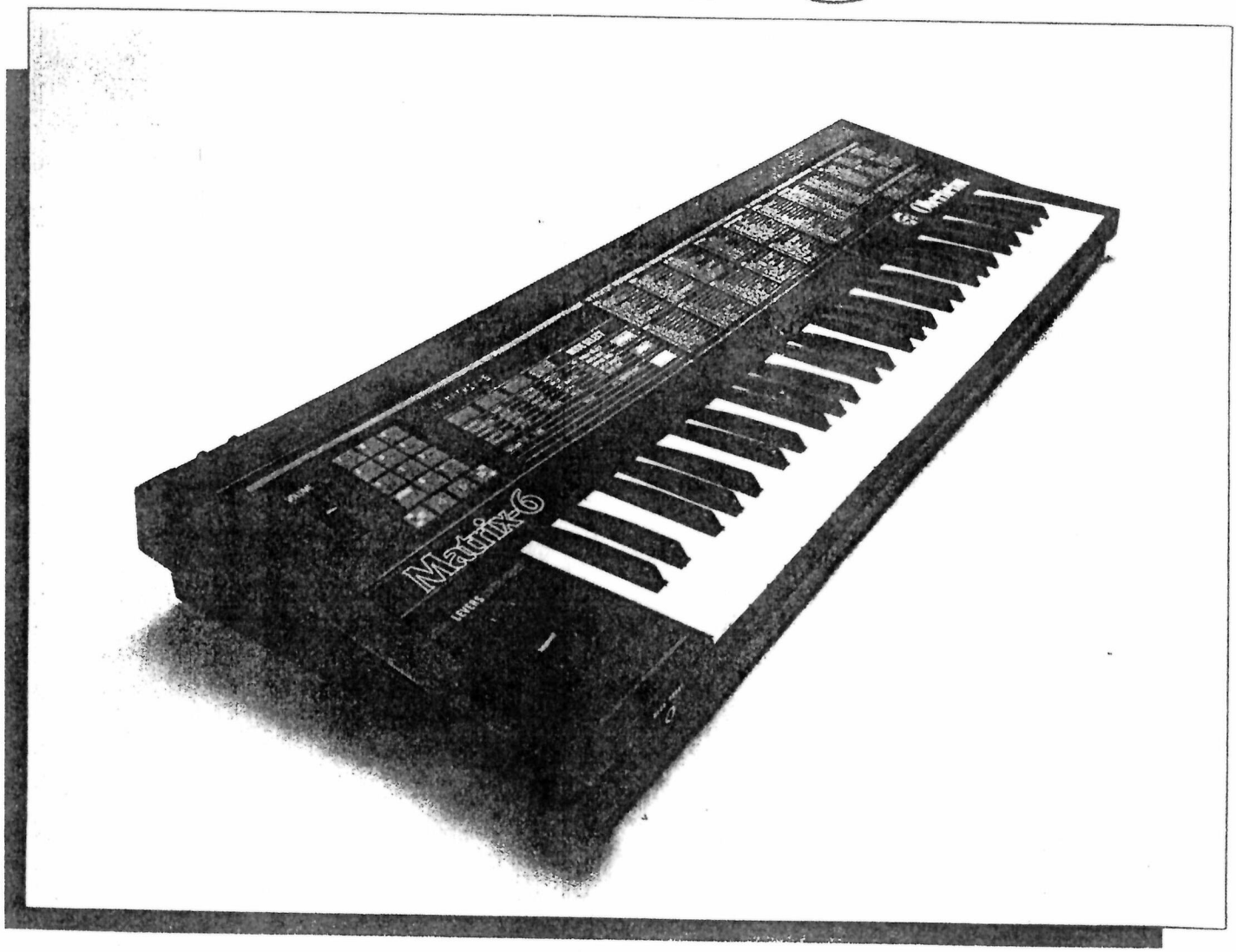
SERVICE MANUAL

Matrix-6



Oberheim

A Division of ECC Development Corporation
Preliminary Edition

Oberheim

Matrix-6

6-Voice Polyphonic MIDI Synthesizer
SERVICE MANUAL

Preliminary Edition - February 1986

MATRIX-6 SERVICE MANUAL

PRELIMINARY EDITION - February, 1986

00 MATRIX-6

A B C D

CALIBRATIONS

1. **TUNE** - While in MASTER EDIT, pressing the **B** button puts the MATRIX-6 into AutoTune. The cycle takes approximately two to three seconds to complete, during which time the display reads "***TUNING...***". While in TUNE mode, the processor is tuning the MATRIX-6's three High Frequency Oscillators (HFOs).

2. **CALIBRATE** - While in MASTER EDIT, pressing the **A** button puts the MATRIX-6 into Parameter Select mode. While in this mode, call up parameter 52 and the display should read "***52 CALIBRATE***". Now press the **D** button. This will put the MATRIX-6 into VALUE mode and the display will read "***READY?***". Press the YES button on the Keypad - the display will blank out during the Calibration routine. When the process is finished, the display will return to read "***52 CALIBRATE***".

   The CALIBRATE function calibrates the three HFOs as well as the VCF Frequency, Pulse Widths, Resonance amount and VCA2 level on each voice. If the MATRIX-6 encounters any problems while tuning the voices, it will display which voice and the section of that voice that is having the problem. To display tuning failures enter CALIBRATE mode and, with the display blank, press and hold the **C** button until the display returns to "***52 CALIBRATE***".

If the MATRIX-6 tunes all six voices without encountering any problems, the display will remain blank during the tuning process. When problems are encountered, the display will indicate which of the four sections of the tuning process and the voice or voices that are bad. Failures in any of the four sections of the tuning process are displayed with the following messages:

"BAD OSC ** "	for problems with the HFOs.
"BAD WAVE ** "	for oscillator waveform problems.
"BAD RES ** "	for resonance problems.
"BAD VCF ** "	for filter problems.

The two stars in each message represent a two digit number that indicates which voice or voices have failed that section of the Calibration. The number is a

decimal equivalent of a binary number, with each digit in the binary number corresponding to a particular voice. For example, if the display reads "*BAD OSC 63* ", it would be broken down like this:

Decimal number -	63					
Value of binary digits -	32	16	8	4	2	1
Binary equivalent -	1	1	1	1	1	1
Corresponding bad voices -	V6	V5	V4	V3	V2	V1

So if the display reads "*BAD OSC 63* " this means that all six of the voices have failed the Oscillator section of the tuning. Now if the display reads "*BAD WAVE 24* ", it would be broken down like this:

Decimal number -	24					
Value of binary digits -	32	16	8	4	2	1
Binary equivalant -	0	1	1	0	0	0
Corresponding bad voices -	--	V5	V4	--	--	--

With "*BAD WAVE 24* ", Voices four and five have failed the waveform Calibration.

Note: When trying to display the tuning failures, be sure to watch the display, because the failure displays are only shown for a short time.

When tuning failures are encountered, run the CALIBRATE function two more times. If there are no more failures after the third attempt, Tuning is OK. This will happen most often when the unit is cold.

3. DAC CALIBRATION - To enter this mode, the MATRIX-6 must be in MASTER EDIT parameter select mode. With parameter "52 CALIBRATE" displayed, first press and hold the **D** button. Next, press and hold the **C** button then press and hold the **B** button. The MATRIX-6 is now in DAC CALIBRATION mode and all three held buttons can be released. The display should read "*TUNING...*".

Caution: Be careful not to short any pins when zeroing the DAC.

With a DVM in the millivolt range, set the DAC output to 0.000 volts. The DAC output is measured at pin 6 of U712 on the Voice board. Connect the DVM ground to the ground leg of C13 (the leg toward rear of unit). C13 is directly behind U704. Adjust the DAC output to zero by turning the trimmer located directly behind U712. To exit DAC CALIBRATION mode press the MASTER button.

Note: After zeroing the DAC, the MASTER EDIT parameter number "52 CALIBRATE" must be preformed.

4. HFO CALIBRATION - To enter the High Frequency Oscillator Calibration mode, the MATRIX-6 must be in the MASTER EDIT parameter select mode.

Select parameter number "52 CALIBRATE". Now press and hold the **C** button, then press and hold the **B** button. The MATRIX-6 is now in HFO CALIBRATION mode and the held buttons can be released.

> **Caution:** when adjusting the coils of the HFO's, take care not to damage the very fragile core.
>
> When adjusting HFOs, be sure to remove adjusting tool from the core of the coil before taking the frequency measurement.

There are three High Frequency Oscillators which need to be adjusted when Calibrating HFO's. The adjustments are made first at L2, then L3 and last L1. Use a Frequency Counter to set the frequency of all three Oscillators between 3.500 and 3.505 MegaHZ. After L1 is set, the frequency of L2 and L3 should be double checked to make sure they have not changed.

> To adjust L2 connect Frequency Counter to pin 14 of U732.
> To adjust L3 connect Frequency Counter to pin 14 of U733.
> To adjust L1 connect Frequency Counter to pin 14 of U736.

After adjusting all three HFOs, exit HFO CALIBRATION mode by pressing MASTER button.

> **Note:** After Calibrating the HFOs, the MASTER EDIT parameter "52 CALIBRATE" must be preformed.

5. **PROCESSOR RESET & INITIALIZE** - First, make sure the AC power is turned off. Press and hold the red STORE button. Turn the AC power on and the display should have one or two characters flickering in the display. Now release the STORE button and the display will go blank for a few seconds. When the display resets, it will recall patch number "00". Although the unit will display patch "00", it will be playing the initialized patch.

