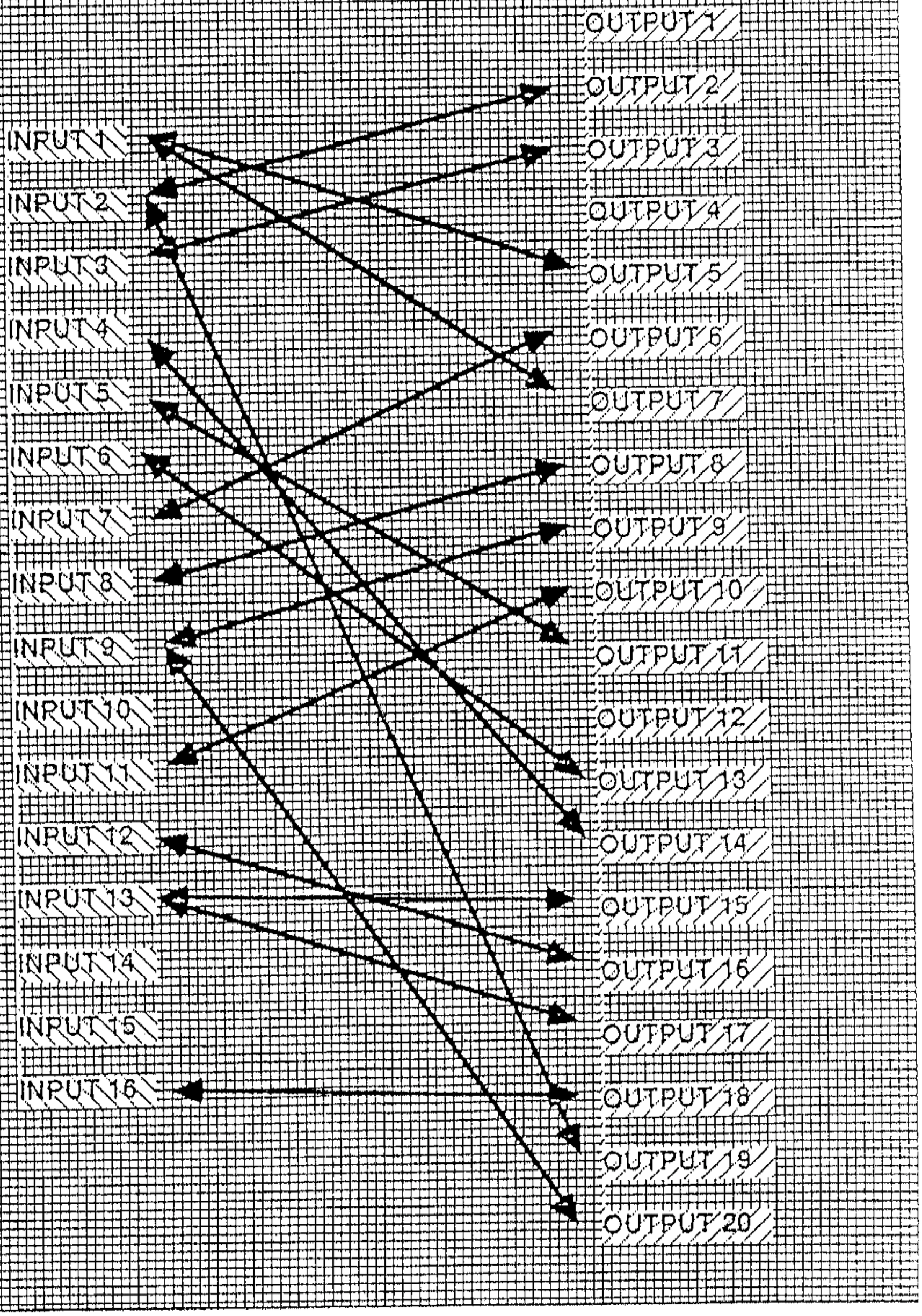
Beagle Corp.

MSB 16/20

Owner's Manual



Midi Switch Box 16/20

Introduction

Welcome to the J.L.Cooper Electronics line of Midi Switch Boxes. From your choice of the MSB 16/20, it is obvious that you are a massive user of Midi Equipment. To allow a maximum of flexibility and a minimum of hassel in Midi innerconnection, no holds were barred in the MSB 16/20 design. It features:

Sixteen Midi Inputs
Twenty Midi Outputs
Full Configuration Programmability
Sixty Four Memory Locations
Battery Backup
Remote Control Capability.
Extensive Systems Exclusive Ability.

