

Coding SpaceMat 2.6 “all in one”



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User manual revision b,
latest update September 2021
for hardware 2.6

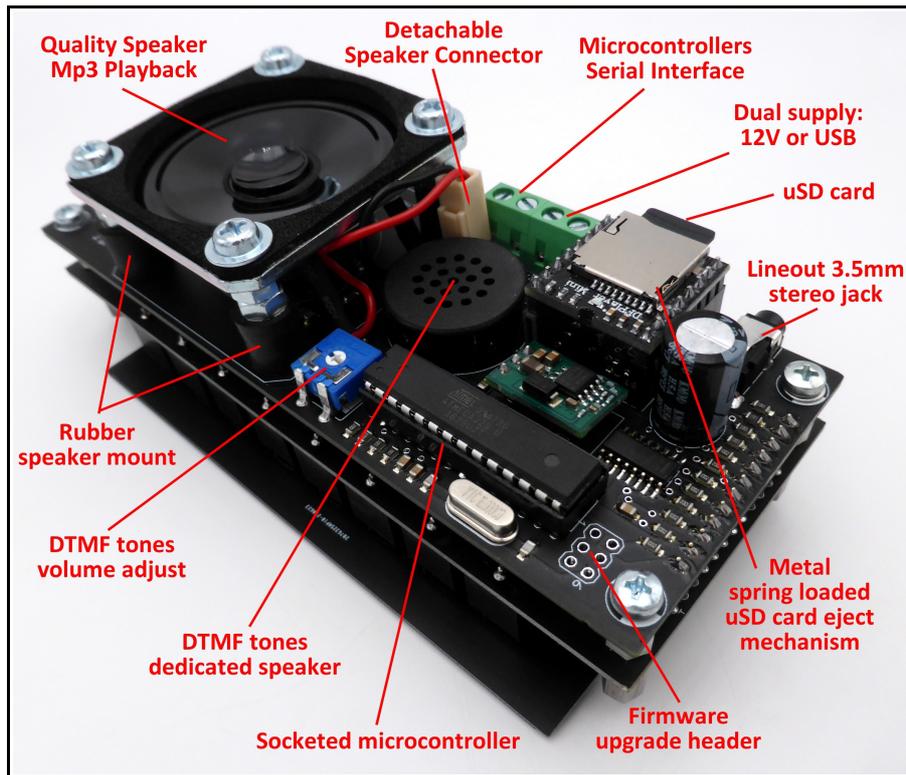


<http://www.ideegeniali.it/spacemat>



This user manual applies to hardware revision 2.6
If you have hardware revision 2.0 2.1 2.2 2.3 2.4 2.5 please download other manual.

Features



Coding spacemat has **32 working buttons**, with screen-accurate **screen printed** white lettering, and screen-accurate overlay. Colored stripes on overlay are not digital prints, but **high quality UV-Resistant vinyl**, shop sign outdoor grade, which won't fade over time.

Dual supply: USB-Powered or 12VDC (or both!) with auto-detect.

Mp3 player with uSD card and internal audio amplifier and high quality and generous sized speaker. There is also a 3.5mm jack stereo line-out for external audio amplifier. Load your mp3 files in the uSD card. uSD card included.

USB Keyboard: the keystrokes are the alphabet and arrow keys by factory defaults. You can assign any other key, including modifiers (ctrl, alt, shift, win), function keys, special keys, multimedia keys. No driver is required for HID devices as USB keyboard. Plug n play without driver for any operating system: Windows, Linux, Mac, Android. USB Connector type B (USB A/B cable not included).

DTMF tones playback. Dedicated speaker: can play mp3 and dtmf at the same time. Top half of spacemat will emit the same tone for the same key, as a telephone keyboard. Botto half of spacemat will emit random DTMF tones to go wild. Set dtmf tones volume by trimmer.

Serial output. Interface to microcontroller boards like arduino, raspberry pi and alike

Mechanical spacers, screws, washers, nuts all included and pre-assembled.
Special spacers with rubber to mount the speaker preserving audio quality.