POWER SUPPLY

VOLTAGE	TOLERANCES	J03 PIN # *
-5	+/- 200mv	1
+5A	+/- 200mv	3,4
+5B	+/- 200mv	5,6
+12	+/- 500mv	7,8
-12	+/- 500mv	9,10
-42	-41v to -45v	n/a **

* J03 is the connector located on the Power Supply board.

** The -42 volt supply is measured on the noncomponent side of the Display Board, at the point labeled "-42", located directly behind the fluorescent display.

MEMORY VOLTAGE

The memory voltage is measured at pin 28 of U7 orU8.

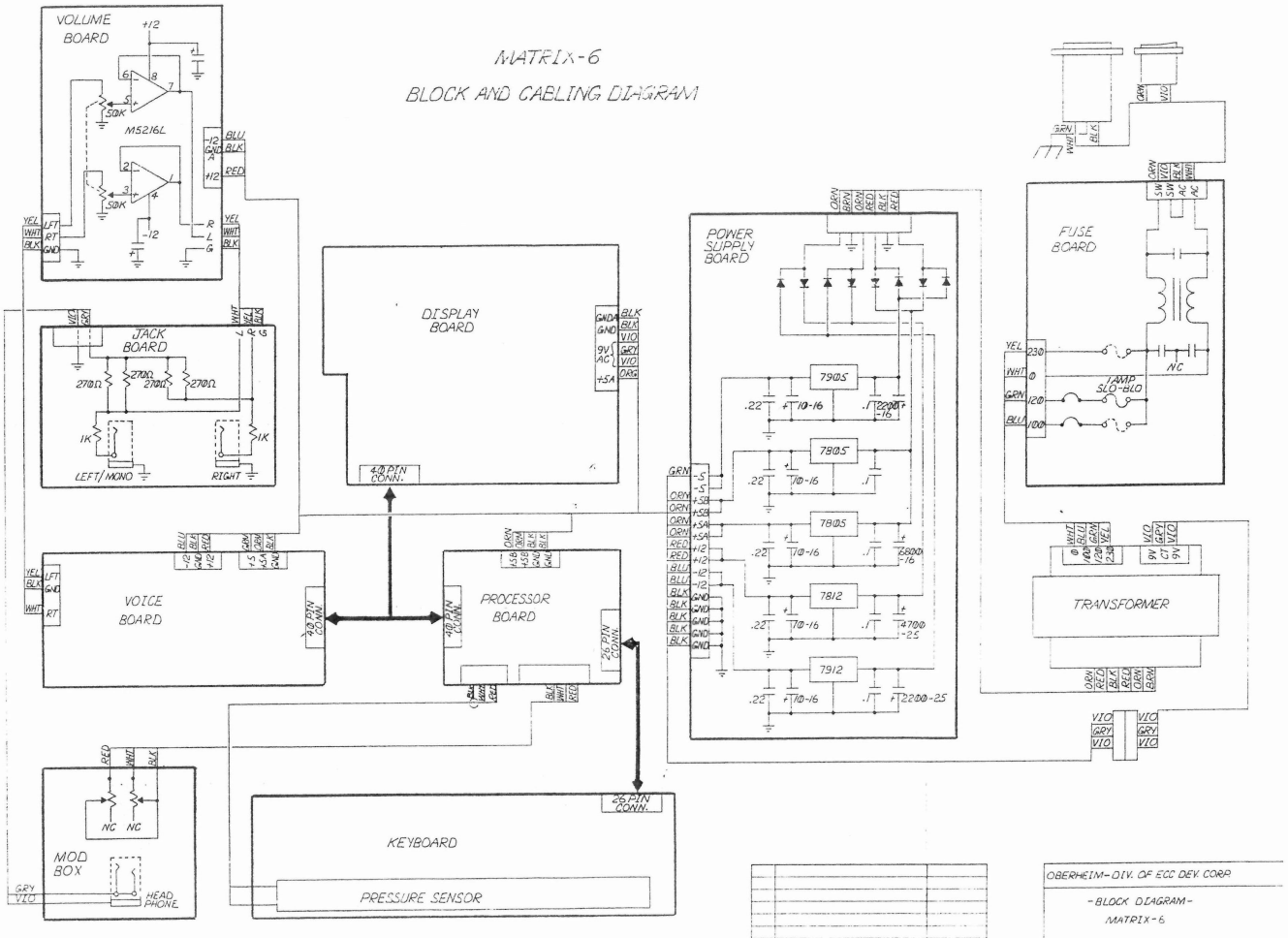
Power off: The voltage should range from +3 to +2.4 volts. If the voltage goes below +2.4, the MATRIX-6 may lose all or part of its memory.

Power on : The voltage should be 4.4 volts +/- 60mv.