Along with the features is a slightly higher level of complexity than the average manual switching box. While most of the features are self-explanatory, some like the REMOTE functions should be understood (via this manual) in order to prevent problems. In this manual, we will cover the basic operation, theory of operation, and explain the Systems Exclusive functions for the advance user.

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Basic Operation
(Refer to Fig. 1)

The MSB 16/20 front panel is broken down into two basic sections:

First is the MIDI INPUT/OUTPUT Configuration Section, with its 20 switches and readouts. With it, you will actually command the MSB 16/20 as to what MIDI INPUT goes to what MIDI OUTPUT.

The second section is the Program Control , with the eight select buttons, three control buttons, and two-digit readout. This section controls the movement of configuration data to and from the program memory, and controls special functions such as Midi Channel Select and REMOTE ON/OFF.

1) Configuration Section.

Switching on the MSB 16/20 is defined at the OUTPUT level. That is, each of the MIDI OUTPUTS (all 20 of them) has its own selector switch with which to choose which one of the sixteen INPUTS should switch to it. These switches are momentary contact push-buttons. Each time the button is pushed, the OUTPUT is switched to the next higher INPUT number. The seven-segment readout above the push-button shows which INPUT is actually attached at a given moment. Since there are sixteen possible INPUTS to be displayed, a so-called "HEXIDECIMAL" display (slightly modified) is used to show the current INPUT. The figure displayed corresponds to the label on the connectors on the rear of the unit. Below is a chart of the possible displayed figures:

DISPLAY

INPUT NUMBER	DISPLAYED FIGURE
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	b
12	C
13	d
14	E
15	F
16	O
off	blank

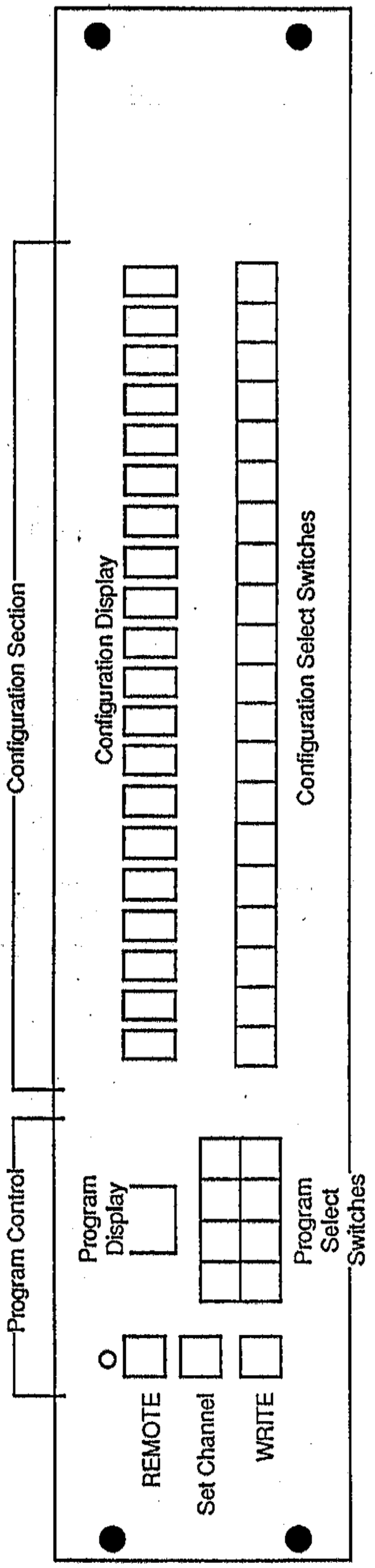

Figure 1.
Front Panel

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Basic Operation (cont.)

Each time the button is pushed, the OUTPUT is switched to the next INPUT, progressing as down the chart above. After the "O" INPUT (which is really just another INPUT, not meant to be "none"), the display for that OUTPUT goes blank, indicating that the OUTPUT is switched OFF.

Thus we go down the line of switches, selecting the INPUT/OUTPUT configuration one at a time.

