there will be two sequences for the QX21 (or QX7) that make use of these two sets of voices. Look for it in issue #8 of AFTERTOUCH.

This will only be the first of a series of Evatone Disks: Later in the year, we will be presenting at least two more highlighting the CX5M music computer. These disks will contain both musical performances and data.

Also, by mid-year, we will start presenting new voices for 4-operator FM digital instruments in the pages of AFTERTOUCH. There have been a lot of requests for patches for instruments like the DX100, so we're working on it!

Finally, we plan a series of articles on choosing the right algorithm for programming the sounds you want—for both 6-operator and 4-operator instruments. These articles will be combined with other programming tips to help you get the most out of your instruments.

Many of these articles and new features have been created as a result of feedback from readers: We do pay attention to your questions, and make every effort to give you the kind of information you ask for.

So, keep those questions and requests coming. Specific questions will be dealt with (if possible) in the Questions column; more general requests for information can help us decide what to put in upcoming issues. Your input is very important!

Also, if you want to belong to or start a Users Group in your area, please send us a letter: Include your address and (if you wish) your telephone number. We'll print it (in our "Touch Response" column), and others in your area will be able to contact you to set up meetings, informational swap meets, or other gatherings.

Remember too that AFTERTOUCH is intended as a vehicle for the exchange of information. If you have a new DX7 or DX100 patch, send it to us and we'll share it with the rest of our readers. How about a new CX5M program or a hot tip on the use of the QX1? Send it along. (For details on how to send material to AFTERTOUCH, please see page 19). Let's keep the flow of information going!

—TD

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(By the way, if you received *this* issue in the mail, you are already on our permanent mailing list, so you don't need to send in another card.)

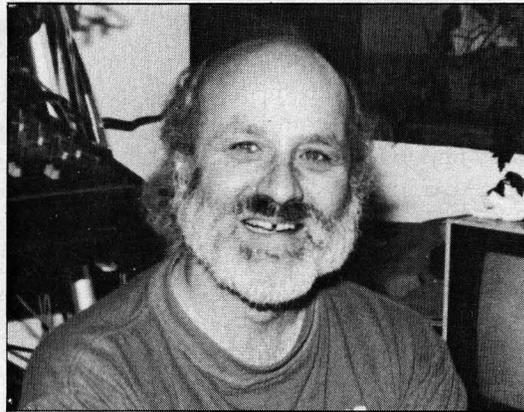
Also, don't limit yourself to just sending in your address. Let us know what kind of articles you want to read. The more input we receive, the more we will be able to tailor the information in AFTERTOUCH to suit your musical needs.

For more detailed product information, write to Yamaha International Corp., P.O. Box 6600, Buena Park, CA 90622.

Morton Subotnick &

Part 2 Of An Exclusive Interview. By Tom Darter.

FOR MORE THAN twenty years, Morton Subotnick has been a leading composer of music produced by electronic means, as well as a restless experimenter in a variety of musical contexts, including multimedia presentations and compositions for acoustic instruments plus electronic sounds. His famous electronic composition *Silver Apples Of The Moon*, released by Nonesuch in 1966, was the first piece of electronic music to be commissioned by a record company.



Subotnick has used a variety of electronic musical instruments to produce his compositions. Most recently, he has turned his attention to the Yamaha Computer-Assisted Music System (YCAMS). His 1986 piece *Return*, composed for TX816 and QX1, is available on New Albion records.

Although Subotnick has only worked with Yamaha instruments for a short time, his deep understanding of the electronic medium has led him to a number of innovative uses of YCAMS. In part 1 of this exclusive interview [published in last month's issue of *AFTERTOUCHE*], he discussed his initial work with the TX816 and QX1. In this month's installment [part 2], he describes some of the techniques he used in *Return*, and outlines some of his upcoming musical projects.

* * * *

TD: *How much of The Key To Songs and Return was entered using the KX88?*

MS: Well, I didn't have the KX88 when I did *The Key To Songs*; I had a DX7. I used it just to enter notes—I didn't play anything on it directly. But I did use it to enter all the notes and chords.

TD: *Did you use the Insert portion of EDIT mode on the QX1 to enter data one step at a time?*

MS: Yes, it was one step at a time, but of course you can enter an entire chord at one time, instead of just single notes. And, instead of hitting the C# key on the QX1 and then specifying the right octave, I just entered the note and octave using the keyboard. When I got the KX88 keyboard for *Return*, I programmed in the same way, except that all the chants in *Return*—the section from Christianity through the 14th century—were played on the keyboard in real time, partly on the KX88, and partly, believe it or not, on the little Yamaha keyboard for the CX5M, the YK01.

TD: *Did you enter the Scarlatti sections one note at a time as well?*

MS: Yeah. All the material was entered one note at a time, except the chant section in *Return*. The reason I used the little CX5M keyboard is that those particular parts were in traditional two- and three-part counterpoint, and I felt that I needed to look at them. So, I input them on the CX5M, printed them out, and played with them on the page. I wish there was a better scoring system in there; but the CX5M sure is a nifty little computer.

TD: *Did you use the KX88 to enter things beside note data?*

MS: Yes, I used it to enter all of the control data: It was all entered with either sliders or with the breath controller. For instance, I would program the KX88 so that the breath controller would be control 007. This gave me a lot of options. The stereo location in *Return* is done that way. I made location tracks by using 007 for overall amplitude, and then blew the right channel and the left channel and the center channel, so that it has these almost breath-like qualities of smashing across the room.

TD: *How did you do the panning?*

MS: With the control data from the breath controller, used on a number of tracks with slight displacements. I started with a basic "whoosh" shape, and then I would displace it by an eighth-note, quarter-note, 16th-note, or 32nd-note for use on another track. Both tracks would have the same note material, but they would occupy different positions in the stereo mix, and the control data would be displaced, so that the sounds would warble back and forth, following my breath control data. It did take a little practice to get the right output. . . .

TD: *Did you enter that control code material as an overdub, after the note material had been entered in?*

"I used [the KX88] to enter all of the control data: It was all entered with either sliders or with the breath controller."

YCAMS

MS: Yes. Well, no—I did it both ways. I built up a number of control tracks with all kinds of gestures that ranged from a quarter of a second to 10 seconds long, and then I would try these on a note passage that was already entered. Sometimes it worked, but usually it would just give me an idea of what I needed to add to the part; then I would put in the correct control data after the fact.

If anyone wants to try this, here is the best approach: Take your note information, put it on a separate bank so you're not playing with the note information itself, and then add the control information in, from another bank.

For moving the sound from left to right, for instance, I put the same note information, say the C major scale, on tracks 1, 2, and 3. Then, on a separate bank, I input the control information on track 1. Next, I would transfer that control information to tracks 2 and 3, and displace it on both tracks. Finally, I would merge those onto the tracks 1, 2, and 3 that have the original note information; so you don't end up displacing the note information. And it's tedious, but it works incredibly well. I also changed the Pitch Bend between tracks 1, 2, and 3 as standard detuning. So I would take the entire phrase and detune it on track 2, and detune it again on track 3, giving it a kind of Doppler effect as it moves across space.

TD: Did you use Clock Moves on whole tracks?

MS: Yes. That's what I was saying—the displacement I was talking about was accomplished using Clock Moves on the control tracks, but *not* on the original note information. The result sounds like the notes are flying across space. If I go "whoooew" with my breath, you would hear it go crescendo/dimenuendo on track 1, but the crescendo on track 2 would begin a little bit later, and the crescendo on track 3 would begin a little later again. And then if track 1 is coming up again, it makes a circle. You can do it with pots as well, but I preferred the breath because it gives a more natural feel.