TAD

MATRIX-6

BLOCK AND CABLING DIAGRAM

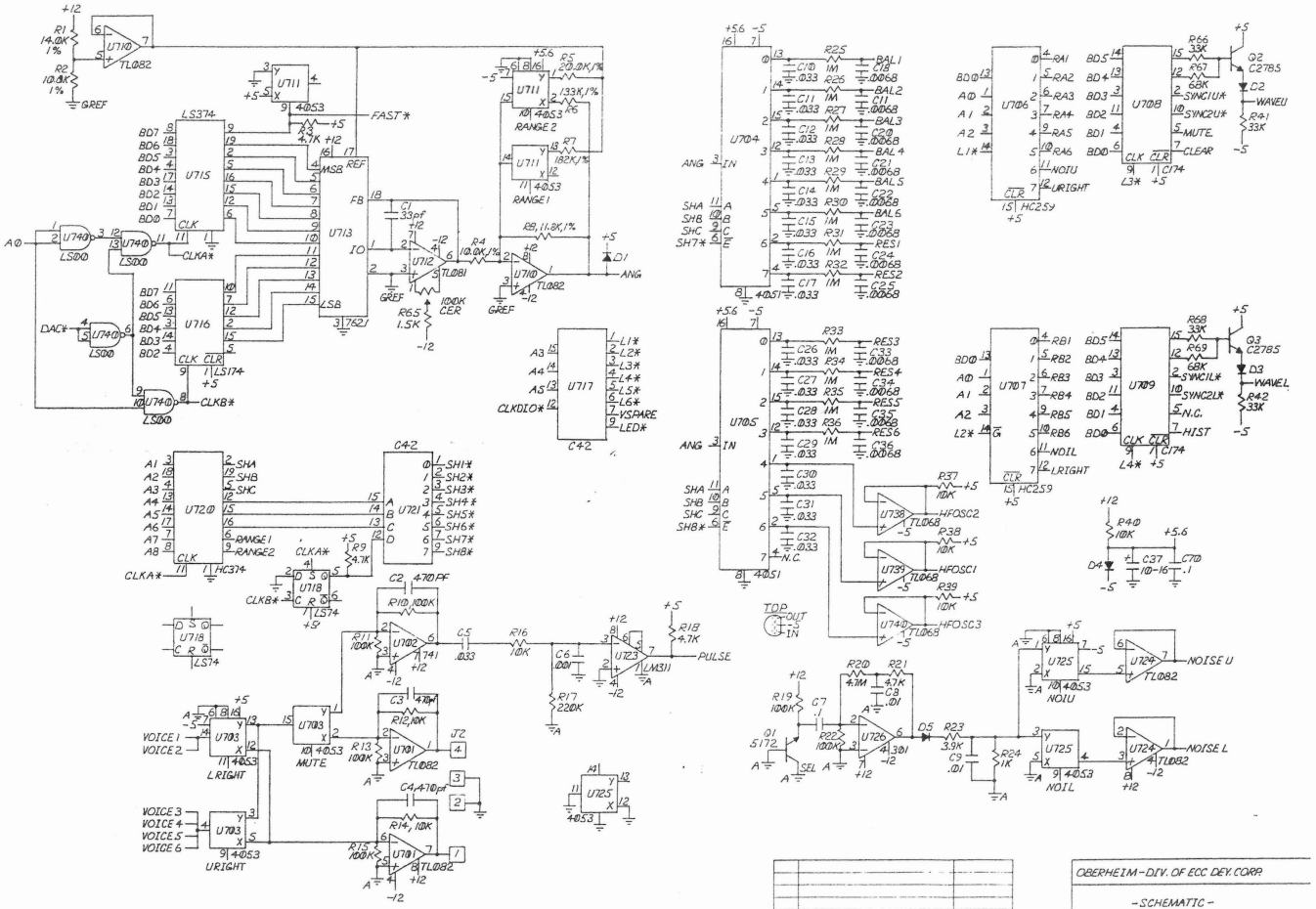


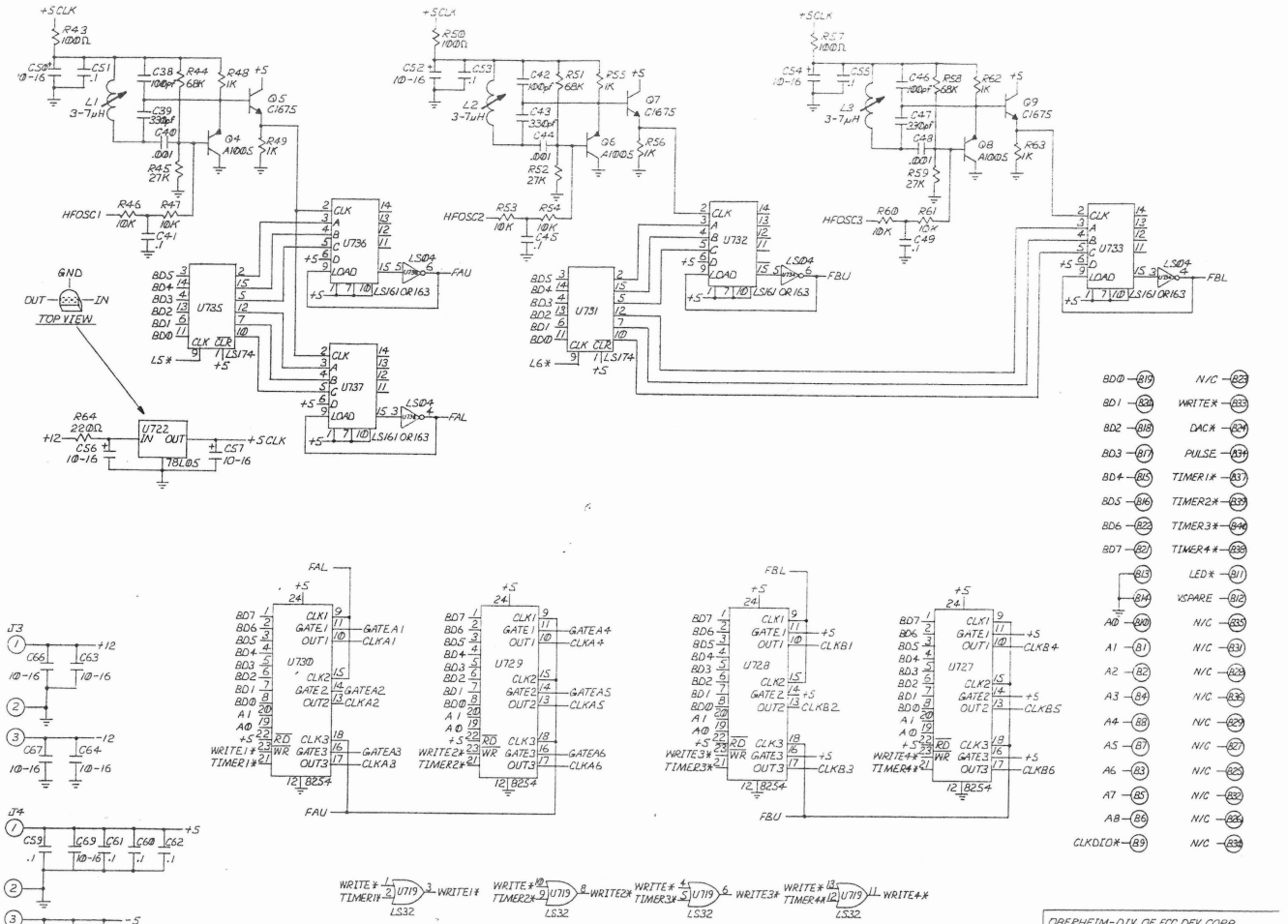
OBERHEIM - DIV. OF ECO DEV. CORP

- BLOCK DIAGRAM -
MATRIX-6

LTR	REVISION	DATE	APPD
A	INITIAL RELEASE	10-15-85	T.R.

2113A


OBERHEIM - DIV. OF ECC DEV. CORP.
- SCHEMATIC -
M6 & M8R VOICE BOARD
A INITIAL RELEASE 10-15-85
LTR REVISION DATE SHEET 1 OF 3
J.R
2028



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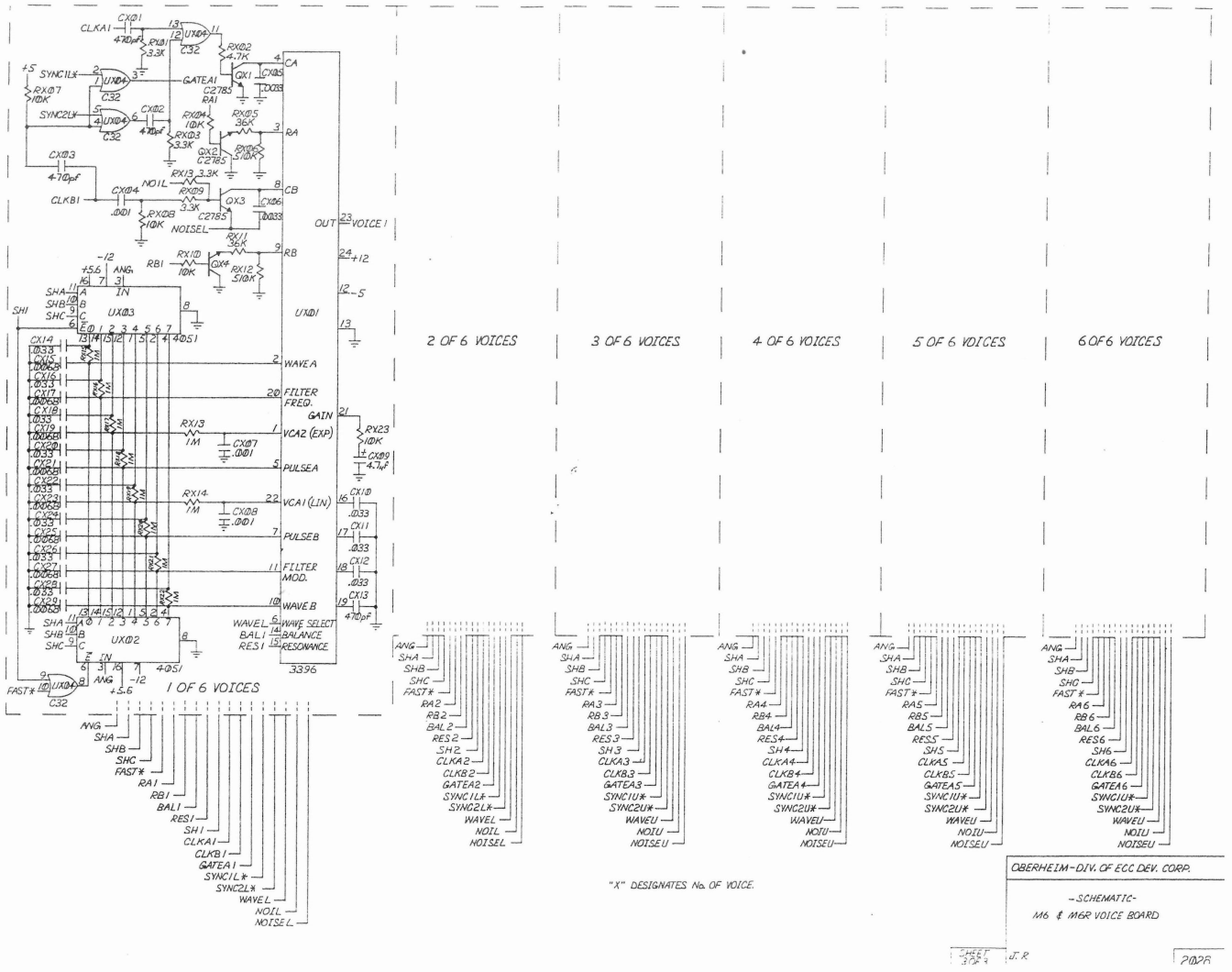
-SCHEMATIC-