2) Program Control Section

Once a configuration is set up with the INPUT/OUTPUT selection buttons, and correctly shown in the display, we can program it into memory. To do this, hold down the red WRITE button, and then push two numbers on the Program Select Switches. The eight buttons give the range of 11 to 88, or a total of 64 program locations. The chosen number is displayed.

These numbers cover a decimal MIDI Program Change Command range of 1 to 64. Figure 2. shows the conversion from the "Octal" display used on the MSB 16/20 to the equivalent decimal number. If you don't need to REMOTE the MSB 16/20 to another piece of MIDI equipment, then you probably won't need to worry about this conversion.

To call up a configuration "patch", just press the two numbers into the selection switches. As soon as the second number is punched in, the twenty OUTPUT displays show the configuration that was in that memory location. Remember that a blanked-out display means that a given OUTPUT is switched OFF, not that the display is burned-out.

That is all there is to the simple part of using the MSB 16/20. The next section covers the more complex part- REMOTE function .

MSB Disp.	Midi Pgm.	MSB Disp.	Midi Pgm.
11	1	51	33
12	2	52	34
13	3	53	35
14	4	54	36
15	5	55	37
16	6	56	38
17	7	57	39
18	8	58	40
21	9	61	41
22	10	62	42
23	11	63	43
24	12	64	44
25	13	65	45
26	14	66	46
27	15	67	47
28	16	68	48
31	17	71	49
32	18	72	50
33	19	73	51
34	20	74	52
35	21	75	53
36	22	76	54
37	23	77	55
38	24	78	56
41	25	81	57
42	26	82	58
43	27	83	59
44	28	84	60
45	29	85	61
46	30	86	62
47	31	87	63
48	32	88	64

Figure 2.
MSB "Octal" vs.
Midi Pgm Numbers

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Advanced Operation

To allow the changing of program configuration from some master device such as a Keyboard or Sequencer, the REMOTE function is used. When **ENABLED**, a MIDI Program Change Command on the **proper MIDI CHANNEL**, coming in on the proper **INPUT PORT** will result in a new configuration being called up. If any of these three requirements is in-correct, no action will take place. Lets look at them one at a time:

1) Remote On/Off. The Push-button in the upper left-hand corner of the MSB 16/20 is the Remote On/Off switch. This is an alternate-action switch, changing back and forth with each pushing. The LED above it is ON when the REMOTE function is ENABLED.

2) MIDI CHANNEL Selection. Only Program Change Command which have the same Channel Number as the MSB 16/20 is set to will be recognized. To set the Channel Number, push and hold the SET CHANNEL button. The display will show the current Channel Number. If you want to change it, press one of the OUTPUT SELECT buttons 1 thru 16, corresponding to the desired Channel. (Note that you don't use the Program Select buttons!)

3) INPUT PORT. In order to allow the maximum flexibility, the internal microprocessor is not hard-wired to one INPUT PORT. Rather, it is wired to OUTPUT PORT #20. Since you may switch this PORT to be controlled by any of the INPUT PORTS, you can change, on the fly, so to speak, what the REMOTE function is being controlled by. Just set the OUTPUT #20 to the INPUT PORT that the Master device is attached to.

BUT- Along with the flexibility, comes possible confusion!

If you plan to always control the REMOTE function from, for instance, INPUT PORT #1, you **MUST** make sure that **ALL** of the patches have OUTPUT PORT #20 assigned to INPUT PORT #1. If you don't, and should call up a patch that doesn't have this assignment, you will suddenly lose control of the REMOTE function, since it will now be attached to some other INPUT. **BEWARE! OUTPUT PORT #20 must be assigned to the "Master Device" INPUT PORT.**

You may have an application which needs the REMOTE Master Device to change during a song or performance. In that case, you may indeed have OUTPUT PORT #20 change its INPUT PORT assignment to fit the need, but make sure you know what you are doing.

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Misc. Things you should know

1) The Program Select Display turns on its decimal point whenever you make a change of configuration. This shows that the configuration has changed from the one called up with a Program Select. The decimal point goes off when a new Program Selection is made.