Advanced users can use just the pcb with the matrix of pushbutton, without Mp3, USB keyboard or Dtmf, and attach to self-built electronics or microcontrollers boards.

Dual supply

Spacemat (hardware revision 2.6) supports several power supply modes:

- 1) Self-powered from USB cable: just plug the USB cable, and the spacemat will draw power from host;
- 2) 12VDC power supply input into +12V and GND screw terminals;
- 3) You can also connect both 12VDC power supplies and USB cable at the same time, Spacemat will auto-detected which supply(s) is(are) present, and use it(them).
However, we recommend using either USB power or 12V power, but not both at the same time.

BEWARE: GND is short-circuited inside spacemat and put in common between 12V (GND screw terminal) and USB ground. Usually this is OK, but if for any reason you have USB ground at a different voltage level than car ground, you cannot connect spacemat to both supplies at the same time.

BEWARE: Dual supply only applies to spacemat hardware revision 2.6

If you have hardware revision 2.0 2.1 2.2 2.3 2.4 or 2.5, they only support USB-power and they **DO NOT SUPPORT** 12V power. NEVER attach 12VDC to a 2.0 2.1 2.2 2.3 2.4 or 2.5 revision board.

Select mode

Spacemat has 5 modes of operations

- 1) MP3 playback, FILES
- 2) MP3 playback, FOLDERS
- 3) USB Keyboard
- 4) DTMF playback
- 5) SERIAL output

Select mode any time by pressing these 2 buttons combo on spacemat.

The two buttons must be pressed at the same time, not one after the other.

Mp3 Files	Mp3 Folders	USB Keyboard	DTMF	Serial
<i>Select Mp3 Playback <u>files</u> mode</i>	<i>Select Mp3 Playback <u>folders</u> mode</i>	<i>Select <u>USB</u> Keyboard mode</i>	<i>Select <u>DTMF</u> Playback mode</i>	<i>Select <u>Serial</u> Output mode</i>

Spacemat will remember and start in last mode when shut off and powered up again.

Mp3 files

Mp3 files are on a uSD card. If you want to replace the mp3 files with other ones, you must remove the uSD card from the spacemat, edit the files with a PC, and insert the uSD card again in the spacemat.

The uSD card socket is push-to-extract kind. Gently push on the uSD card: a spring-loaded mechanism will eject the uSD card. You can now edit uSD card contents with your PC, tablet or smartphone. You need a PC, smartphone, tablet with uSD card slot, or add-on third parties uSD card reader.

Please find a folder named 01 on the uSD card. If there is no folder named 01, create it. Inside the folder, copy mp3 files and rename them to 001.mp3 002.mp3 003.mp3 etcetera, up to 032.mp3.

That's 32 mp3 files (named from 001.mp3 to 032.mp3) for the 32 buttons of the spacemat.

The buttons are numbered and associated with mp3 files as follows:

001.mp3	009.mp3	017.mp3	025.mp3
002.mp3	010.mp3	018.mp3	026.mp3
003.mp3	011.mp3	019.mp3	027.mp3
004.mp3	012.mp3	020.mp3	028.mp3
005.mp3	013.mp3	021.mp3	029.mp3
006.mp3	014.mp3	022.mp3	030.mp3
007.mp3	015.mp3	023.mp3	031.mp3
008.mp3	016.mp3	024.mp3	032.mp3

*Which mp3 file will play
for each spacemat button*

If you would like some buttons to play no mp3 files, just skip that file. E.g. if you want key 23 to play nothing, just delete 023.mp3 file. If there is no 023.mp3 file, the spacemat will play no mp3 file when pressing button 23.

If you want descriptive names for the files, you can add the descriptive name after the first three characters. E.g. if 004.mp3 says “Welcome Michael”, you can rename the file to “004 welcome.mp3”. Spacemat will look at first three numerical characters of the file name, and ignore remainder.

Mp3 folders

You can have up to 32 folders with up to 32 mp3 files each. To choose folders instead of choosing files, select Mp3 Folders mode. The keys from 1 to 32 will select folder from 01 to 32 to play mp3 files from.