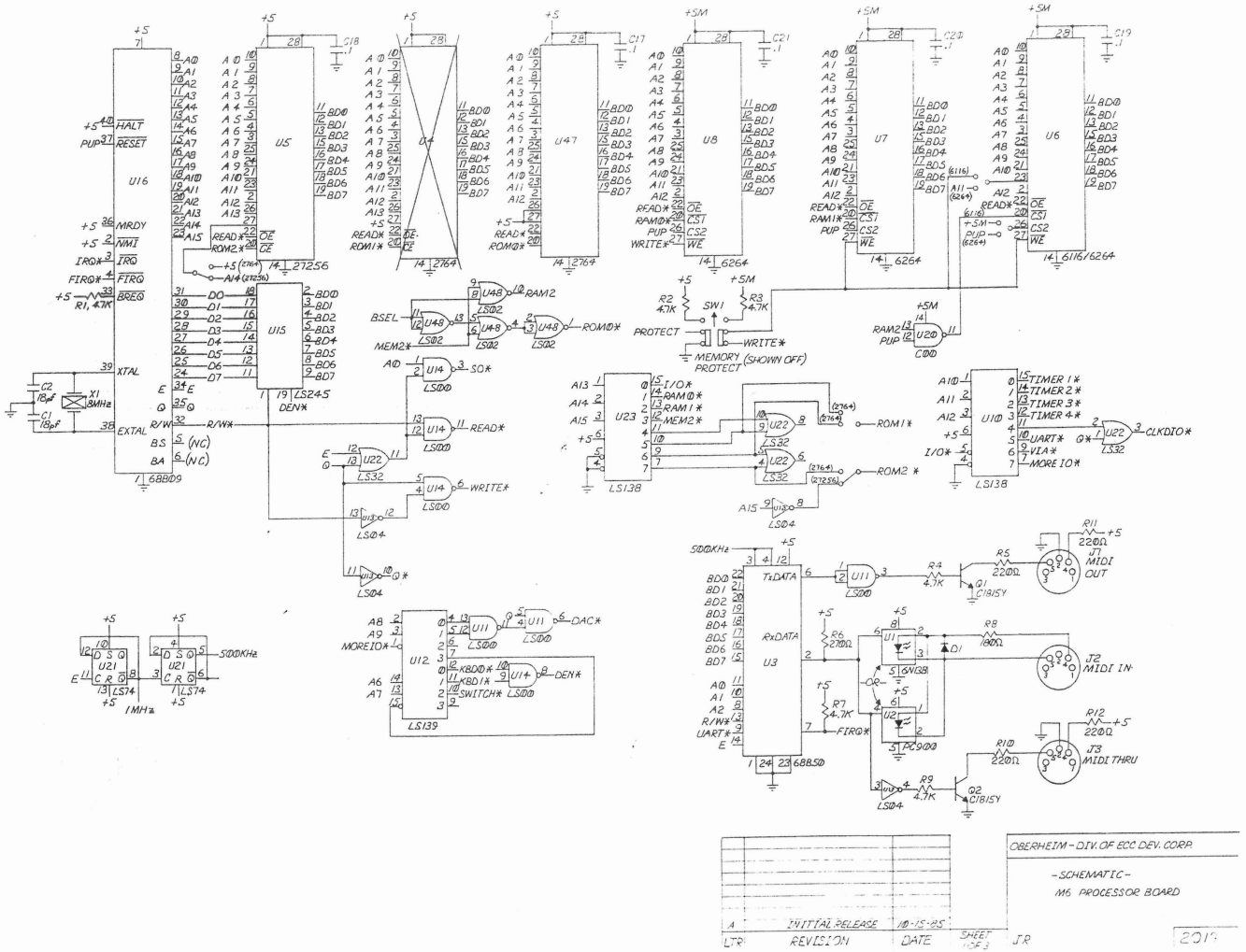
M6 & MSR VOICE BOARD

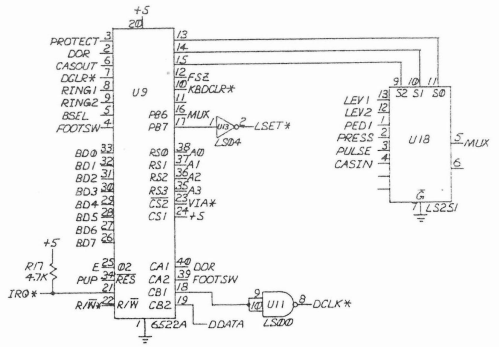
SHEET 2 OF 3

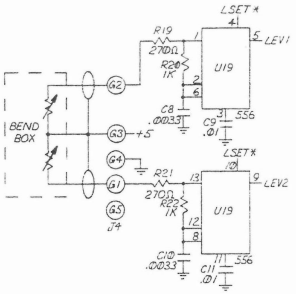
J.P.

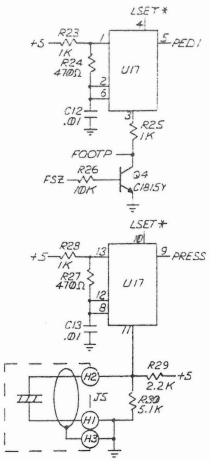
21028

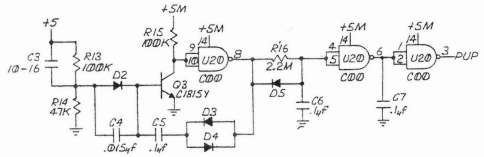

1 OF 6 VOICES
2 OF 6 VOICES
3 OF 6 VOICES
4 OF 6 VOICES
5 OF 6 VOICES
6 OF 6 VOICES
"X" DESIGNATES No. OF VOICE.
OBERHEIM - DIV. OF ECC DEV. CORP.
- SCHEMATIC -
M6 & M6R VOICE BOARD
SHEET 3 OF 3
J. R
2102R

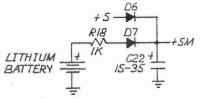

U16
6809
HALT
RESET
MRDY
NMI
IRQ
FIRQ
BREQ
XTAL
EXTAL
R/W
BS
BA
X1
8MHz
C2
18pF
C1
18pF
R1, 4.7K
U5
U15
U47
U8
U7
U6
27256
2764
6264
6116/6264
LS245
DEN*
READ*
ROM2*
ROM1*
RAM2
RAM1*
RAM0*
MEM2*
BSEL
ROM0*
WRITE*
PROTECT
SW1
R2 4.7K
R3 4.7K
MEMORY PROTECT (SHOWN OFF)
U23
LS138
I/O*
RAM0*
RAM1*
MEM2*
ROM1*
ROM2*
U10
TIMER 1*
TIMER 2*
TIMER 3*
TIMER 4*
UART*
VIA*
MORE IO*
CLKDIO*
U12
KBD0*
KBD1*
SWITCH*
DEN*
DAC*
LS139
U21
LS74
1MHz
500KHz
U3
6850
TxDATA
RxDATA
IRQ*
R/W*
UART*
R4 4.7K
R5 220Ω
R6 270Ω
R7 4.7K
R8 180Ω
R9 4.7K
R10 220Ω
R11 220Ω
R12 220Ω
Q1 C1815Y
Q2 C1815Y
D1
6N138
PC900
J1 MIDI OUT
J2 MIDI IN
J3 MIDI THRU
OBERHEIM - DIV. OF ECC DEV. CORP.
-SCHEMATIC-
M6 PROCESSOR BOARD
A
INITIAL RELEASE
10-15-85
LTR
REVISION
DATE
SHEET 1 OF 3
JR
2010

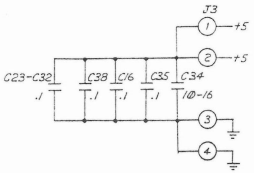


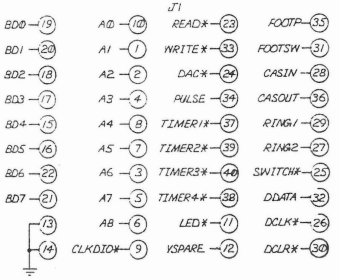












OBERHEIM - DIV. OF ECG DEV. CORP.