2) Systems Exclusive data and Program Change Commands are sent out on the OUTPUT PORT (or PORTS) that are assigned to INPUT PORT #16. For instance, if you have OUTPUT PORT #5 being driven by INPUT PORT #16, MIDI Program Change Commands will be sent to device #5 when you hit a pair of Program Select buttons. Also, note that the Program Change Command is not transmitted until <u>after</u> the switching configuration has changed. This means that if you make a Program Select change, the MIDI Program Change command will be sent to the OUTPUT PORT(s) which is <u>newly</u> assigned to INPUT #16.

3) You must be VERY careful just when you make a configuration change. There is no reasonable way that any switchbox could be "Intelligent" enough to know that you are trying to change a configuration right in the middle of some notes being played, so the burden falls on you.

If you change a configuration while a slave device is playing a chord or note, that slave device will not get the corresponding NOTE OFF command that would have told it to shut up. So it will continue to play until you shut the slave device off, (or use a J.L.Cooper Panic Button Box.- How is that for self-promotion?)

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Theory of Operation

(See Fig. 3)

The MSB 16/20 consists of two main section: The COMPUTER SECTION, and the SWITCHING SECTION.

The COMPUTER SECTION consists of the MicroProcessor, its Program Control (EPROM), Memory, and the UART, which is the interface for MIDI commands. It also includes all push-button switches and displays.

The SWITCHING SECTION consists of twenty "CROSS-POINT" MATRIX switches, each having sixteen solid-state switch closures within. This gives 20 times 16 = 320 digital switch closures within. This corresponds to the 16 INPUTS and 20 OUTPUTS. Also included in this section are the sixteen Opto-Isolators for the INPUTS and the twenty output buffer drivers that feed the OUTPUT PORTS. An additional circuit imposes itself between Opto-Isolator #16 and the corresponding input into the MATRIX. This allow the COMPUTER SECTION to inject MIDI Commands into the switches, for eventual output to some OUTPUT PORT. This allows SYSTEM EXCLUSIVE data to output from the COMPUTER SECTION and for Program Change Commands to be output when you select a new program.