The track# in that folder will play as you choose different folders. E.g. if you last played track #5 in a folder, selecting folders mode and pressing the buttons will listen to track#5 in the different folders.

After selecting the folder you like, don't forget to select back mp3 files mode (instead of mp3 folders mode) to then be able to play other mp3 files in that folder, instead of changing folder again.

Mp3 Volume

Press these keys combinations to increase / decrease listening volume.
There exist 30 steps of volume. Step 0 is muted.

Volume UP	Volume DOWN																																																																								
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		3	4																																																																						
<i>Increase mp3 volume</i>	<i>Decrease mp3 volume</i>																																																																								

Volume is not preserved when removing and applying power again.

Internal speaker and LineOut

Mp3 playback is relayed to a quality and generous dimensions monophonic internal speaker, driven by an internal monophonic audio amplifier.

If you prefer using your audio amplifier and speaker, and/or need stereo mp3 playback, please find the 3,5mm stereo jack socket. Connect a jack 3.5mm stereo to 2x RCA plugs (usually found as audio inputs in car audio plants). Or a jack 3.5mm to jack 3.5mm (found as AUX input on some other car audio plants). These cables are not included in the scope of delivery or spacemat: please source yourself proper cable for your plant at third parties.

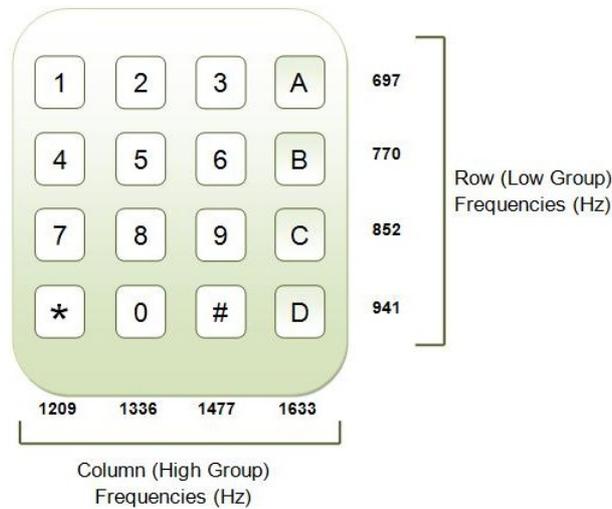
The lineout on jack 3.5mm will work regardless if internal speaker is connected or not. You can use both internal audio amplifier & speaker and external lineout. If you do not want the internal speaker, just disconnect it: it is on a connector and can be plugged and unplugged from the spacemat at wish.

BEWARE: Spacemat board short-circuits and puts in common, lineout ground to board ground to car GND ground and USB ground. This is usually OK. If for any reason you have audio equipment ground at a different level than car ground and/or usb ground, you CANNOT connect lineout to your audio equipment directly. Risk damage to usb, car plant, spacemat, audio equipment and fire hazard. You may use a third party audio isolation box in between spacemat lineout and audio linein.

BEWARE: by connecting lineout ground to audio equipment input ground, depending on remainder of your audio circuit, you may or may not create a ground loop and cause noise. If that's the case, you may want to remove ground wire from lineout cable and/or use a third party audio isolator.

DTMF tones

DTMF tones are played from a dedicated and separated speaker than mp3 files on the spacemat. There is a trimmer to adjust volume. Operating range for the trimmer is first half of scale (from 8 o'clock to 12 o'clock). Second half of scale is too loud, will distort and possibly even damage speaker. We recommend "10 o'clock" setting for the dtmf volume trimmer. Do not exaggerate.



DTMF stands for Dual Tone Multi Frequency, and is a telephony standard widely used during 70es, 80es and 90es, and still today. It was used a lot for Knight Rider TV-Show. Telephones used 12 keys out of the 16 of the standard. Ideegeniali spacemat supports the whole 16 keys of the standard. Each key plays two frequencies at the same time, hence the name of the standard: dual tone, multi frequency. The spacemat is actually generating two frequencies with hardware synth and analogue mixing them together, then analogue amplify them and reproduce on the speaker. This is not mp3 playback of prerecorded dtmf tones, but live hardware synthesis.