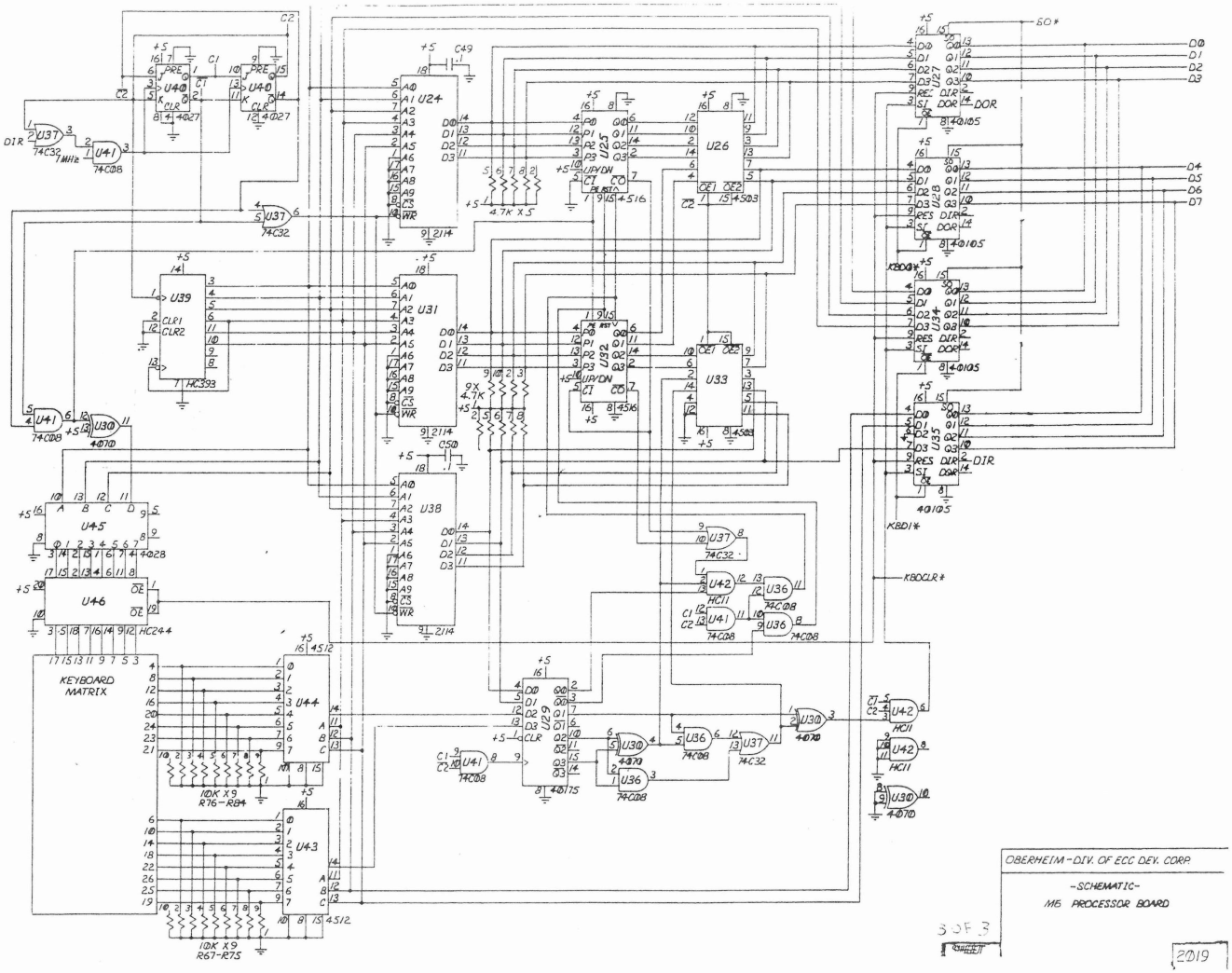
-SCHEMATIC-

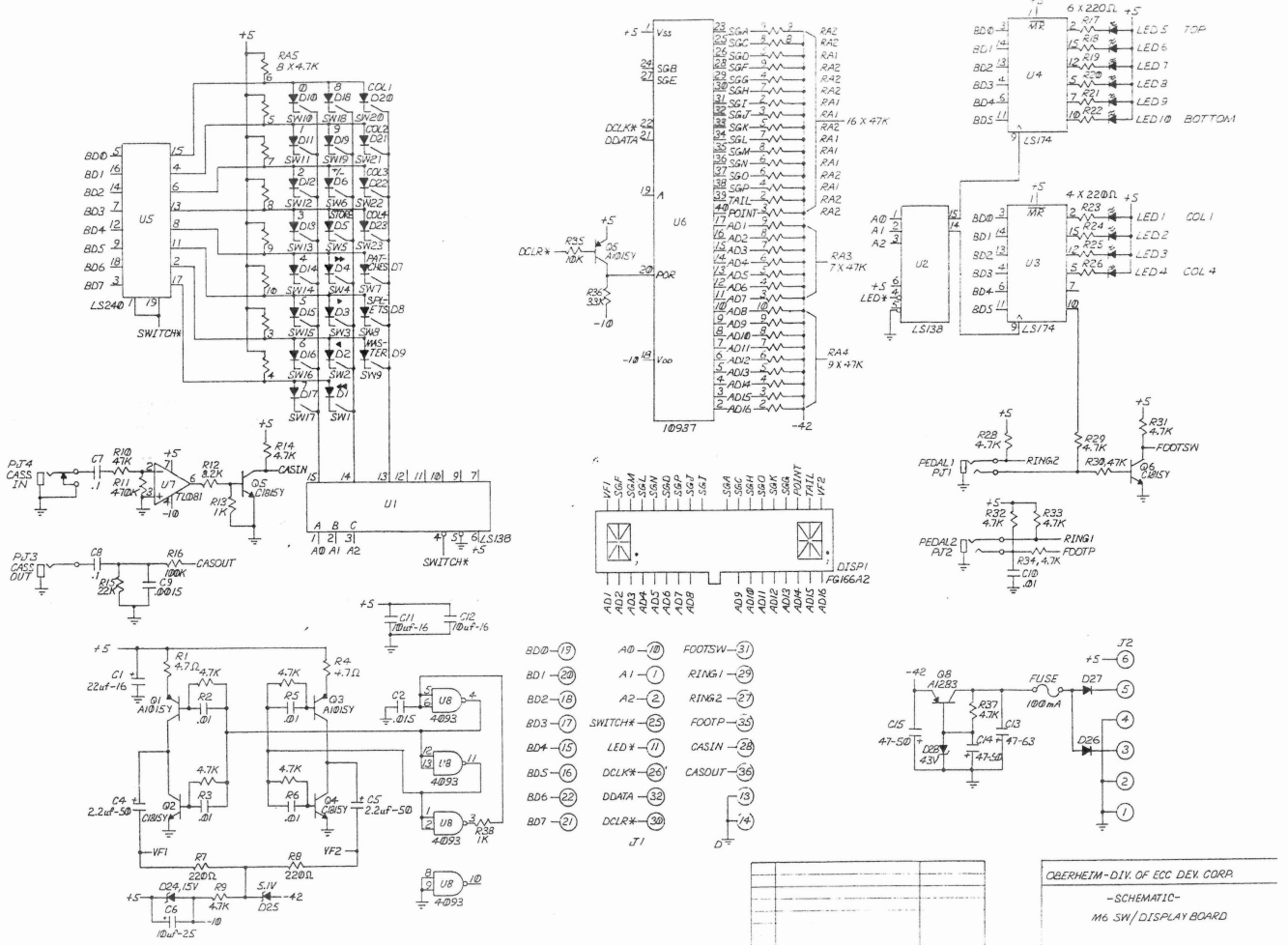
M6 PROCESSOR BOARD

SHEET 2 OF 3

J.R

2010


OBERHEIM - DIV. OF ECC DEV. CORP.
-SCHEMATIC-
M6 PROCESSOR BOARD
3 OF 3
2019
KEYBOARD MATRIX
KBD1*
KBDCLR*
10K X9 R76-R84
10K X9 R67-R75
4.7K X5
9X 4.7K



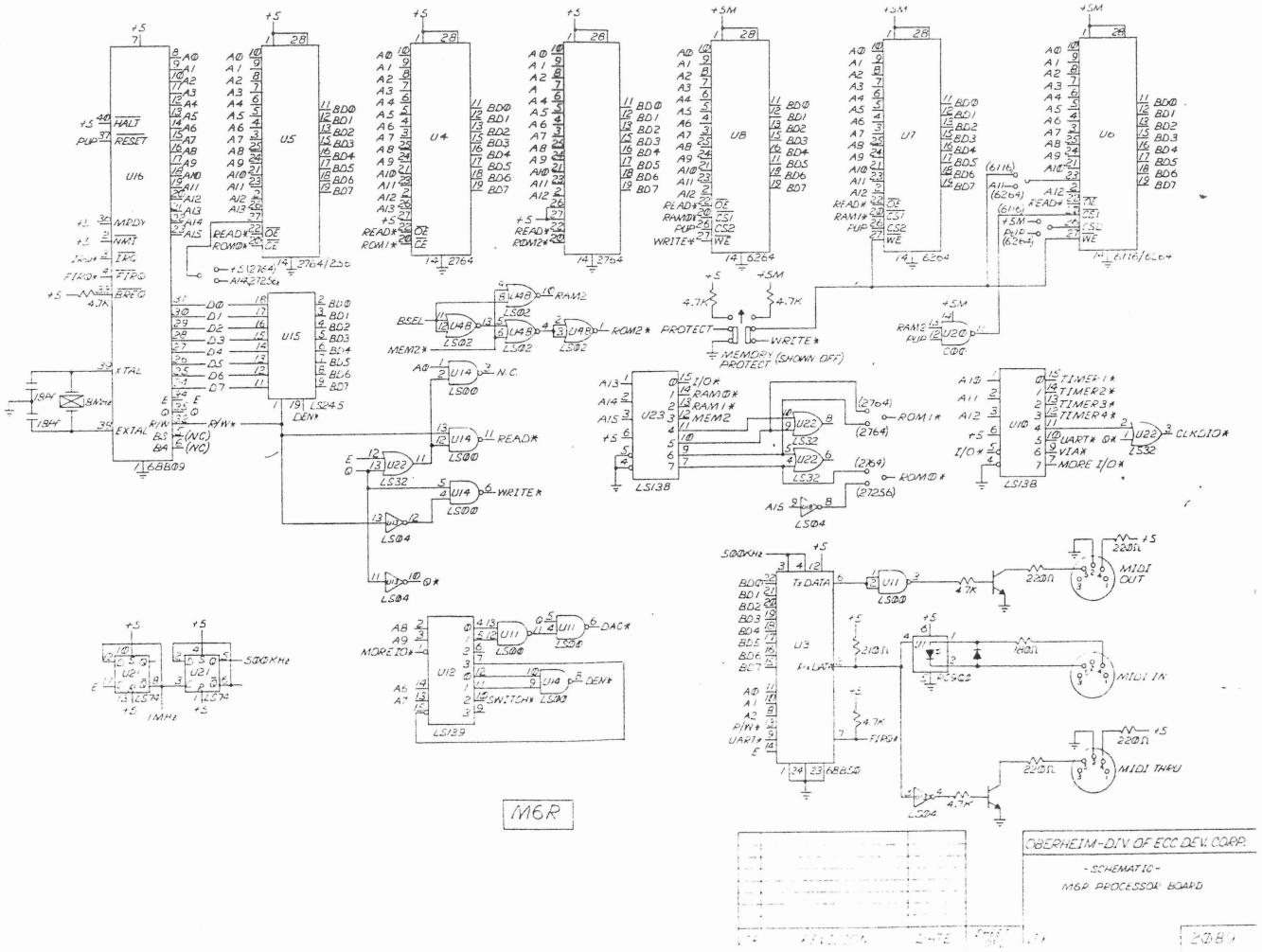
LTR	REVISION	DATE	APP'D
A	INITIAL RELEASE	10-15-85	

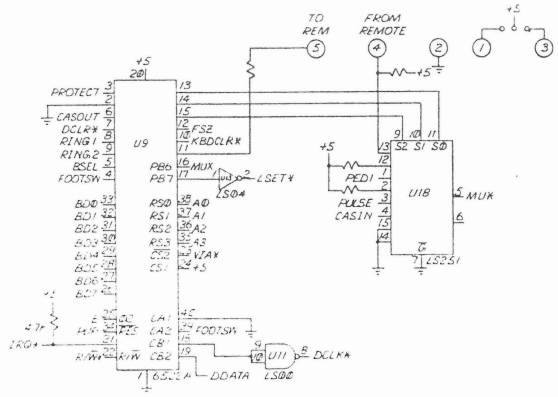
OBERHEIM - DIV. OF ECC DEV. CORP.