TD: So all of the panning effects in *Return* are written into the QX1?

MS: Right.

TD: And, when you recorded *Return*, you just turned the QX1 on and let the tape run?

MS: That's right. The only reason we used two QX1s and two TX816s was so I wouldn't have to edit, because there are seven disks for the piece, and they're all full. But, next time around, I'm going to use a 32-track tape

recorder and two TX816s, and we'll do it one disk at a time, and have tape sync, and lay in each successive disk so that it will overlap the previous disk. The one problem with the record as it stands now is that there are time gaps in places where they shouldn't be. I don't mind them—they're at cadence points—but it would be better if I overlap them a little bit.

TD: The intention is not to have those gaps?

MS: Right.

TD: Where did the commission for *Return* come from?

MS: That was originally a Nonesuch Records commission. But that was several years ago, and I just didn't feel I had the right equipment. I actually thought I was going to have to go to a large center like IRCAM or MIT to do the piece.

TD: Was that after you started having specific ideas for how the piece should sound?

MS: Yeah. I knew what I wanted to do, I just didn't have the . . . I didn't think I could do it without the large computers. That was three years ago, really before the TX816 and QX1.

And then, when I realized I could do it, Nonesuch had changed leaders, and the new leaders weren't interested in the piece. I still got paid, but they weren't interested in putting the piece out any more. So then I went over to New Albion, and they took the piece. In a way, it's a joint commission between the two record companies.

In the meantime, a group in Los Angeles, the Da Camera Society, wanted me to do a piece to celebrate the return of Halley's Comet, and so I combined all of the commissions into one. That's how it came about.

TD: And is *Return* usually performed live?

MS: No, it's been tape for most performances. The problem is that change in the disks. I'm going to do it live with two TX816s and two QX1s, for performances in San Luis Obispo in July and London in September. There really isn't any great advantage to doing it live, because the tape is so good, but you do get a better presence of sound, and certainly the dynamic range is greater. So I'm going to do it that way at least twice that I know of. But, for most places—I mean, it's been done in Planetariums, and we intended to do it live, but it was so much trouble that they finally ended up putting it one tape, because they had to do their own sky show at the same time.

"I built up a number of control tracks with all kinds of gestures that ranged from a quarter of a second to 10 seconds long, and then I would try these on a note passage that was already entered."

Continued on page 20



FM-T. BASS.
A New DX7
Voice By
Reggie
Turner.

TR1	35	0	0	0	ON	0
WAVE	SPEED	DELAY	PMD	AMD	SYNC	PMS

R1	R2	R3	R4
99	99	99	99
L1	L2	L3	L4
50	50	50	50

PITCH ENVELOPE

C2
KEY TRANSPOSE
ON
OSC SYNC

FUNCTIONS

POLY	0	0	NA	0	0
POLY/MONO	RANGE	STEP	MODE	GLISSANDO	TIME
	PITCH BEND		PORTAMENTO		

(CONTROLLER)	RANGE	PITCH	AMPLITUDE	EG BIAS
MOD WHEEL	NA	OFF	OFF	OFF
FOOT CONTROL	NA	OFF	OFF	OFF
BREATH CONTROL	NA	OFF	OFF	OFF
AFTERTOUCH	NA	OFF	OFF	OFF

FREQUENCY	25.00	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
99	55	95	30		0
L1	L2	L3	L4		
99	65	0	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT		DEPTH		
L	-L	G2	L	10	
R	-L		R	0	
OP#	OUTPUT LEVEL	VELOCITY			
6	99	3			

FREQUENCY	0.50	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
99	62	75	50		1
L1	L2	L3	L4		
99	50	0	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT		DEPTH		
L	-L	C1	L	0	
R	-L		R	99	
OP#	OUTPUT LEVEL	VELOCITY			
2	99	0			

FREQUENCY	1.00	DETUNE	-7	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
99	0	20	50		1
L1	L2	L3	L4		
99	75	0	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT		DEPTH		
L	-L	A-1	L	0	
R	-L		R	0	
OP#	OUTPUT LEVEL	VELOCITY			
4	85	0			

FREQUENCY	1.00	DETUNE	+5	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
99	49	70	66		1
L1	L2	L3	L4		
99	50	0	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT		DEPTH		
L	-L	G1	L	5	
R	-L		R	0	
OP#	OUTPUT LEVEL	VELOCITY			
5	70	6			

FREQUENCY	1.00	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
99	44	20	58		2
L1	L2	L3	L4		
99	65	0	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT		DEPTH		
L	-L	A-1	L	0	
R	-L		R	0	
OP#	OUTPUT LEVEL	VELOCITY			
1	99	1			

FREQUENCY	1.00	DETUNE	+1	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
99	45	35	58		2
L1	L2	L3	L4		
99	65	0	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT		DEPTH		
L	-L	A-1	L	0	
R	-L		R	0	
OP#	OUTPUT LEVEL	VELOCITY			
3	99	2			

ALGORITHM #7



DX7 TALK-Y. A New DX7 Voice By Reggie Turner.

TR1	75	0	0	0	ON	3
WAVE	SPEED	DELAY	PMD LFO	AMD	SYNC	PMS

R1	R2	R3	R4
90	78	66	99
L1	L2	L3	L4
60	50	0	50

PITCH ENVELOPE

A1
KEY TRANSPOSE

ON
OSC SYNC

FUNCTIONS					
POLY	0	0	NA	0	0
POLY/MONO	RANGE	STEP	MODE	GLISSANDO	TIME
PITCH BEND			PORTAMENTO		

(CONTROLLER)	RANGE	PITCH	AMPLITUDE	EG BIAS
MOD WHEEL	NA	OFF	OFF	OFF
FOOT CONTROL	NA	OFF	OFF	OFF
BREATH CONTROL	NA	OFF	OFF	OFF
AFTERTOUCH	NA	OFF	OFF	OFF

FREQUENCY	1.00	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
21	99	99	75	0	
L1	L2	L3	L4		
99	99	0	0		
KEYBOARD SCALING DEPTH					
CURVE	BREAKPOINT				
L	-L	A-1	L	0	
R	-L		R	0	
OP#	5	OUTPUT LEVEL	99	VELOCITY	1

FREQUENCY	1.00	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
99	99	0	60	0	
L1	L2	L3	L4		
99	99	0	0		
KEYBOARD SCALING DEPTH					
CURVE	BREAKPOINT				
L	-L	A-1	L	0	
R	-L		R	0	
OP#	6	OUTPUT LEVEL	99	VELOCITY	2

6

FREQUENCY	371.5Hz	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
39	99	99	85	0	
L1	L2	L3	L4		
99	0	0	0		
KEYBOARD SCALING DEPTH					
CURVE	BREAKPOINT				
L	-L	A-1	L	0	
R	-L		R	0	
OP#	2	OUTPUT LEVEL	99	VELOCITY	1

FREQUENCY	1.00	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
50	99	0	85	0	
L1	L2	L3	L4		
99	99	0	0		
KEYBOARD SCALING DEPTH					
CURVE	BREAKPOINT				
L	-L	A-1	L	0	
R	-L		R	0	
OP#	3	OUTPUT LEVEL	93	VELOCITY	1

FREQUENCY	371.5Hz	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
20	99	99	85	0	
L1	L2	L3	L4		
99	99	0	0		
KEYBOARD SCALING DEPTH					
CURVE	BREAKPOINT				
L	-L	A-1	L	0	
R	-L		R	0	
OP#	4	OUTPUT LEVEL	99	VELOCITY	1

FREQUENCY	1.00	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	
56	51	60	60	0	
L1	L2	L3	L4		
99	75	0	0		
KEYBOARD SCALING DEPTH					
CURVE	BREAKPOINT				
L	-L	A-1	L	0	
R	-L		R	0	
OP#	1	OUTPUT LEVEL	99	VELOCITY	0

ALGORITHM #16

These DX7 voices can also be loaded into all the other Yamaha 6-operator FM digital synthesizers and tone generators, including the DX1, DX5, TX7, TX216, TX816, and TF1.