Top half of the spacemat will emit a specific dtmf tone, as a telephone keyboard would do. Bottom half of the spacemat will emit random dtmf tones

1	2	3	A
4	5	6	B
7	8	9	C
*	0	#	D
Random	Random	Random	Random
Random	Random	Random	Random
Random	Random	Random	Random
Random	Random	Random	Random

DTMF playback

USB Keyboard

The USB keyboard requires no driver in any operating system, it's ready to work as soon as plugged it. The 32 buttons are arranged in 8 rows by 4 columns. Factory setting gives these assignments:

A	I	Q	Y
B	J	R	Z
C	K	S	SPACE
D	L	T	BACKSPACE
E	M	U	LEFT ARROW
F	N	V	UP ARROW
G	O	W	DOWN ARROW
H	P	X	RIGHT ARROW

Factory settings for keys assignments

Restore factory assignment predefined keys

If by chance you get really messed up with keys assignments (see below) you may restore coding spacemat to factory settings, by following this procedure:

- 1) unplug/power-down the coding spacemat
- 2) connect back to USB port the coding spacemat while holding down the last two buttons of the first column (seventh and eighth row, first column, marked R6 R7 and C0). The two buttons to hold while powering up, are marked with a X on the scheme on the right
- 3) factory settings are already restored, and you may use the device with the factory assignment for keys

G			
H			

Restore factory settings

Reprogramming USB Keys

- 1) Open the notepad on PC, and keep it open and focused on a new, empty document.
- 2) If plugged, unplug the coding spacemat from USB port
- 3) Plug-in/power-up the coding spacemat while holding down the first two keys of the first column (that's first and second row, first column, marked R0 R1 and C0). The two buttons are marked with a X on the scheme on the right
- 4) As soon as the USB connector is plugged in, you may release the buttons
- 5) Now wait 5 seconds while on the PC you still have notepad open on an empty document
- 6) While in programming mode, the coding spacemat will send keystrokes to PC to show messages on screen, guiding the reprogramming process. User must respond to each request by pressing the correct buttons in the correct sequence on the coding spacemat
- 7) When you're done with programming, just unplug the USB cable
- 8) Plug it back in to use the coding with the newly programmed codes as a keyboard

A			
B			

Keys to hold down to enter programming mode

Let's pretend we don't like that the first row buttons are assigned to keys A I Q Y and we prefer PAGEUP, ALT+F4, MUTE and WINDOWS+D. Needless to say, ALT+F4 will close current application, MUTE will turn audio on and off, WINDOWS+D will show desktop on a windows PC.

As soon as the coding spacemat enters programming mode, it will propose on notepad the request KEY and wants to know which button is to be redefined.

In response to KEY request, we will press the button in the upper left corner, which was previously assigned to key A, but we want to redefine to PAGEUP.

KEY

X			

Let's redefine this key

As soon as the key is pressed, the spacemat asks us the first part of the code by outputting NEW1 on notepad. Since we want to assign PAGEUP, let's look on the Scan Code Table, which code is for PAGEUP. We find out that the code is 4B. First digit of code is 4, second digit B.

To NEW1 request we must reply 4, by pressing the button associated with 4 on the coding spacemat, look at the scheme on the right. That's the fifth button on the first column. It's in Bold in the scheme. So press this button.

We can instead abort reprogramming this key by pressing the lower right button marked X. If we press the abort key, spacemat will go to KEY request again.

NEW1

0	8		
1	9		
2	A		
3	B		
4	C		
5	D		
6	E		
7	F		X

First digit of code

At subsequent request NEW2 must respond with B, the second digit of the code. Look at the scheme again, B is in bold in the scheme on the right. So we must press the button in the fourth row, second column.

We can instead abort reprogramming this key by pressing the lower right button marked X. If we press the abort key, spacemat will go to KEY request again.