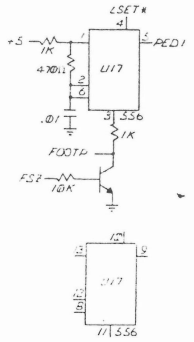
- SCHEMATIC -

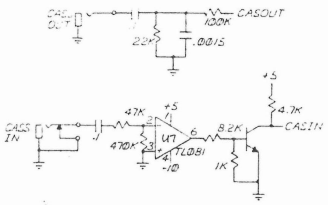
M6 SW/DISPLAY BOARD

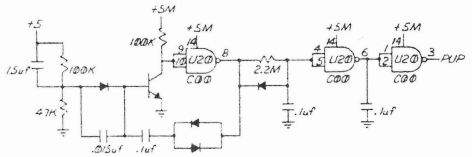
2065

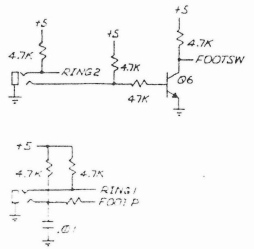

M6R
OBERHEIM-DIV OF ECC DEV. CORP.
- SCHEMATIC -
M6R PROCESSOR BOARD
2018

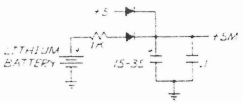


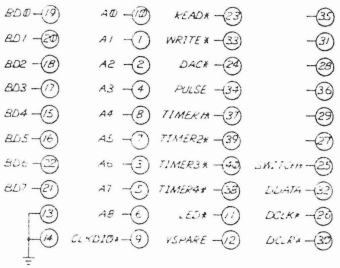












M6R

OBERHEIM-DIV OF ECC DEV. CORP.

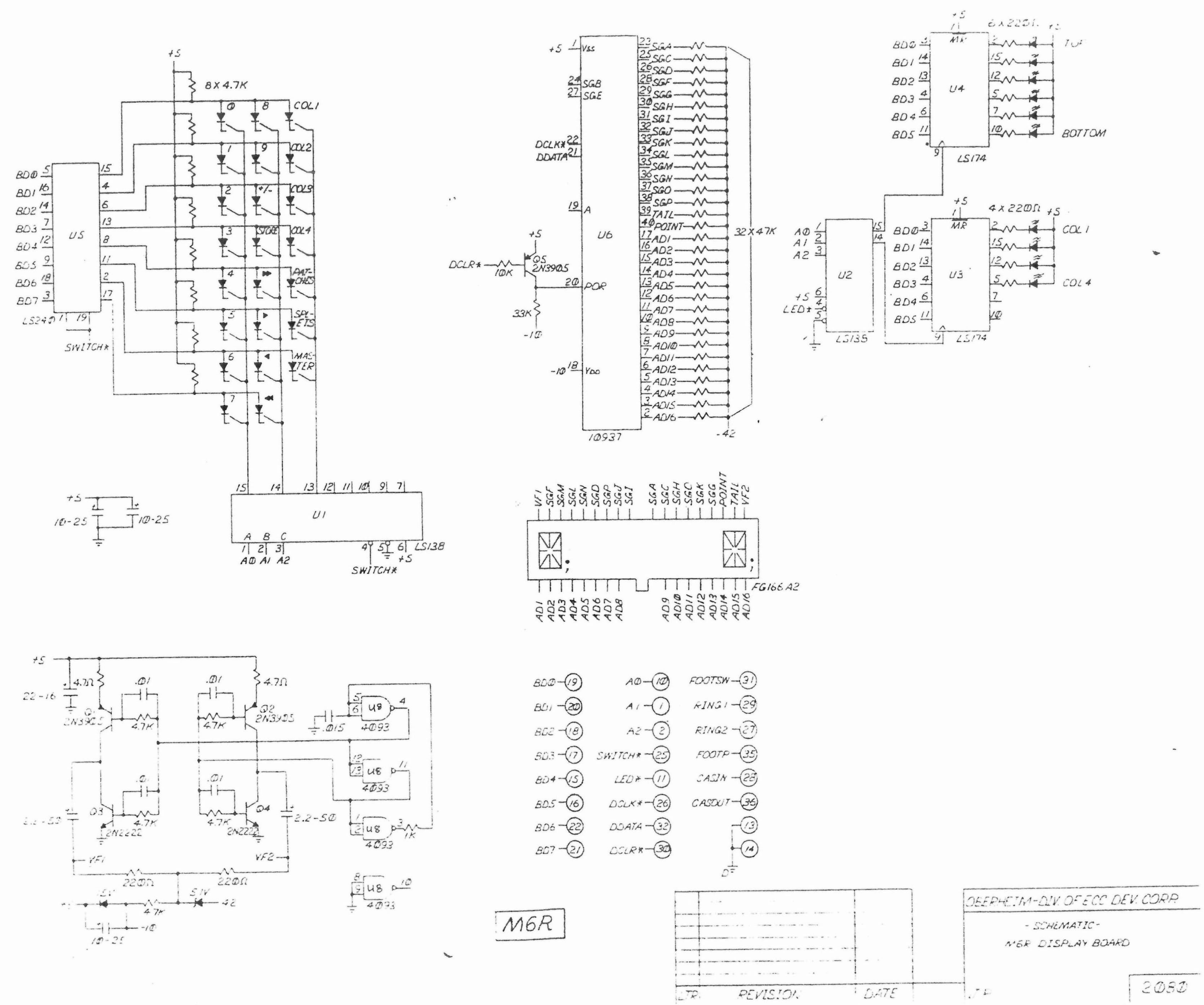
-SCHEMATIC-

M6R PROCESSOR BOARD

SHEET 2 OF 2

J.R

2085


OBERHEIM-DIV OF ECC DEV. CORP.
- SCHEMATIC -
M6R DISPLAY BOARD
2050
M6R
LTR. REVISION DATE
U1 LS138
U2 LS135
U3 LS174
U4 LS174
U5 LS240
U6 10937
FG166A2
8X4.7K
32X47K
6X220Ω
4X220Ω
COL1
COL4
TOP
BOTTOM
SWITCH*
DCLR*

Oberheim
Matrix 6 / 6R V 2.0
(6 Voice Synthesizer)

System Exclusive

The M-6 uses System Exclusive messages to send patches from one unit to another and to allow one M-6 to be the "front panel" for another when editing patches and setting parameters. This section describes the system exclusive message functions and formats.

General Format

All system exclusive messages generated and recognized by the M-6 have the same general structure. This structure consists of three parts: a Lead-In, which starts and identifies the system exclusive sequence, an operation, which contains an opcode and data bytes, and an End of Exclusive status byte. There can only be one operation in the system exclusive message.

There are two valid formats of the lead in sequence. One is specific to the Matrix-6 and Matrix-6R, and is a "general" message addressable to any device. They differ only in the device ID (06H for the M-6, 7FH for "general"). Unless otherwise noted, the M-6 will recognize system exclusive messages sent with either lead-in, and will always generate the M-6 specific format on transmission. The format of an entire system exclusive message is:

```
F0H           System Exclusive byte
10H           Oberheim ID code
dd            Device ID, 06H for M-6 specific format, 7FH for general format
<opcode>      Opcodes are always in the range 0 through 127, inclusive.
<data bytes>  The number of date bytes is defined by the
              <opcode>.
              The data bytes are always in the range 0 through 7FH.
F7H           End of System Exclusive (EOX)
```

While the M-6 always generates an EOX byte to end its system exclusive transmission, it will recognize any status message except real-time messages as ending a received system exclusive message. Any system exclusive message which contains a manufacturer ID other than 10H or a device ID otherthan 06H or 7FH, or an illegal opcode is ignored. In addition, the Matrix-6 will always wait 20 mSec after sending an EOX byte before sending any other data. Conversely, system exclusive data send to the M6 - particularly patch dumps - should be separated by at least 20 mSec.

The individual operations are described on the next page.

Patch Transmission

See Source

The M-6 can both send and receive patches, split patches, and master parameters via MIDI. Patch transmission can be triggered from the front panel or via a MIDI request for a patch dump. The M-6 can also be requested to send all of its single patches, splits and master parameters at once.

The operations are:

Request Patch Dump

This message is used by an external device to request the M-6 to dump one or all of its patches via MIDI. This is usually used in a "closed loop" MIDI configuration: the MIDI Out of the M-6 goes to the MIDI In of the other device, and the MIDI Out of the other device goes to the MIDI In of the M-6. The format of a Request Patch Dump operation is:

Byte	Function
04H	Opcode
xx	Code indicating what to transmit: 0: Transmit all single patches, splits, and master parameters 1: Transmit a single patch 2: Transmit a split patch 3: Transmit master parameters
pp	Patch number to transmit, in range 0 through 99 for single patches, 0 through 49 for splits. This byte is ignored for Transmit Master Parameters and Transmit All requests, but must be included to pad out the fixed-length message.

When a DUMP ALL command is received (Code 0), the M-6 will dump all of its internal data as separate patches, splits and master parameter blocks.This means that each patch in the stream will have its own system exclusive header and EOX command. If it is desired to transfer this data to a remote data storage device, the user should be required to tell the device when the transfer is done (> 1 second after the "10 SEND ALL" message reappears on the M-6's display) or the device should assume more data will be incoming until a timeout of > 500 mSec with no further incoming data has occurred. The total numberof bytes transmitted in response to the dump all command is approximately 29 Kbytes including headers, checksums and EOX marks. It should be noted that all data (excluding headers, checksums and EOX marks) is transmitted nibblewise so judicious use of space could store all the transmitted data in as little as 15Kbytes.