PEDAL-STEEL. A New DX7 Voice By Joel Fairstein.

SAW UP	0	0	0	0	ON	4
WAVE	SPEED	DELAY	PMD	AMD	SYNC	PMS
LFO						
R1	R2	R3	R4	C3 KEY TRANSPOSE		
99	99	99	99			
L1	L2	L3	L4	ON OSC SYNC		
50	50	50	50			
PITCH ENVELOPE						

FUNCTIONS					
POLY	2	0	NA	OFF	0
POLY/MONO	RANGE	STEP	MODE	GLISSANDO	TIME
PITCH BEND			PORTAMENTO		
(CONTROLLER)	RANGE	PITCH	AMPLITUDE	EG BIAS	
MOD WHEEL	80	OFF	OFF	ON	
FOOT CONTROL	0	OFF	OFF	OFF	
BREATH CONTROL	0	OFF	OFF	OFF	
AFTERTOUCH	50	ON	OFF	OFF	

FREQUENCY	0.50	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	2
72	17	14	40		
L1	L2	L3	L4		
99	90	80	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT	DEPTH			
L	-L	D#3	L	0	
R	-L		R	7	
OP#	OUTPUT LEVEL	VELOCITY			
2	80	1			

FREQUENCY	0.50	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	2
72	17	14	40		
L1	L2	L3	L4		
99	90	80	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT	DEPTH			
L	-L	D#3	L	0	
R	-L		R	9	
OP#	OUTPUT LEVEL	VELOCITY			
3	81	2			

FREQUENCY	0.50	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	1
72	15	15	40		
L1	L2	L3	L4		
99	90	80	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT	DEPTH			
L	-L	C2	L	0	
R	-L		R	7	
OP#	OUTPUT LEVEL	VELOCITY			
6	47	2			

FREQUENCY	0.50	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	2
99	20	20	40		
L1	L2	L3	L4		
99	90	80	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT	DEPTH			
L	-L	D#3	L	0	
R	-L		R	7	
OP#	OUTPUT LEVEL	VELOCITY			
5	46	1			

FREQUENCY	0.50	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	2
72	17	14	40		
L1	L2	L3	L4		
99	90	80	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT	DEPTH			
L	-L	D#3	L	0	
R	-L		R	8	
OP#	OUTPUT LEVEL	VELOCITY			
4	88	2			

FREQUENCY	0.50	DETUNE	0	AMS	0
ENVELOPE DATA					
R1	R2	R3	R4	RS	2
80	27	19	77		
L1	L2	L3	L4		
99	89	0	0		
KEYBOARD SCALING					
CURVE	BREAKPOINT	DEPTH			
L	-L	E2	L	0	
R	-L		R	0	
OP#	OUTPUT LEVEL	VELOCITY			
1	96	1			

ALGORITHM #18

Notes:

Use aftertouch for downward pitch bends.

The pitch-bend effect is created by setting the LFO speed to 0. For upward pitch bends, set the LFO wave to SAW DOWN; for downward pitch bends (as in this patch), set the LFO to SAW UP. Other important settings: PMS to 4, LFO SYNC ON, and LFO DELAY to 0.

In the Function mode, set the aftertouch range to 50 (or to taste), with PITCH ON. Both AMPLITUDE and EG BIAS should be OFF. All of these settings are reflected in this patch.



NEUTRN- PLUK. A New DX7 Voice By Ken Como.

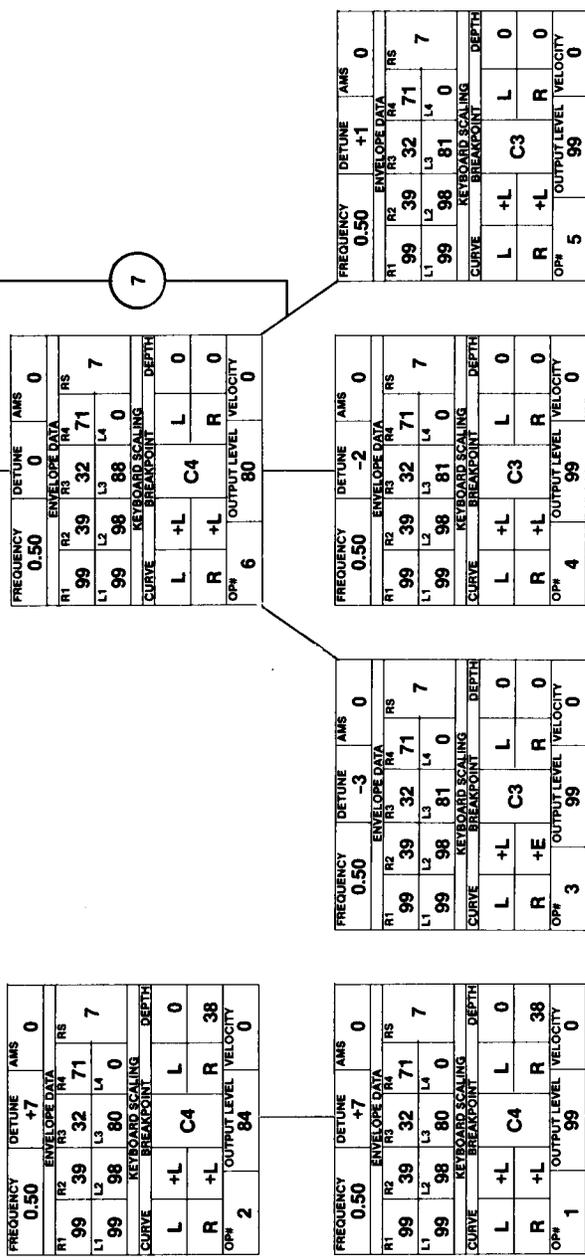
SINE	37	0	0	28	OFF	3
WAVE	SPEED	DELAY	PMD	AMD	SYNC	PMS
			LFO			

C3	ON
KEY TRANSPOSE	OSC SYNC

84	95	95	60
R1	R2	R3	R4
50	50	50	50
L1	L2	L3	L4

PITCH ENVELOPE

FUNCTIONS			
POLY	12	0	OFF
POLY/MONO	RANGE	STEP	GLISSANDO
	PITCH BEND	MODE	PORTAMENTO
(CONTROLLER)	RANGE	PITCH	AMPLITUDE
MOD WHEEL	42	ON	OFF
FOOT CONTROL	NA	OFF	OFF
BREATH CONTROL	NA	OFF	OFF
AFTERTOUCH	53	ON	OFF



ALGORITHM #22

Notes:

The patch was created for the song "Neutron Dance," recorded by the Pointer Sisters.

The "stuff" characteristics are determined by the feedback applied to op #6.

With some modifications to the output levels, this could also be used as a left-hand Bass patch.

MCS2

Use The New MCS2 MIDI Control Station To Increase The Musical Power Of Your MIDI System. By Kevin Laubach.

THE MCS2 MIDI CONTROL station turns any MIDI keyboard into a powerful MIDI Master Keyboard capable of sending out any MIDI controller data. The MCS2 actually adds MIDI data to the MIDI data coming into the MCS2 from its two MIDI IN ports. This means that you can add pitch bend, modulation, breath control, foot controller, or any MIDI controller data to a basic MIDI note-data input.