NEW2

0	8		
1	9		
2	A		
3	B		
4	C		
5	D		
6	E		
7	F		X

Second digit of code

Then the coding spacemat will ask if we want to insert any modifier (CTRL, ALT, SHIFT, WINDOWS). We don't want for this key, so when asked MOD we'll reply pressing the key in the upper left corner, corresponding to 0: None. If we wanted a CTRL+PAGEUP we instead would press the key on second row on first column, and so on. Pressing lower right button marked X will abort instead.

MOD

0: None	8: WIN		
1: CTRL	9: WIN+CTRL		
2: SHIFT	A: WIN+SHIFT		
3: CTRL+SHIFT	B: WIN+CTRL+SHIFT		
4: ALT	C: WIN+ALT		
5: CTRL+ALT	D: WIN+CTRL+ALT		
6: ALT+SHIFT	E: WIN+ALT+SHIFT		
7: CTRL+ALT+SHIFT	F: WIN+CTRL+ALT+SHIFT		X

Available modifiers

Key is redefined. Spacemat will tell us DONE to confirm we're done with this key.

Coding spacemat will just start proposing to modify another key, by outputting KEY again. So we can repeat the process for the second key (KEY), it was factory defaults to B, but we don't like B any more, and we prefer ALT+F4. The scan code for the "F4 function key" is 3D. So first digit is 3 (NEW1) and second digit is D (NEW2). As modifier (MOD) this time we want ALT, so we'll press the 4:ALT when asked for MOD. To reprogram second key for ALT+F4, we must do these 4 button presses, in this order:

<p>KEY</p> <table border="1"> <tr><td></td><td>X</td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </table> <p><i>Let's redefine second key</i></p>		X																															<p>NEW1</p> <table border="1"> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </table> <p><i>First digit of scan code</i></p>									3																								<p>NEW2</p> <table border="1"> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td>D</td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </table> <p><i>Second digit of scan code</i></p>																							D										<p>MOD</p> <table border="1"> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </table> <p><i>Modifier for ALT</i></p>																									4							
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Not to mess up or get wrong with programming, let's take note of the codes we want to input before starting the programming sequence itself. For our example, we wanted to assign PAGEUP to first key. PAGEUP has scan code 4B, therefore we will write 4 and B in the first key zone and 0 as MOD (modifier) in the zone for the first key in this table. Follows 3D (scan code for "function key F4") and modifier 4 (for ALT) for second key. Then to the third key we want to assign MUTE: scan code is 7F and modifier is 0 (no modifiers). And then we assign "D" (which has code 07) and modifier 7 (Windows key) to assign WIN+D to fourth key. Complete the table by writing down with a pen what you want to assign, then use the table while programming as quick-reference of what to enter as NEW1 NEW2 MOD and DTMF for each key to redefine.

New1	New2	Mod									
4	B	0	3	D	4	7	F	0	0	7	7

When you're done inputting keys, you must unplug the coding spacemat from USB port to exit programming mode. Plug it in again to use with the freshly programmed key. If you mess up with one or a few key, just reprogram those. If you mess up with a lot of keys, and want to restore factory settings, refer to "Restore factory assigned predefined keys" paragraph.

Here is one empty tables for you: just photocopy or printout this page, and note down your preferred assignment for the 32 keys.

New1	New2	Mod									

Let's repeat the scheme for the input of KEY NEW1 NEW2 and MOD

KEY

*Choose the button
you want to modify/reassign
by pressing it*

<p>NEW1</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>0</td><td>8</td><td></td><td></td></tr> <tr><td>1</td><td>9</td><td></td><td></td></tr> <tr><td>2</td><td>A</td><td></td><td></td></tr> <tr><td>3</td><td>B</td><td></td><td></td></tr> <tr><td>4</td><td>C</td><td></td><td></td></tr> <tr><td>5</td><td>D</td><td></td><td></td></tr> <tr><td>6</td><td>E</td><td></td><td></td></tr> <tr><td>7</td><td>F</td><td></td><td>X</td></tr> </table> <p style="text-align: center;"><i>First digit of scan code or X to abort</i></p>	0	8			1	9			2	A			3	B			4	C			5	D			6	E			7	F		X	<p>NEW2</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>0</td><td>8</td><td></td><td></td></tr> <tr><td>1</td><td>9</td><td></td><td></td></tr> <tr><td>2</td><td>A</td><td></td><td></td></tr> <tr><td>3</td><td>B</td><td></td><td></td></tr> <tr><td>4</td><td>C</td><td></td><td></td></tr> <tr><td>5</td><td>D</td><td></td><td></td></tr> <tr><td>6</td><td>E</td><td></td><td></td></tr> <tr><td>7</td><td>F</td><td></td><td>X</td></tr> </table> <p style="text-align: center;"><i>Second digit of scan code or X to abort</i></p>	0	8			1	9			2	A			3	B			4	C			5	D			6	E			7	F		X
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MOD