Note that for downward compatibility with version1.xx, a single patch can also be requested by the sequence F0, 10, 06, 00, pp, F7 where pp is the requested single patch number in the range 0 to 9.

SINGLE PATCH DATA

This message contains the actual single patch data. The opcode is followed by a stream of data bytes containing the patch information. When more than one patch is being transmitted at a time (in a "send all" operation), each patch is send as a separate system exclusive message. The form of a single patch dump operation is:

Byte	Function
01H	Opcode
pp	Single patch number from 0 through 99.
xx..yy	Patch or parameter data. Each byte is sent nibble-by nibble, as follows: each byte in the (eight bit) patch data to be transmitted is sent as two bytes. The first sent byte, in its least significant four bits, contains the least significant four bits of the original byte; the second sent byte, also in its least significant four bits, contains the most significant four Format for the exact format of this data.
cc	Checksum. The transmitted (not original) data is summed in seven bits ignoring overflows, and the result is put here. If this checksum does not match that calculated while reading the sent patch in, the patch is ignored.

When the M-6 receives a patch data message via MIDI, it checks to see that hardware protect is not on, and the patch whose number is in the message is not protected. It then replaces the patch in M-6 patch storage with the patch received.

Split Patch Data

This message contains the actual split patch data. The opcode is followed by a stream of data bytes containing the patch information. The form of a single patch dump operation is:

Byte	Function
02H	Opcode
pp	Split patch number from 0 through 49.
xx..yy	Patch data. Each byte is send nibble-by-nibble,as above.
cc	Checksum.

Master Parameter Data

This message contains the actual master parameter data. The opcode is followed by a stream of data bytes containing the parameter information. The form of a master parameter dump operation is:

Byte	Function
03H	Opcode
xx..yy	Parameter data. Each byte is send nibble-by-nibble, as above.
cc	Checksum

Remote Editing

The M-6 has a set of system exclusive messages which can be used to edit patch parameters via MIDI. This is an alternative to transmitting the entire patch in its edited form. The primary differences are that this editing operation can be performed much more quickly than retransmitting the entire patch, and any currently gated sounds will continue playing through the remote edit operation. This makes it possible to hear a sound change under remote control without regating the sound after each update. The remote editing system exclusive messages are:

Select Quick Patch Edit

This operation selects the Quick mode of the Patch Edit function on the M-6. The M-6 must be in this mode to act upon parameter change commands. This command should be used as a prefix to any remote editing commands. The select Quick Patch Edit operation has the format:

Byte	Function
05H	Opcode

Change Parameter

This operation changes the value of the specified parameter. If the value specified is out of range for the parameter, the operation is ignored. This operation implicitly selects the specified parameter as the current parameter, just as does the Select Parameter operation. The M-6 must be in quick patch edit mode to perform this operation.

Byte	Function
06H	Opcode
pp	Parameter number to change; must be in range 0 through 99, and specify a parameter in the current page.
vv	New parameter value.; must be within correct range or current parameter.

Remote Mode Change

For compatibility with the Oberheim Xk, Matrix-12 and Xpander, the following codes are recognized, though they can not be generated:

Select Single Patch Mode

Byte	Function
F0H	Start of System Exclusive
10H	Oberheim Mfg ID
02H	Xpander Product Code
0DH	Switch Program Mode Opcode
01H	Select Single Patch Mode
F7H	End of System Exclusive

Select Split Mode

Byte	Function
F0H	Start of System Exclusive
10H	Oberheim Mfg ID
02H	Xpander Product Code
0DH	Switch Program Mode Opcode
02H	Select Multi-Patch (Split) Mode
F7H	End of System Exclusive

Parameters

For any system exclusive messages to be generated or recognized, the parameter M04 SYSTE EXCLUSIVE must be ON. the master page parameter M10 SEND DATA is used to send a sing patch, split patch, or the master parameter set via MIDI to another device. If the M-6 is in single patch mode, M10 SEND DATA sends the currently selected single patch. If the M-6 is in split patch mode, M10 SEND DATA sends the currently selected split patch. The parameter M11 SEND ALL sends all of the M-6's 100 single patches, 50 split patches, and master parameter se to another device. A SEND ALL operation takes about 12 seconds to complete.

System Exclusive Data Format

Device ID = 06H : Matrix-6

Opcode	Byte	Description
00H		Single Patch Request (Rcv Only)
	0ppppppp	Patch Number (0-99)
01H		Single Patch Data
	0ppppppp	Patch Number (0-99)
	<patch data>	See "Single Patch Data Format"
	Occccccc	Checksum
02H		Split Patch Data
	00pppppp	Split Number (0-49)
	<split data>	See "Split Patch Data Format"
	0ccccccc	Checksum
03H		Master Parameter Data
	<parm data>	See "Global Parameters Data Format"
	0ccccccc	Checksum
04H		General Data Request (Rcv Only)
	000000xx	Code For Request Type 0 = Transmit all single patches, splits and master parameters 1 = Transmit a single patch 2 = Transmit a split patch 3 = Transmit Master Parameters
	0ppppppp	Patch Number to Transmit 0 - 99 for single patches 0 - 49 for split patches 0 for master parameters
05H		Enter Remote Edit Mode (Rcv Only)
06H		Change Parameter (Rcv Only)
	0ppppppp	Parameter to change
	0vvvvvvv	New Value

Device ID = 02H : Xpander (Compatible with Matrix-12, Xk)

Opcode	Byte	Description
0DH		Mode Change (Rcv Only)
02H		Multi Patch Mode (Split Mode)
0DH		Mode Change (Rcv Only)
01H		Single Patch Mode

Single Patch Data Format

Statistics:
134 Bytes/Single Patch
= 268 Nibbles Transmitted + 4 Bytes Header + 1 byte checksum +
1 byte EOX
= 274 Total Transmitted Bytes/Single Patch

Byte	Parm	#Bits	Description
0 - 7		6 each	Patch Name Each character is represented by the lower 6 bits of it's ASCII representation.
8	48	2	Keyboard Mode 0 = Rotate 1 = Reassign 2 = Unison 3 = Reassign w/Rob
9	00	6	DCO 1 Initial Frequency LSB = 1 Semitone
10	05	6	DCO 1 Initial Waveshape 0 = Sawtooth, 31 = Triangle
11	03	6	DCO 1 Initial Pulse Width
12	07	2	DCO 1 Fixed Modulations Bit 0 - Lever 1 Bit 1 = Vibrato
13	06	2	DCO 1 Waveform Enable Bit 0 = Pulse Bit 1 = Wave
14	10	6	DCO 2 Initial Frequency LSB = 1 Semitone
15	15	6	DCO 2 Initial Waveshape 0 = Sawtooth, 31 = Triangle
16	13	6	DCO 2 Initial Pulse Width
17	17	2	DCO 2 Fixed Modulations Bit 0 = Lever 1 Bit 1 = Vibrato
18	16	3	DCO 1 Waveform Enable Bit 0 = Pulse Bit 1 = Wave Bit 2 = Noise
19	12	6(signed)	DCO 2 Detune
20	20	6	Mix
21	08	2	DCO 1 Fixed Modulations Bit 0 = Portamento Bit 1 = Not used
22	09	1	DCO 1 Click
23	18	2	DCO 2 Fixed Modulations Bit 0 = Portamento Bit 1 = Keyboard Tracking Enable
24	19	1	DCO 2 Click
25	02	2	DCO Sync Mode
26	21	7	VCF Initial Frequency LSB = 1 Semitone
27	24	6	VCF Initial Resonance
28	25	2	VCF Fixed Modulations Bit 0 = Lever 1 Bit 1 = VVibrato

Byte	Parm	#Bits	Description
29	26	2	VCF Keyboard Modulation Bit 0 = Portamento Bit 1 = Keyboard
30	30	6	VCF FM Initial Amount
31	27	6	VCA 1 (Exponential) Initial Amount
32	44	6	Portamento Initial Rate
33	46	2	Lag Mode 0 = Constant Speed 1 = Constant Time 2 = Exponential 3 = Exponential
34	47	1	Legato Portamento Enable
35	80	6	LFO 1 Initial Speed
36	86	2	LFO Trigger 0 = No Trigger 1 = Single Trigger 2 = Multi Trigger 3 = External Trigger
37	87	1	LFO 1 Lag Enable
38	82	3	LFO1 Waveshape (see Table 1 below)
39	83	5	LFO 1 Retrigger point
40	88	5	LFO 1 Sampled Source Number
41	84	6	LFOInitial Amplitude
42	90	6	LFO 2 Initial Speed
43	96	2	LFO 2 Trigger See LFO 1 Triggers above
44	97	1	LFO 2 Lag Enable
45	92	3	LFO 2 Waveshape (see Table 1 below)
46	93	5	LFO 2 Retrigger point
47	98	5	LFO 2 Initial Amplitude
49	57	3	Env Trigger Mode Bit 0 = Reset Bit 1 = Multi Trigger Bit 2 = External Trigger
50	50	6	Env 1 Initial Delay Time
51	51	6	Env 1 Initial Attack Time
52	52	6	Env 1 Initial Decay Time
53	53	6	Env 1 Sustain Level
54	54	6	Env 1 Initial Release Time
55	55	6	Env 1 Initial Amplitude
56	59	2	Env 1 LFO Trigger Mode Bit O = Gated Bit 1 =Lf0 Trigger
57	58	2	Env 1 Mode Bit 0 = DADR Mode Bit 1 = Free Run
58	67	3	Env 2 Trigger Mode See Env 1 Trigger Mode Above
59	60	6	Env 2 Initial Delay Time
60	61	6	Env 2 Initial Attack Time
61	62	6	Env 2 Initial Decay Time
62	63	6	Env 2 Sustain Level
63	64	6	Env 2 Initial Release Time
64	65	6	Env 2 Initial Amplitude
65	69	2	Env 2 LFO Trigger Mode See Env 1 LFO Trigger Mode above