The MCS2 adds MIDI controller and performance data to both live performance and sequenced tracks. Its 12 controllers (three fixed and nine assignable) make it easy to generate any type of MIDI control message. You can, for example, add Pitch Bend to the basic MIDI output from a PF80. The MCS2 can also merge MIDI information from its two MIDI IN port with its own MIDI output, and present the merged data at its MIDI OUT port.

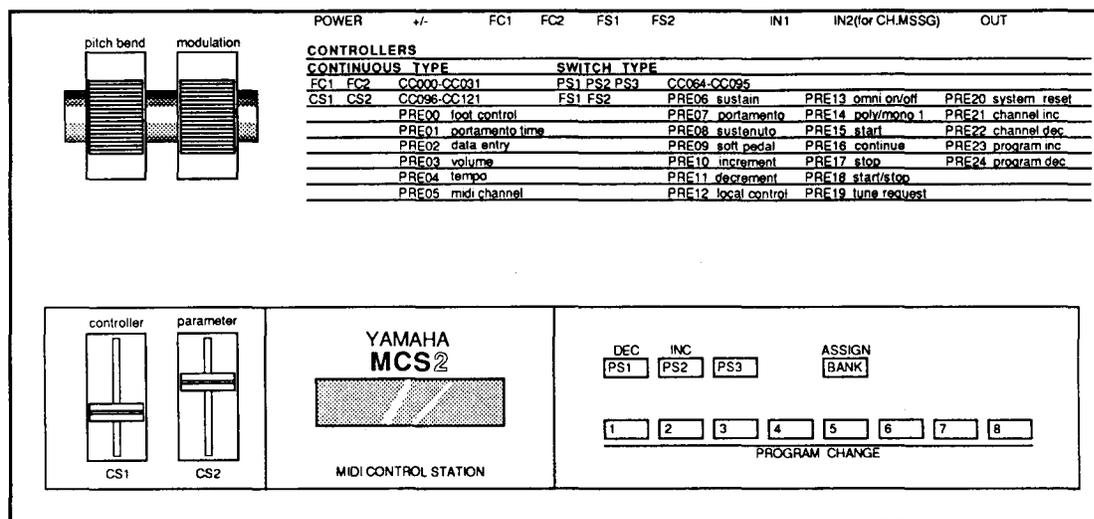
The unit's three fixed controllers are the Pitch Bend wheel, the Modulation wheel, and the Breath Controller. The nine programmable controllers fall into two basic types: **Continuous** type and **Switch** type. The Continuous controllers include Sliders 1 and 2 (CS1 and CS2), and Foot Controllers 1 and 2 (FC1 and FC2). The Switch controllers include Foot Switches 1 and 2 (FS1 and FS2), and Push Switches 1, 2, and 3 (PS1, PS2, and PS3). These can be programmed to output any kind of MIDI controller data that is appropriate.

Understanding The MCS2

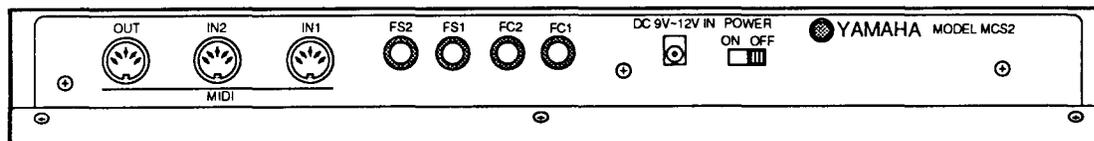
There are two modes in the MCS2: **PLAY** and **ASSIGN**. When you power up the MCS2, it is in the **PLAY** mode. This mode allows you to add MIDI controller data to a live or sequenced performance. The **PLAY** mode display indicates (on the left side) the MIDI channel on which the MCS2 is sending its MIDI messages, and (on the right side) the program (voice number) currently selected. A decimal point between the two digits on the right side indicates that the **BANK HOLD** function is **ON**. In addition, the left side of the display will indicate whether or not the **FS1** and **FS2** switches are **ON** (by displaying darkened bars for the **ON** switches), while the right side indicates whether or not the **PS1**, **PS2**, and **PS3** switches are **ON** (by displaying darkened bars for the **ON** switches).

In the **ASSIGN** mode, the nine programmable controllers are given assignments. An assignment may either be one of the **PREset** parameter codes (listed on the MCS2 top panel as **PRE00-PRE24**), or a **MIDI Control Change** code (**CC000-031** or **CC064-095**). The most frequently-used functions have been given **PREset** parameter codes. If you want to assign a function that is not listed in the **PREset** codes, you can find the proper **MIDI Control Change** code in the "MIDI Format Table" in the back of the MCS2 manual.

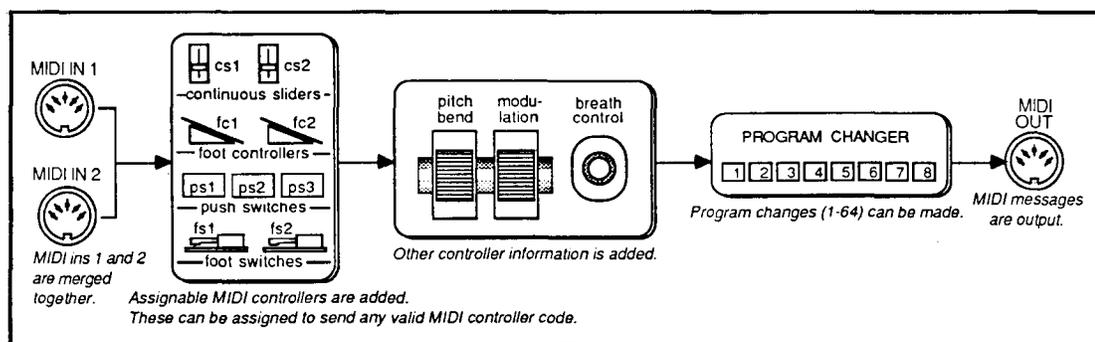
Front panel of the MCS2.



Back panel of the MCS2.



This diagram shows the basic operational structure of the MCS2.



In the ASSIGN mode, CS1 and CS2 perform specific functions: Continuous Slider 1 (CS1) selects the controller, while Continuous Slider 2 (CS2) assigns the PREset parameter or Control Change code to that controller. The display will alternately show the controller and its current assignment. Return to the PLAY mode to use the controllers.

As we said earlier, there are two basic types of controllers: Continuous and Switch. Refer to the MCS2 top panel to determine which PREset parameters and Control Change codes are appropriate for each type of controller.

The best way to understand how the MCS2 works is to show some specific applications for the unit in conjunction with other MIDI instruments. Let's take a look at two specific MIDI systems that involve the MCS2, and show how the MCS2 functions in these systems. First, though, the MCS2 must be programmed for the specific controller applications that will be used with the two setups.

Programming The MCS2

In the systems that follow, five of the controllers will be used in their "default" assignments (that is, the assignments programmed into the MCS2 when it is shipped from the factory). In order to make sure that the default values are activated, it is necessary to "initialize" the MCS2 assignments. Use this procedure:

- 1) Turn the MCS2 power OFF.
- 2) Hold down the PS1 and PROGRAM CHANGE 1 switches while turning the MCS2 power ON.