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2: SHIFT	A: WIN+SHIFT		
3: CTRL+SHIFT	B: WIN+CTRL+SHIFT		
4: ALT	C: WIN+ALT		
5: CTRL+ALT	D: WIN+CTRL+ALT		
6: ALT+SHIFT	E: WIN+ALT+SHIFT		
7: CTRL+ALT+SHIFT	F: WIN+CTRL+ALT+SHIFT		X

*Modifiers table
or X to abort*

List of scan codes

00	No USB KeyStroke	2B	TAB	54	KEYPAD /	7D	KB PASTE
		2C	SPACE	55	KEYPAD *	7E	KB FIND
04	a A	2D	- _ ' ?	56	KEYPAD -	7F	KB MUTE
05	b B	2E	= + ` ^	57	KEYPAD +	80	KB VOLUME UP
06	c C	2F	[ { ` € [	58	KEYPAD ENTER	81	KB VOLUME DOWN
07	d D	30	] } + * ]	59	KEYPAD 1 END	82	KB LOCKING CAPS
08	e E	31	\ | ` §	5A	KEYPAD 2 DOWN	83	KB LOCKING NUM
09	f F	32	EUR1 ` §	5B	KEYPAD 3 PGDOWN	84	KB LOCKING SCROLL
0A	g G	33	; : ` ç @	5C	KEYPAD 4 LEFT	85	KEYPAD . BRAZIL
0B	h H	34	' " ` ° #	5D	KEYPAD 5	86	KB =
0C	i I	35	` ~ \ |	5E	KEYPAD 6 RIGHT	87	INT'L1 "Ro"
0D	j J	36	, < , ;	5F	KEYPAD 7 HOME	88	INT'L2 "Katakana"
0E	k K	37	. > . :	60	KEYPAD 8 UP	89	INT'L3 "Yen"
0F	l L	38	/ ? - _	61	KEYPAD 9 PGUP	8A	INT'L4 "Henkan"
10	m M	39	CAPS LOCK	62	KEYPAD 0 INSERT	8B	INT'L5 "Hiragana"
11	n N	3A	F1	63	KEYPAD . DELETE	8C	INT'L6 "Furigana"
12	o O	3B	F2	64	EUR2 < >	8D	INT'L7 "Kanji"
13	p P	3C	F3	65	APP	8E	INT'L8
14	q Q	3D	F4	66	KB POWER	8F	INT'L9
15	r R	3E	F5	67	KEYPAD =	90	LANG1 English
16	s S	3F	F6	68	F13	91	LANG2 Hanja
17	t T	40	F7	69	F14	92	LANG3 Katakana
18	u U	41	F8	6A	F15	93	LANG4 Hiragana
19	v V	42	F9	6B	F16	94	LANG5 Zenkaku
1A	w W	43	F10	6C	F17	95	LANG6
1B	x X	44	F11	6D	F18	96	LANG7
1C	y Y	45	F12	6E	F19	97	LANG8
1D	z Z	46	PRINT SCREEN	6F	F20	98	LANG9
1E	! !	47	SCROLL LOCK	70	F21	99	KB ERASE
1F	2 @ 2 "	48	PAUSE	71	F22	9A	KB SYSREQ
20	3 # 3 £	49	INSERT	72	F23	9B	KB CANCEL
21	4 \$ 4 \$	4A	HOME	73	F24	9C	KB CLEAR
22	5 % 5 %	4B	PAGE UP	74	KB EXECUTE	9D	KB PRIOR
23	6 ^ 6 &	4C	DELETE	75	KB HELP	9E	KB RETURN
24	7 & 7 /	4D	END	76	KB MENU	9F	KB SEPARATOR
25	8 * 8 (	4E	PAGE DOWN	77	KB SELECT	A0	KB OUT
26	9 (9)	4F	RIGHT ARROW	78	KB STOP	A1	KB OPER
27	0) 0 =	50	LEFT ARROW	79	KB AGAIN	A2	KB CLEAR/AGAIN
28	RETURN	51	DOWN ARROW	7A	KB UNDO	A3	KB CRSEL/PROPS
29	ESC	52	UP ARROW	7B	KB CUT	A4	KB EXSEL/SETUP
2A	BACKSPACE	53	NUM LOCK	7C	KB COPY		