Byte	Parm	#Bits	Description
66	68	2	Env 2 Mode See Env 1 Mode Above
67	77	3	Env 3 Trigger Mode See Env 1 Trigger Mode Above
68	70	6	Env 3 Initial Delay Time
69	71	6	Env 3 Initial Attack Time
70	72	6	Env 3 Initial Decay Time
71	73	6	Env 3 Sustain Level
72	74	6	Env 3 Initial Release Time
73	75	6	Env 3 Initial Amplitude
74	79	2	Env 3 LFO Trigger Mode See Env 1 LF0 Trigger Mode above
75	78	2	Env 3 Mode See Env 1 Mode above
76	33	5	Tracking Generator Input Source Code See Table 2 Below
77	34	6	Tracking Point 1
78	35	6	Tracking Point 2
79	36	6	Tracking Point 3
80	37	6	Tracking Point 4
81	38	6	Tracking Point 5
82	40	6	Ramp 1 Rate
83	41	2	Ramp 1 Mode 0 = Single Trigger 1 = Multi Trigger 2 = External Trigger 3 = External Gated
84	42	6	Ramp 2 Rate
85	43	2	Ramp 2 Mode "See ramp 1 mode above"
86	01	7 (Signed)	DCO 1 Freq. by LFO 1 Amount
87	04	7 (Signed)	DCO 1 PW by LFO 2 Amount
88	11	7 (Signed)	DCO 2 Freq. by LFO 1 Amount
89	14	7 (Signed)	DCO 2 PW by LFO 2 Amount
90	22	7 (Signed)	VCF Freq. by Env 1 Amount
91	23	7 (Signed)	VCF Freq. by Pressure Amount
92	28	7 (Signed)	VCA 1 by Velocity Amount
93	29	7 (Signed)	VCA 2 by Env 2 Amount
94	56	7 (Signed)	Env 1 Amplitude by Velocity Amount
95	66	7 (Signed)	Env 2 Amplitude by Velocity Amount
96	76	7 (Signed)	Env 3 Amplitude by Velocity Amount
97	85	7 (Signed)	LFO 1 Amp. by Ramp 1 Amount
98	95	7 (Signed)	LF0O2 Amp. by Ramp 2 Amount
99	45	7 (Signed)	Portamento Rate by Velocity Amount
100	31	7 (Signed)	VCF FM Amount by Env 3 Amount
101	32	7 (Signed)	VCF FM Amount by Pressure Amount
102	81	7 (Signed)	LFO 1 Speed by Pressure Amount
103	91	7 (Signed)	LFO 2 Speed by Keyboard Amount
104		5	"Matarix Modulation" Bus 0 Source Code (see tbl 2)
105		7 (Signed)	MM Bus 0 Amount
106		5	MM Bus 0 Destination code (see table 3)
	107	5	"Matarix Modulation" Bus Source Code (see tbl 2)
108		7 (Signed)	MM Bux 1 Amount
109		5	MM Bus 1 Destination code (see table 3)
110		5	Matrix Modulation Bus 2 Source Code (see tbl 2)
111		7 (Signed)	MM Bux 2 Amount

Byte	Parm	#Bits	Description
112		5	MM Bus 2 Destination code (see table 3)
113		5	Matrix Modulation Bus 3 Source Code (see tbl 2)
114		7 (Signed)	MM Bus 3 Amount
115		5	MM Bus 3 Destination code (see table 3)
116		5	Matrix Modulation Bus 4 Source Code (see tbl 2)
117		7 (Signed)	MM Bus 4 Amount
118		5	MM Bus 4 Destination code (see table 3)
119		5	Matrix Modulation Bus 5 Source Code (see tbl 2)
120		7 (Signed)	MM Bus 5 Amount
121		5	MM Bus 5 Destination code (see table 3)
122		5	Matrix Modulation Bus 6 Source Code (see tbl 2)
123		7 (Signed)	MM Bus 6 Amount
124		5	MM Bus 6 Destination code (see table 3)
125		5	Matrix Modulation Bus 7 Source Code (see tbl 2)
126		7 (Signed)	MM Bus 7 Amount
127		5	MM Bus 7 Destination Code (see table 3)
128		5	Matrix Modulation Bus 8 Source Code (see tbl 2)
129		7 (Signed)	MM Bus 8 Amount
130		5	MM Bus 8 Destination Code (see table 3)
131		5	Matrix Modulation Bus 9 Source Code (see tbl 2)
132		7 (Signed)	MM Bus 9 Amount
133		5	MM Bus 9 Destination code (see table 3)

Table 1
LF0 Wave codes

0 = Triangle
1 = Up Sawtooth
2 = Down Sawtooth
3 = Square
4 = Random
5 = Noise
6 = Sampled Modulation
7 = Not Used

Table 2
Modulation Source Codes
Tracking Generator Inputs

0 = Keyboard
1 = Portamento
2 = Velocity
3 = Release Velocity
4 = Pressure
5 = Tracking Generator
6 = Ramp 1
7 = Ramp 2
8 = Envelope 1
9 = Envelope 2
10 = Envelope 3
11 = Gate
12 = Pedal 1
13 = Pedal 2
14 = LFO 1
15 = LFO 2
16 = Vibrato
17 = Lever 1
18 = Lever 2
19 = Lever 3

Table 3
Modulation Destination Codes

0 = DCO 1 Frequency
1 = DCO 1 Waveshape
2 = DCO 1 Pulse Width
3 = DCO 2 Frequency
4 = DCO 2 Waveshape
5 = DCO 2 Pulse Width
6 = Mix Level
7 = VCF Frequency
8 = VCF Resonance
9 = VCF FM Amount
10 = VCA 1 Level
11 = VCA 2 Level
12 = LFO 1 Speed
13 = LFO1 Amplitude
14 = LFO 2 Speed
15 = LFO 2 Amplitude
16 = Env 1 Delay
17 = Env 1 Attack
18 = Env 1 Decay
19 = Env 1 Release
20 = Env 1 Amplitude
21 = Env 1 Delay
22 = Env 1 Attack
23 = Env 1 Decay
24 = Env 1 Release
25 = Env 1 Amplitude
26 = Env 1 Delay
27 = Env 1 Attack
28 = Env Decay
29 = Env 1 Release
30 = Env 1 Amplitude
31 = Portamento Time

Split Patch Data Format

Statistics:
18 Bytes/Split Patch
= 36 Nibbles Transmitted + 4 Bytes Header + 1 byte checksum + 1 byte
EOX
= 41 Total Transmitted Bytes/Split Patch

Byte	Parm	# Bits	Description
0 - 5		6 Each	Split Name Each character is represented by the lower 6 bits of it's ASCII representation
6		6	Not Used
7		6	Not Used
8		7	Lower Patch Number
9		7	Upper Patch Number
10	0	7	Left Zone Limit
11	1	6 (Signed)	Left Zone Transpose
12	2	1	Left Zone MIDI Out Enable
13	3	7	Right Zone Limit
14	4	6 (Signed)	Right Zone Transpose
15	5	1	Right Zone MIDI Out Enable
16	6	6 (Signed)	Left/Right Balance -31 = Left only +31 = Right only
17	7	2	Voice Configuration 0 = 2/4 1 = 4/2 2 = 6/0 3 = 0/6

Global Parameters Data Format

Statistics:
236 Bytes/Global Parameters
= 472 Nibbles Transmitted + 4 Bytes Header + 1 byte checksum + 1 byte
EOX
= 477 Total Transmitted Bytes/Global Parameters

Byte	Parm	#Bits	Description
0			Not Used
1	30	6	Vibrato Speed
2	31	3	Vibrato Waveform
3	32	6	Vibrato Amplitude
4	33	2	Vibrato Speed Mod Source Code
5	34	6	Vibrato Speed Modulation Amount
6	35	2	Vibrato Amp Mod Source Code
7	36	6	Vibrato Amp Modulation Amount
8	55	6 (Signed)	Master Tune
9	40	2	Velocity Scale Type
10	41	6	Velocity Sensitivity
11	00	4	MIDI Basic Channel
12	01	1	MIDI OMNI Mode Enable
13	02	1	MIDI Controllers Enable
14	03	1	MIDI Patch Changes Enable
15	04	1	MIDI SysX Enable
16	05	1	MIDI Local Control Enable
17	06	7	MIDI Pedal 1 Controller
18	07	7	MIDI Pedal 2 Controller
19	08	7	MIDI Lever 2 Controller
20	09	7	MIDI Lever 3 Controller
21	42	1	Pedal 2 invert Enable
22	43	1	Levers Invert Enable
23	53	5	Display Brightness
24	56	1	SQUICK Enable
25	17	1	Patch Map Echo Enable
26	57	1	Stereo Output Enable
27			Not Used
28	44	6	Pressure Standoff
29	13	1	Spillover Enable
30			Not Used
31	14	1	MIDI Active Sensing Enable
32	12	1	MIDI Echo Enable
33	15	1	Patch
34			Not Used
35	18	1	MIDI Mono Mode Enable
36-135		6 each	Input Patch Map
136-235		6 each	Output Patch Map