Now that all controller assignments are initialized, it is time to reprogram four of the MCS2's controllers for use with the two MIDI systems we are about to look at. Follow these steps:

- 1) Press and hold the BANK HOLD button until the LCD shows "ASSIG". This puts the MCS2 into the ASSIGN mode.
- 2a) Move CS1 until the LCD shows "CS1". This SELECTS Continuous Slider 1.
- 2b) Move CS2 until the LCD shows "PRE02". This ASSIGNS Data Entry to CS1.
- 3a) Move CS1 until the LCD shows "CS2". This SELECTS Continuous Slider 2.
- 3b) Move CS2 until the LCD shows "PRE04". This ASSIGNS Tempo to CS2.
- 4a) Move CS1 until the LCD shows "PS1". This SELECTS Push Switch 1.
- 4b) Move CS2 until the LCD shows "PRE18". This ASSIGNS Start/Stop to PS1.
- 5a) Move CS1 until the LCD shows "PS2". This SELECTS Push Switch 2.
- 5b) Move CS2 until the LCD shows "PRE16". This ASSIGNS Continue to PS2.
- 6) Press BANK HOLD until the LCD shows "1 XX". This returns the MCS2 to the PLAY mode and the last program you had selected (indicated by XX above).

The MCS2's controllers are now set to the assignments needed for the operations described below for both System 1 and System 2. A complete rundown of the controller assignments is shown in the chart on page 12, called "MCS2 Assignment Table."

System 1

This setup involves controlling a TX7 and an RX11 from a PF80 plus an MCS2. Start by making the MIDI connections shown in the diagram on page 13. Now, follow these additional setup procedures:

- 1) Make sure the PF80, TX7, and RX11 are set to receive on MIDI channel 1. If you are not sure how to do this, check your owners manual for instructions.

MCS2 *Continued*

- 2) Set the RX11 to MIDI CLOCK and CH INFO UNAVAIL. If you are not sure how to do this, check your owners manual for instructions.
- 3) Make sure that the TX7 has its CTL. CHNG. RCV. ON. This enables the TX7 to accept real-time control data. If you are not sure how to do this, check your owners manual for details.

Various other MIDI keyboards, tone generators and drum machines may be substituted for the equipment in this system. In place of the PF80, for example, you could use a PF70, CP60M or CP80M. For the TX7 you could use a TX216 or TX816, and for the RX11 you could use a RX15, RX21, or RX21L.

This MIDI system, when used in conjunction with the MCS2 controller assignments we have programmed above, will give you the following:

- When you play the PF80, you will also hear the TX7.
- Pitch Bend, Modulation, and Breath Control can be sent to the TX7 using the appropriate controllers on the MCS2.
- CS1 acts like the data entry slider on a DX7 (this allows you to adjust master tune, key limit low and key limit high when they are on the TX7 LCD display).
- PS2 controls the tempo of the RX11.
- PS1 will alternately Start and Stop the RX11.
- PS2 will send a Continue message to the RX11.
- PS3 will toggle the TX7 between the Poly and Mono modes. This is very useful for switching between chordal and monophonic solos while staying on the same patch.
- Pressing down and releasing MCS2 FS1 turns the TX7 sustain ON and OFF.
- FS2 turns portamento ON and OFF. (Portamento time on the TX7 voice patch must be

This chart shows the MCS2 controller assignments used in the operations of the two MIDI systems described in this article.

MCS2 Assignment Table

Controller	Assignment	MIDI Message	Function
FC1	PRE00	Foot Control	This foot controller sends Foot Control messages (MIDI Control Change 04).
FC2	PRE03	Volume	This foot controller sends Volume messages (MIDI Control Change 07).
CS1	PRE02	Data Entry	This slider sends Data Entry messages (MIDI Control Change 06).
CS2	PRE04	Tempo	This slider controls the Tempo of a MIDI rhythm machine or sequencer.
PS1	PRE18	Start/Stop	This push switch toggles between sending a Start and a Stop message (MIDI System messages).
PS2	PRE16	Continue	This push switch sends a Continue message (MIDI System Message).
PS3	PRE14	Poly/Mono	This push switch toggles between sending a Poly On and a Mono On message (MIDI Control Changes 127 and 126).
FS1	PRE06	Sustain	When this footswitch is pressed, a Sustain On message is sent; when released, a Sustain Off message is sent.
FS2	PRE07	Portamento	When this footswitch is pressed, a Portamento On message is sent; when released, a Portamento Off message is sent.

above 0 in order to hear this effect.)

- FC1 will control the TX7 foot controller assignment.
- FC2 will control the TX7 volume.

System 2

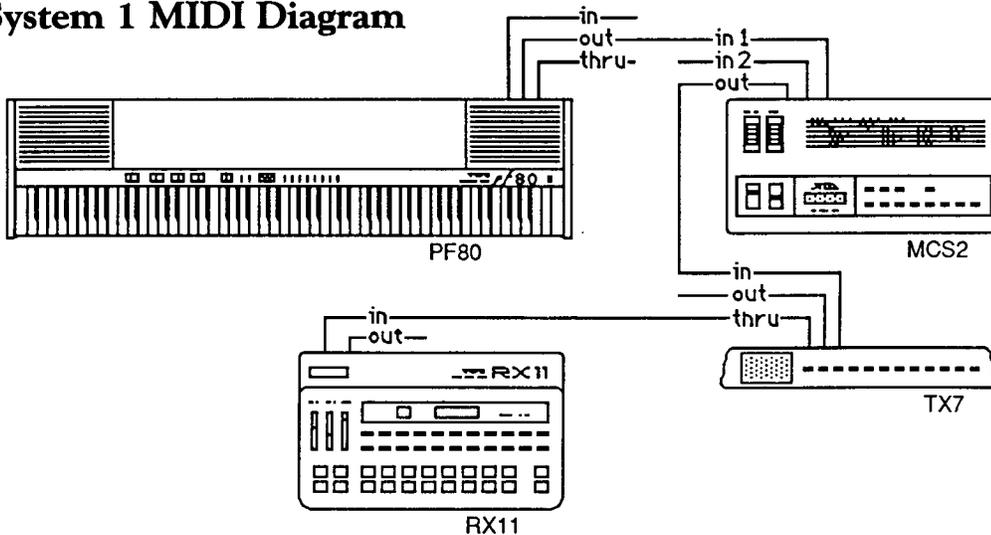
This system is designed to build up a drum track on a QX1, using a DX7, an RX11, and an MCS2. The MIDI merge feature of the MCS2 allows the RX11 to be controlled by the QX1 and DX7 simultaneously. Start by making the MIDI connections shown in the diagram. Then use the following procedure:

- 1) Make sure the RX11 is set to CH INFO AVAIL. (This is automatically set on power up.)
- 2) Check the RX11 owners manual to find the correct MIDI key numbers for the drums.

(You can also find this information in the "RX Series MIDI Key Assignment" article that appears in the Nov. '85 issue of AFTERTOUCHE.)