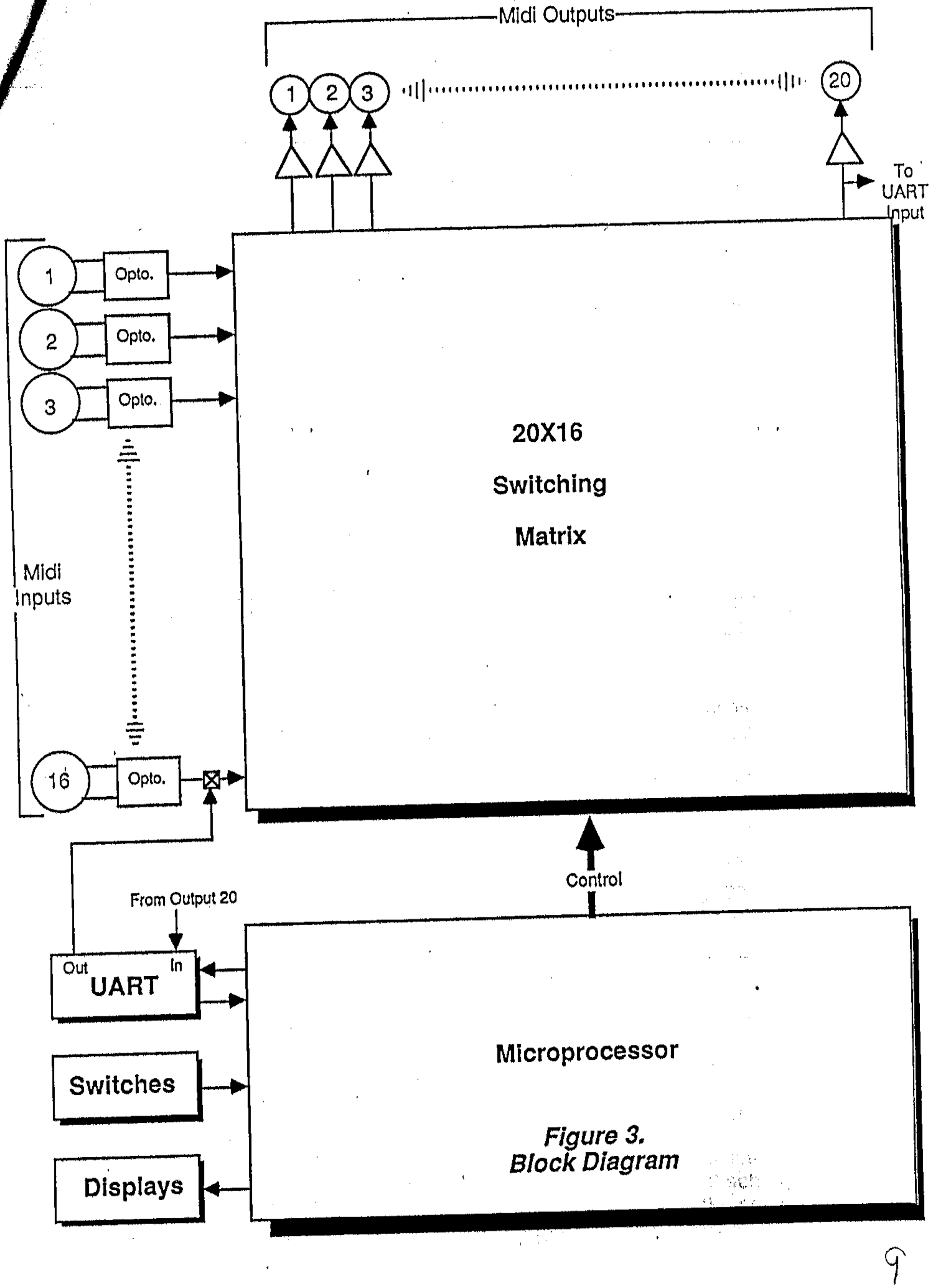

Figure 3.
Block Diagram

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Systems Exclusive

(Not for the feint of heart)

The MSB 16/20 has several Systems Exclusive Modes for the advance user. These Modes allow, for instance, the data contents to be loaded/dumped to a storage device such as the J.L.Cooper MidiDisk. Of more interest is the ability to "inform" a computer just what the current configuration is, so that it may display, in plain words, what the hook-up is like. We will have a listing available by Aug. 85 for the MacIntosh written in Basic that will do this function. Anyone versed in Basic and having a computer with a MIDI port should be able to write a Basic program for this task.

All Systems Exclusive Commands must start with:

F0h	--	Start of Systems Exclusive
15h	--	J.L.Cooper ID code
01h	--	MSB 16/20 ID code

At this point, one of 8 possible command byte, possibly followed by an extension byte, and then possibly by data. Finally, a End Of Exclusive code is required, a F7h. Following is the list of command bytes.

Command:	Extension:	Data	Explanation
00h	none	1280 bytes	Full Memory Dump.
01h	none	none	Full dump request. Upon receipt, the MSB responds with a Full Memory Dump.
02h	Pgm Number	20 bytes	One Program Dump.
03h	Pgm Number	none	One Pgm Dump Request. Upon receipt, the MSB responds with a One Program Dump.
04h	none	20 bytes	"Current" Dump. This load directly into the working buffer.
05h	none	none	"Current" Dump Request. Upon receipt, the MSB responds with the contents of the working buffer. This is useful for telling an attached computer what the actual configuration is.

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06h	none	none	"ALERT". If enabled, this is sent by the MSB whenever an OUTPUT select switch is pushed to alert an external computer that it should do a Current Dump Request to update itself.
07h	none	00=off 01=on	This enables or disables the ALERT mode above. The MSB has the ALERT mode disabled on power up.

Remember that all of these commands must be followed by a F7h.

Data Format

The data is sent as a 5 bit word with bits 6 and 7 set to zero. The format is very simple: the first byte defines OUTPUT PORT #1's assignment, byte number 2 is for OUTPUT PORT #2, and so forth.

Each of the bytes defines the assigned INPUT PORT as follows:

00h	--	INPUT PORT #1
01h	--	INPUT PORT #2
02h	--	INPUT PORT #3
	etc.	
09h	--	INPUT PORT #A
0Ah	--	INPUT PORT #B
	etc.	
0Fh	--	INPUT PORT #0
10h	--	off

Full data dumps start with the data for Pgm #11 (0) and continue to Pgm #88 (64) for a total of 20 times 64 = 1280 bytes.

Keep in mind that all commands sent to the MSB 16/20 must come in on the INPUT PORT assigned to OUTPUT PORT #20 and that the output data will go out of the OUTPUT PORT(s) that are assigned to INPUT PORT #16.