"Optimus Maximus (Aux)" protocol

When connected to a PC or Mac, Maximus will be exposed as generic Mass Storage Device (referred later as virtual Disk) that can be used to control the device and display images on the OLED buttons. Just open an appropriate .sys file and write commands or data to them, check **appendix #A** for some usage examples. There are also a several HID devices in Maximus, please refer to **table #3** for more information.

💾 **Virtual Disk**   (2,3 MB capacity, 0 KB free, MS-DOS FAT12 file system)   **Table #1,** Virtual Disk File Structure

📁 **vOptimus**		Write / Read		Usage, command syntax and comments			
🖵 order.sys	5 bytes	✔	✘	Adjust brightness	"b" + ### + ("A")		### is brightness value from 000 to 100, and optional "A" at the end turns on automatic adjustment using ambient light sensor
				Change auto-sleep delay	"s" + ####		#### is a sleep delay in seconds. Set it to 0000 to immediately wake up the keyboard, or to 9999 to prevent it from automatically going to sleep
				Modify default layout on an SD card	"wc"		Copies scancode.sys file from virtual disk to an SD card
					"wan"	"wn" + ###	Copies every or only specified normal/###.sys file to an SD card
					"was"	"ws" + ###	Copies every or only specified shift/###.sys file to an SD card
🖵 version.sys	13 bytes	✘	✔	Get keyboard firmware version, *ex: OptimusV0.76b*			
🖵 present.sys	114 bytes	✘	✔	Check which buttons has OLED screens inside them. Not available in firmware 0.76b or later			
🖵 layout.sys	114 bytes	✔	✔	Determine what image to use on every key – from static (0x00) or dynamic (0x01) layout. One byte for every button			
🖵 scancode.sys	64×144 bytes	✔	✔	This file is divided into 144 segments, 64 bytes each. To change the scancodes for a specific button, just fill a corresponding segment with two-byte pairs – first byte is a command and the second is a scancode value. The rest of the segment should be terminated with 0xFF.			

The available commands are: **0x01** – Single press and release | **0x02** – Key down | **0x04** – Key up

To determine the segment address use button map on **figure #2** and for an available scancode values please refer to **table #2**.

🖵 upgrade.bin	640 KB	✔	✘	Upload and upgrade keyboard firmware
📁 **normal, shift**				Contains a copy of similar files from an SD card and used as an temporary buffer for a "wan" and "was" order.sys commands
📁 **dynamic**				This folder is used to display dynamic images on buttons, make sure that appropriate layout.sys bytes are set to 0x01

🖵 001.sys ... 🖵 114.sys	2×48×48 bytes	✔	✔	Images for a specific OLED buttons in RGB565 format. Use **figure #1** for more information about the OLED file numbers

[rrrrrgggggbbbbb] × 48 × 48   (pictures for OLED numbers 003 and 014 should be rotated 90 degrees clockwise)

Figure #1, OLED Numbers
Defines which ###.sys image file to use

Optimus Maximus OLED Numbers

099
100 101 102 103 104 105 106 107 108 109 110 111 112 113 114
097 098 088 087 074 073 072 071 058 057 056 055 042 041 040 039 021 020 019 018 017 016 015
096 089 085 086 075 069 070 059 060 054 053 043 044 038 037 036 022 023 024 011 012 013 014
095 090 084 083 076 068 067 062 061 051 052 046 045 034 035 010 009 008
094 091 082 077 066 065 063 064 050 049 048 047 033 030 027 006 005 004 003
093 092 081 080 079 078 032 031 029 028 026 025 001 002

Optimus Aux OLED Numbers

001 006 011
002 007 012
003 008 013
004 009 014
005 010 015

Note: OLED number 007 is not used in Optimus Maximus

Figure #2, Button Numbers
Multiply by 64 to determine segment byte address in scancode.sys for a specific button

Optimus Maximus Button Numbers

7
15 23 31 39 47 55 63 71 79 87 95 103 1 9 17
6 46 5 13 21 29 37 45 53 61 69 77 85 93 101 109 25 33 41 0 8 16 24
14 54 4 12 20 28 36 44 52 60 68 76 84 92 100 108 49 57 65 32 40 48 56
22 62 3 11 19 27 35 43 51 59 67 75 83 91 99 64 72 80
30 70 2 10 18 26 34 42 50 58 66 74 82 90 73 96 104 112 136
38 78 86 94 102 110 118 126 134 81 89 97 120 128

Optimus Aux Button Numbers

7 6 5
15 14 13
23 22 21
31 30 29
39 38 37

Unused button numbers: 88, 93, 105-107, 111, 113–117, 119, 121–125, 127, 129–133, 135, 137–143