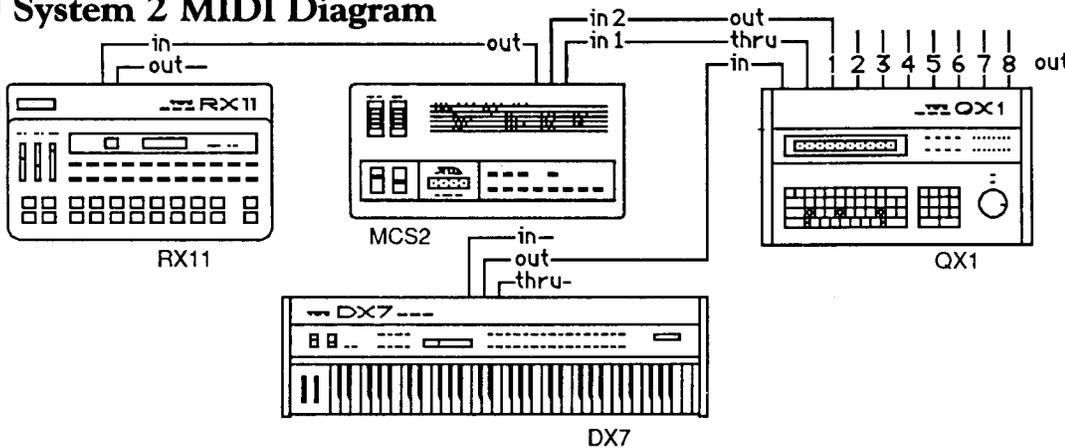
- 3) When you play the proper keys on the DX7, you will trigger the RX11 drums with velocity sensitivity.
- 4) Turn the QX1's CLICK ON. (Make sure the QX1 CLICK OUT is connected to an amplifier.)
- 5) Go to RECORD mode on the QX1 and select track 1.
- 6) Record the bass drum and snare drum on track 1.
- 7) Set the QX1 to PLAYback, and perform a third drum part on the DX7. You will hear all three parts on the RX11.
- 8) You can overdub other drums by recording new parts on the QX1 while listening to your original tracks.

System 1 MIDI Diagram



Basic MIDI connections for System 1, which shows one possible way to use the MCS2 with the PF80 to control the TX7 and the RX11.

System 2 MIDI Diagram



Basic MIDI connections for System 2, which shows how to use the MCS2 for recording drum tracks on a QX1 using the DX7 and the RX11.

TWE01

MIDI Applications Of The TWE01 Word Processor/Tele-Word Enhancer For The CX5M Music Computer. By Kevin Laubach.

WITH THE ADDITION of the TWE01 Word Processor/TeleWord Enhancer cartridge, the CX5M music computer is able to receive and send MIDI data. This allows you to use the CX5M as a bulk data load/save device.

The TWE01 cartridge is capable of a number of useful MIDI operations. It can store things such as voice data from a DX synthesizer, pattern data from an RX11 drum machine, or sequence data from a QX sequencer. The TWE01 cartridge can also load this same data back into the MIDI instrument at a later time. All of these operations are performed in conjunction with the SFG01 or SFG05 MIDI/tone generator module.

The information that the TWE01 cartridge understands is called a MIDI bulk data dump. A MIDI bulk data dump is a group of numbers that can be sent to, or received from, any MIDI instrument that is designed to utilize this data.

The TWE01 will work with any MIDI device that is capable of manual MIDI bulk data dumps. This includes the bulk data listed for the following Yamaha gear:

DX100: 1 voice & function
24 voices & functions

DX27: 1 voice & function
24 voices & functions

DX21: 1 voice & function
24 voices & functions

DX9: 1 voice
20 voices

DX7: 1 voice
32 voices

DX5: 1 voice followed by 1 function
32 voices followed by 32 functions

DX1: 1 voice followed by 1 function
32 voices followed by 32 functions

TX7: 1 voice followed by 1 function
32 voices followed by 32 functions

TX816: 1 voice followed by 1 function
32 voices followed by 32 functions

TX216: 1 voice followed by 1 function
32 voices followed by 32 functions

RX11: patterns
(settings not transmitted via manual dumps)

QX21: sequence data (if less than 14K)
Note: Memory Protect defaults to OFF.

QX7: sequence data (if less than 14K)
Note: Memory Protect defaults to OFF.

QX1: sequence data (if less than 14K)
bulk data (if less than 14K)

MEP4: setups

Equipment Requirements

In order to take full advantage of the MIDI capabilities offered by the TWE01 cartridge, you will need the following equipment for your CX5M music computer system:

- CX5M Music Computer (with SFG01 or SFG05 MIDI/tone generator module)
- Video Monitor (with video/sound cable)
- Storage Device: a cassette recorder (with appropriate interface cable), an FD05 disk drive (with FD051 disk drive controller and CA01 single cartridge adapter for correct connections), an FD03 disk drive (which includes disk drive controller), or a UDC01 data cartridge (with CA01 single cartridge adapter)
- Two MIDI Cables (a single cable can be used if you remember to switch it when loading and saving)

CX5M music computer.



- TWE01 Word Processor/TeleWord Enhancer Cartridge (*Note: The TeleWord module may not be used for these applications, since an SFG module is required.*)

Connections

Before beginning, make sure that your CX5M system is properly connected, and that all MIDI connections are correct. Follow these steps:

- 1) Make sure the video monitor is properly connected to the CX5M (connect the CX5M MONITOR output to the video input of your monitor).
- 2) Make sure the cassette recorder, disk drive, or data cartridge is properly connected to the CX5M. (For cassette, connect the red plug of the interface cable to MIC, the black plug to REMote, and the white plug to EAR).
- 3) Make sure the CX5M and each device is properly connected to a power source (but don't turn them ON yet).
- 4) Connect the CX5M's MIDI OUT port to the MIDI IN port of the MIDI instrument you are working with. (This connection is used to load MIDI data to the instrument from the CX5M.)
- 5) Connect the CX5M's MIDI IN port to the MIDI OUT port of the MIDI instrument you are working with. (This connection is used to save MIDI data from the instrument to the CX5M.)

Starting Up The TWE01 Cartridge

Now its time to begin working with the TWE01 cartridge. First, double check to make sure that your CX5M system is properly hooked up and that the proper MIDI connections are made. Then follow this procedure:

- 1) With the power OFF, insert the TWE01 cartridge into the CX5M's cartridge slot.
- 2) Turn your monitor and any other external computer devices ON, then turn your CX5M computer ON. (Turn your MIDI instrument ON as well.)
- 3) If there is no disk drive in your system, go to step 4. Otherwise, press RETURN to bypass the date input.
- 4) To call the word processor from BASIC,

type this:

CALL TW40

then press RETURN.

- 5) You will now see the TELEWORD menu screen. Select the word processor by pressing the F1 Function key. You are now in the main word processor mode.

Saving MIDI System Exclusive Data

There are two main steps for saving MIDI bulk data. The first is to get the MIDI data from your MIDI instrument into the CX5M's memory. The second is to save the MIDI data from the CX5M's memory to your computer system's storage device. (Consult the owners manual for the MIDI instrument you are using to get the specifics on manually sending system exclusive data.) Also, make sure that the MIDI transmit channel and MIDI receive channel match. To avoid problems, we suggest using MIDI channel 1 for system exclusive data.

Here is the procedure for getting data from your instrument to the CX5M's memory:

- 1) Select the file menu by pressing the F2 Function key.
- 2) Use the left and right cursor keys to set "function" to "Load." (*Note: The load function will erase everything that is currently in the CX5M's memory.*)
- 3) Press the down cursor key to go to "device."
- 4) Use the left and right cursor keys to set "device" to "MIDI (Sys Ex)."
- 5) Press the down cursor key to go to "named."
- 6) Make sure that your MIDI instrument is ready to transmit the system exclusive message. Consult your owners manual if you are unsure of how to do this.
- 7) Press RETURN, since the "name" is not used at this point.
- 8) The CX5M will now display this:

Receiving...

- 9) Now transmit the data from your MIDI instrument.
- 10) After the CX5M receives the entire system exclusive message, it will display this message:

TWE01 *Continued*

Packet1 received. More (Y/N) ?

- 11) Press "N" and you will be returned to the main word processor mode with the system exclusive message displayed in ASCII characters. The CX5M will display this message:

Can't continue. (Bin)

since you cannot type over the system exclusive data.

Now that you have the MIDI data in the memory of your CX5M computer, it's time to save the data to the storage device of your computer system. Follow these steps:

- 1) Select the file menu by pressing the F2 Function key.
- 2) Use the left and right cursor keys to set "function" to "Save."
- 3) Press the down cursor key to go to "device."
- 4) Use the left and right cursor keys to set "device" to "Cassette," "Disk," or "Data Cartridge," depending on which device you wish to use.
- 5) Press the down cursor key to go to "named."
- 6) Type in the name you wish to use for the MIDI data and press RETURN.
- 7) The CX5M will momentarily display "Writing..." on the screen, and will then return to the main word processor mode.

FD03 3.5" disk drive.



Loading MIDI System Exclusive Data

As with the save function described above, there are two main steps for loading MIDI bulk data from the CX5M. The first is to load the MIDI data into the CX5M's memory from your computer's storage device. The second is to send the MIDI data from the CX5M's memory to your MIDI instrument. (Consult the owners manual for your MIDI instrument to get specifics on how to set the instrument to receive MIDI system exclusives.) Also, make sure that the MIDI transmit channel and MIDI receive channel match. To avoid problems, we suggest using MIDI channel 1 for system exclusive data.

To load MIDI data from the storage device to the memory of the CX5M, follow these steps:

- 1) Select the file menu by pressing the F2 Function key.
- 2) Use the left and right cursor keys to set "function" to "Load." (Note: The load function will erase everything that is currently in the CX5M's memory.)
- 3) Press the down cursor key to go to "device."
- 4) Use the left and right cursor keys to set "device" to "Cassette," "Disk," or "Data Cartridge," depending on which device you wish to use.
- 5) Press the down cursor key to go to "named."
- 6) Type in name of the MIDI data file you wish load back into your MIDI device and press RETURN.
- 7) If you are using Disk or Data Cartridge, the CX5M will momentarily display "Reading..." on the screen. If you are using Cassette, the CX5M will display "Searching..."; when it finds the file it will ask if you wish to load it.
- 8) After the file is loaded, the CX5M will return to the main word processor mode.

Now that you have the MIDI data in the memory of your CX5M computer, it's time to load the data to your MIDI instrument. Follow these steps:

- 1) Select the file menu by pressing F2.
- 2) Use the left and right cursor keys to set "function" to "Save." (Note: This operation may change valuable data in your MIDI device. Be sure that you have saved anything that you wish to save.)
- 3) Press the down cursor key to go to

“device.”

- 4) Use the left and right cursor keys to set “device” to “MIDI (Sys Ex).”
- 5) Press the down cursor key to go to “named.”
- 6) Verify that any memory protection is OFF on your MIDI device.
- 7) Press RETURN, since the “name” is not used at this point.
- 8) The CX5M will now display “Sending...” on the screen.
- 9) After the CX5M sends the entire system exclusive message, it will display this:

Packet 1 sent. More (Y/N) ?

- 10) Press “N” and you will be returned to the main word processor mode. (Note: Some MIDI instruments do not indicate that they have received data over MIDI. This may cause confusion in some cases.)

Using Multiple Packets

Multiple packets allow you to save many system exclusive messages in a single file. Packets will only work when “MIDI (Sys Ex)” is the selected “device.” After the CX5M sends or receives an entire system exclusive message, it will display this:

Packet 1 received. More (Y/N) ?

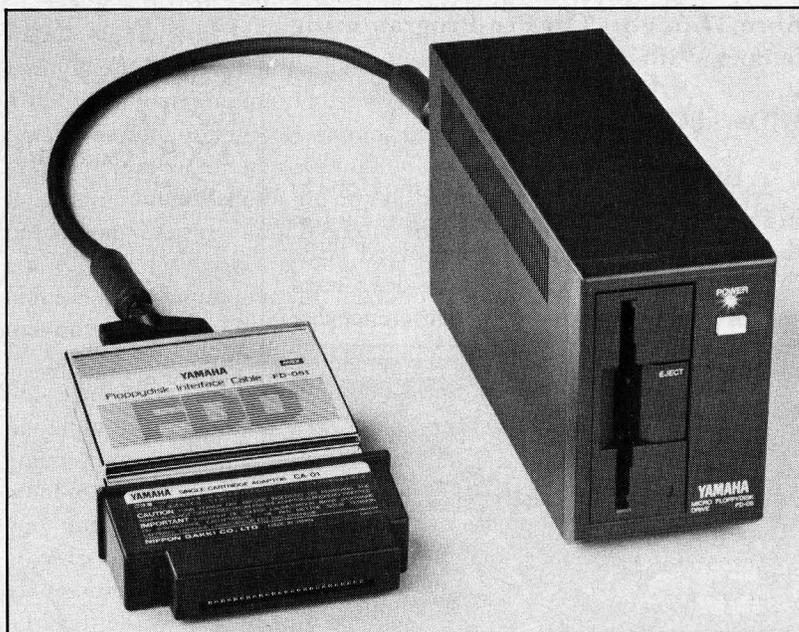
To use multiple packets, press “Y” to continue sending or receiving the next system exclusive messages.

“MIDI (All)” And “MIDI (Sys Ex)”

It is important to understand what these two “device” modes mean on the CX5M. “MIDI (Sys Ex)” does the following: It only stores MIDI system exclusive data, it waits for a MIDI system exclusive message to be sent, and it divides all of the data that is sent into packets. Each packet is a separate system exclusive event that is saved and loaded one at a time.

On the other hand, “MIDI (All)” stores everything that is received by the CX5M, and must be manually terminated by pressing the ESC key.

If, for example, you wanted to save the voice and function data from a TX7 (which sends the function data immediately after the voice data).



To do this, you would use “MIDI (All).” Since the two bulks do not have a pause in between them, “MIDI (Sys Ex)” would only get the first bulk (voice data). “MIDI (All)” avoids this by accepting all of the MIDI information, but you must manually ESCape out of the receive mode.

Storage Capacity

The TWE01 software will stop accepting MIDI data when the amount of memory used reaches 87%. This is slightly less than 14 kilobytes for MIDI information. This is approximately 3 MIDI bulk data dumps (96 total voices or 32 voices x 3) from a DX7.

Useful Control Codes

The following control codes can be used to view MIDI data that is contained in the word processors memory. (Since normal scrolling does not work, you will need to manually jump to the lines you wish to view.)

- CTRL E: Jumps to the end of the file.
- CTRL J: Jumps to a certain line number.
- CTRL L: Shows percentage of memory that has been used.
- CTRL T: Jumps to the beginning of the file.

Also be aware that the data displayed is in ASCII format and cannot be changed. Viewing the ASCII characters on the screen will enable you to determine the source of the MIDI data.

FD05 3.5" disk drive with controller.

Final Touch

More Thoughts On Pre-Programming Tempos With The RX11.

By David Gaunt.

I am writing this in response to the Hot Tip on Pre-Programming RX11 tempos by Jim Mancuso [in the Dec. '85 issue of *AFTERTOUCH*]. I came up with the same idea several months ago, with one important difference that



I would like to pass on to your readers.

When I use my RX11 live, I often run into a problem caused by occasionally bumping or jarring the drum machine. Quite often, this movement will jostle the tempo slider just enough so that the RX11's microprocessor will read it and reset my tempo to the one I had chosen as my starting point—121 bpm (beats per minute). You can imagine the havoc this wreaks upon my live performance in the middle of a song. I also dislike having to rediscover 121 bpm every time I stop a song before it ends.

My solution is to use 250 bpm—the top of the range—as my starting point. There is enough play at the top of the slider that taps and shoves will not change the tempo, and finding my starting point is a snap: I just move the slider to the top. This has eliminated my tempo problems, and has speeded up lag time in my sets as well.