Key	Code	Key	Code	Key	Code	Key	Code	Key	Code
"A"	0x04	Right Arrow	0x4F	Fn	0xA7	F1	0x3A	New	0x89
"B"	0x05	Left Arrow	0x50	Left Ctrl	0x72	F2	0x3B	Open	0x8A
"C"	0x06	Down Arrow	0x51	Left Shift	0x73	F3	0x3C	Close	0x8B
"D"	0x07	Up Arrow	0x52	Left Alt	0x74	F4	0x3D	Save	0x8C
"E"	0x08	Num Lock	0x53	Left Win/Cmd–key	0x75	F5	0x3E	Print	0x8D
"F"	0x09	Equals (Numpad)	0x66	Right Ctrl	0x76	F6	0x3F	Undo	0x8E
"G"	0x0A	Dot (Numpad)	0x63	Right Shift	0x77	F7	0x40	Copy	0x8F
"H"	0x0B	Divide (Numpad)	0x54	Right Alt	0x78	F8	0x41	Cut	0x90
"I"	0x0C	Multiply (Numpad)	0x55	Right Win/Cmd–key	0x79	F9	0x42	Paste	0x91
"J"	0x0D	Minus (Numpad)	0x56	Caps Lock	0x39	F10	0x43	Redo	0x96
"K"	0x0E	Plus (Numpad)	0x57	Tilde	0x35	F11	0x44	Reply	0x97
"L"	0x0F	Enter (Numpad)	0x58	Enter	0x28	F12	0x45	Forward	0x98
"M"	0x10	"1" (Numpad)	0x59	Escape	0x29	F13	0x67	Send	0x99
"N"	0x11	"2" (Numpad)	0x5A	Backspace	0x2A	F14	0x68	Media Select	0x9E
"O"	0x12	"3" (Numpad)	0x5B	Tab	0x2B	F15	0x69	My Computer	0x9F
"P"	0x13	"4" (Numpad)	0x5C	Space	0x2C	Print Screen	0x46	WWW Search	0xA0
"Q"	0x14	"5" (Numpad)	0x5D	Insert	0x49	Scroll Lock	0x47	WWW Stop	0xA1
"R"	0x15	"6" (Numpad)	0x5E	Home	0x4A	Pause	0x48	WWW Reload	0xA2
"S"	0x16	"7" (Numpad)	0x5F	Page Up	0x4B	"\" or "|" (Non–US)	0x64	WWW Favorites	0xA3
"T"	0x17	"8" (Numpad)	0x60	Delete	0x4C	"#" or "~" (Non–US)	0x32	WWW Home	0x93
"U"	0x18	"9" (Numpad)	0x61	End	0x4D	Hangul	0x70	WWW Back	0x94
"V"	0x19	"0" (Numpad)	0x62	Page Down	0x4E	Hanja	0x71	WWW Forward	0x95
"W"	0x1A	"1"	0x1E	Help	0x7A	Text Editor	0x7E		
"X"	0x1B	"2"	0x1F	Next Track	0x9A	Spreadsheets	0x7F	Code #14	0x6D
"Y"	0x1C	"3"	0x20	Previous Track	0x9B	Mail	0x80	Code #56	0x6B
"Z"	0x1D	"4"	0x21	Stop	0x9C	Calendar	0x81	Code #107	0x6A
"[" or "{"	0x2F	"5"	0x22	Play	0x9D	Calculator	0x82	Code #131	0x6F
"]" or "}"	0x30	"6"	0x23	Mute	0x7B	App. Left	0x84	Code #132	0x6E
"\" or "|"	0x31	"7"	0x24	Volume Down	0x7C	App. Right	0x85	Code #133	0x6C
Semicolon	0x33	"8"	0x25	Volume Up	0x7D	Application	0x65		
Comma	0x36	"9"	0x26	Power	0xA4	Tasks	0x86	Reserved	0x00
Dot	0x37	"0"	0x27	Sleep	0xA5	Spell	0x87	ErrorRollOver	0x01
"/" or "?"	0x38	Minus / Underscore	0x2D	Wake Up	0xA6	File Manager	0x88	POSTFail	0x02
Apostrophe	0x34	Equals / Plus	0x2E	Log Off	0x83	Office	0x92	ErrorUndefined	0x03

Table #3, Devices and IDs

	Vendor ID	Product ID	Device purposes
USB 2.0 Internal Hub	1507 0x5E3	1544 0x608	Serves as connecting point for all internal devices
Mass Storage Device (Virtual Disk)	33059 0x8123	5207 0x1457	Controlling the device capabilities and OLED pictures using OS-independent file I/O
Internal HID Implementation			The secondary HID device is used to report key press events of any button regardless of the scancode programmed to them.
Keyboard Controller (HID) Generic Keyboard Multimedia Keyboard Power Controls	1241 0x4D9	34 0x22	Built-in keyboard chip with generic and multimedia functions. Can be programmed to produce any scancode combinations via scancode.sys file.
DFU Controller	1137 0x471	57173 0xDF55	Used to upgrade firmware via USB. To enter DFU mode—power up the keyboard while holding the little microswitch inside the Kensington lock hole.

Appendix #A, Usage Examples

scancode.sys

"Hello" 0x02 **0x73** 0x02 **0x0B** 0x04 **0x0B** 0x04 **0x73** 0x02 **0x08** 0x04 **0x08**
0x02 **0x0F** 0x04 **0x0F** 0x02 **0x0F** 0x04 **0x0F** 0x02 **0x12** 0x04 **0x12** 0xFF... (64 bytes)

Ctrl+Alt+Del 0x02 **0x72** 0x02 **0x74** 0x02 **0x4C** 0x04 **0x74** 0x04 **0x72** 0x04 **0x4C** 0xFF... (64 bytes)

F1, F2, Shift+F3 0x02 **0x3A** 0x04 **0x3A** 0x02 **0x3B** 0x04 **0x3B** 0x02 **0x73** 0x02 **0x3C** 0x04 **0x3C** 0x04 **0x73** 0xFF... (64 bytes)

order.sys

Set brightness to maximum "b100A" (5 bytes)

Turn auto-sleep off "s9999" (5 bytes)