* * * *

How To Make Smooth Transitions Between Banks In Chain Mode On The QX1.

By Gary Leuenberger.

In the QX1's CHAIN mode, you may hear abrupt "breaks" between BANKS. To smooth this out, Insert SUSTAIN ON commands

Hot Tips For The QX1, RX11, TX816, And DX7.

RX11 digital rhythm programmer.

The first section of this chart shows the voltage outputs for the drawbars of the Hammond B3 organ, measured at each C of the keyboard. The second part of the chart translates these levels into the 0-99 output range of the DX7's operators.

(CTRL 064=127) at the end of the BANK causing the break. This can be done on all tracks, or maybe on just a few tracks containing sustained-type voices such as piano, electric piano, strings, and the like.

To reset this in the next BANK, make sure to Insert SUSTAIN OFF commands (CTRL 064=000) near the beginning of the appropriate tracks.

* * * *

Use Your DX7 To Duplicate B3 Sounds.

By Lance Armstrong.

In my article on duplicating Drawbar organ sounds with the DX7 (in the Feb. '86 issue of *AFTERTOUCH*), I focused on the Porta-B, and presented both a chart of my measurements from the Porta-B and a PORTA-B patch based on those measurements. During my research on this technique, I also measured output levels for the Hammond B3.

Here is a chart showing the voltage outputs for the drawbars of the Hammond B3, measured at each C of the keyboard. The second

HAMMOND B3 OUTPUT LEVELS

DRWBR	C1 36	C2 48	C3 60	C4 72	C5 84	C6 96	KEY —MIDI #
16	27	60	97	127	91	54	
5.33	71	61	65	39	30	15	
8	58	47	88	49	34	31	
4	68	60	50	25	18	10	
2	176	83	41	22	85	7	
2.66	178	71.9	26	11	8	5.8	
1.66	117	78	28	19	10.8	7	
1.33	69	46	30	12	6	5.5	
1	54	28	13	1.12	5.6	5.6	

NORMALIZED TO 99 FOR THE DX7

16	15	33	54	71	51	30
5.33	39	34	36	22	17	8
8	32	26	49	27	19	17
4	38	33	28	14	10	6
2	98	46	23	12	47	4
2.66	99	40	14	6	4	3
1.66	65	43	16	11	6	4
1.33	38	26	17	7	3	3
1	30	16	7	7	3	3

part of the chart translates these levels into the 0-99 range of the DX7's operators. Using this chart as a starting point, you should be able to recreate B3 sounds to your heart's content (following the guidelines presented in my original article).

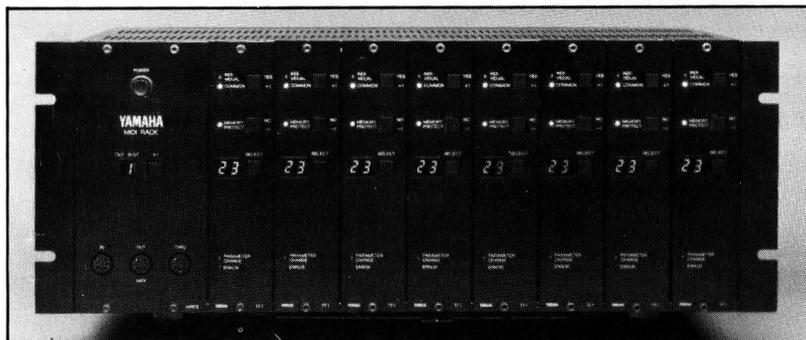
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Transforming TX816 Voice Data From Multiple QX1 Bulks Into A Single Bulk With The New Version 6 Software.

By Tom Darter.

The new Version 6 software for the QX1

TX816 rack-mount FM digital tone generator system.



makes it possible to load an entire set of TX816 voices into one QX1 Bulk, using the new "TX Voice In" and "TX Voice Out" operations (Utility Job Commands 25 and 26).

If you already have TX816 Bulk data stored in the earlier format (using multiple operations of Utility Job Command 21), it is easy to transform the data into the TX Voice format. Use this procedure:

- 1) Load the earlier Bulk data into your TX816, using the Utility Job Command 21 operation sixteen times.
- 2) Now, either erase the old TX Bulks (using Utility Job Command 24), or insert a new disk into the QX1.
- 3) Finally, resave the TX816 patch data using Utility Job Command 25. Now you can deal with the entire voice set with one operation.

As you can see, the new Utility Job Commands 25 and 26 (TX Voice In and TX Voice Out) make it much easier to deal with TX816 patch data. (For more information on the new software for the QX1, see the "QX1 Version 6 Software" article in the March '86 issue of AFTERTOUCHE.)

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If you've got a hot tip on applications or use, send it along. If we use it, you'll receive full editorial credit, plus a check for \$25.00.

Do you have a great new DX7 patch, a CX5M program, or a great pattern for the RX11? Send them in—we'll pay \$25.00 for each one used.

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If you just have a question regarding the use of Yamaha professional products, send it along too, and we'll do our best to answer it in the pages of AFTERTOUCHE. (We regret that we won't be able to answer questions through the mail, but we will use all of your questions to guide us in our choice of future topics.)

Finally, if you just want to get something off your chest, or if you'd like to establish direct contact with other X users, send something in to our letters column, "Touch Response." We'll do our best to print names and addresses of all those who are interested in starting up regional users groups.

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TOUCHE,
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ridge, CA
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Morton Subotnick

Continued from page 5

TD: *That was in Los Angeles, right?*

MS: Griffith Park Observatory in LA did the first performance; then it was done nine times in Rochester, New York, twelve times in Peoria, Illinois, and once in Houston, Texas, for New Music America. All of these performances were in Planetariums.

TD: *Do you see yourself continuing to work with the TX816 and QX1?*

MS: Yes. I'm working on a whole number of things: I'm doing a saxophone concerto, where the saxophone will have a parallel TX part; I'll probably use a pitch follower on the saxophone, but I'm not sure yet. I also haven't decided whether there will be a TX part for the orchestra, to parallel the orchestra. See, when I do *The Key To Songs* with orchestra, the orchestra will actually be paralleled by electronics, as well as the solo instruments. I don't know if I'll do that with the saxophone concerto or not.

And then I'm doing a 90-minute media piece for Linz, Austria, using a whole bunch of equipment, with live performers and video.

TD: *Is that for their Ars Electronica festival?*

MS: Yes. That will be for June '87, and it will be repeated at a Los Angeles Festival in September '87. And then I'm working on a small opera for the Philadelphia New American Music Theatre Festival. That's also for Sep-

tember '87. It's a full evening work which will use the electronic equipment, again paralleling a group of other instruments, and voice.

TD: *So you're continuing to follow the line of parallel synthesis?*

MS: Yes. And I don't think that the YCAMS equipment is going to be used up for some time. The main thing that is going to have to be added is more and more controls—different kinds of controls. For instance, you can play the TX816 in different ways: You can use pitch followers and various kinds of things. But to have passages which are following an instrument but not performed by anybody—passages coming from the QX1—that's what I'm really interested in doing. I want to do things like I did in *The Key To Songs*, where there are notes faster than anyone could play, and chords bigger than anyone could play, which are happening in perfect sync with another musician.

I'm going to work at MIT in October and November as Composer In Residence, and then I'm going to talk to a studio in Amsterdam that specializes in interfacing to the outside world. Maybe between the two places I can get something worked out.

TD: *It sounds fascinating. I'm really looking forward to hearing all of those pieces.*

MS: Me too! [*Laughs.*]