In the table you find the standard keys (A B C D), special keys (TAB, ESC), multimedia keys found on multimedia keyboards (VOLUME UP, VOLUME DOWN, MUTE), and keys you hardly find on commercial keyboards (F13, F14, F15, KB SELECT, KB AGAIN) but you may still program these keys in, and have your PC receive them out, to use in your own software or commercial "system hot-keys" software to activate various functions without messing up with "common" keystrokes.

Not all software or o.s. will recognize all USB scan codes.

Program 00 if you want a button to emit no USB keystroke at all.

Serial output

Spacemat features a Serial output on TX screw terminal. 57600 baud, 8-N-1, 5V levels. You can connect a serial input line of a micro-controller board such as arduino uno, arduino mega, raspberry pi, ESP8266, or any other.

GND must be in common between micro-controller and Spacemat.

1) If both micro-controller and spacemat have supply derived from the same source, you already have GND in common and no extra GND connection is needed.

2) If spacemat supply GND is floating Vs your micro-controller GND, connect a 100ohm resistor between spacemat GND and micro-controller GND to place them to the same electrical potential.

3) If spacemat supply GND and micro-controller GND are driven to different voltage potential, because of your power supply configuration, you cannot connect spacemat to your microcontroller. You would damage spacemat, microcontroller, power supplies, host PC USB port, car plant, and could also get a fire hazard. You must use third party optoisolators or digital isolators in between.

If unsure, DO NOT CONNECT spacemat to your micro-controller.

Spacemat uses 5V levels. Common micro-controller use 3V3 or 5V levels.

You can attach 5V micro-controllers (e.g. Arduino UNO) directly.

Spacemat TX to arduino RX -> and use Serial

Spacemat TX to any arduino digital pin -> and use softwareSerial.

You can also attach 3V3 micro-controllers, with explicit 5V tolerant inputs, directly.

If you attach a 3V3 micro-controller (e.g. Raspberry PI, Arduino Mega, ESP8266), you need a level shifter. Since this is a monodirectional transmission from spacemat to micro-controller, you can use two resistors, connected as voltage divider, as level shifter. On the spacemat board there is already an output 1k series resistor on TX screw terminal, so you only need to add another external 1k8 resistor between TX and GND.

Each time you press a button on spacemat, spacemat will send a single character to the serial link. The ASCII character sent by each button are as follow:

64 0x40 '@'	72 0x48 'H'	80 0x50 'P'	88 0x58 'X'
65 0x41 'A'	73 0x49 'I'	81 0x51 'Q'	89 0x59 'Y'
66 0x42 'B'	74 0x4a 'J'	82 0x52 'R'	90 0x5a 'Z'
67 0x43 'C'	75 0x4b 'K'	83 0x53 'S'	91 0x5b '['
68 0x44 'D'	76 0x4c 'L'	84 0x54 'T'	92 0x5c '\'
69 0x45 'E'	77 0x4d 'M'	85 0x55 'U'	93 0x5d ']'
70 0x46 'F'	78 0x4e 'N'	86 0x56 'V'	94 0x5e '^'
71 0x47 'G'	79 0x4f 'O'	87 0x57 'W'	95 0x5f '_'

ASCII char outputting on Serial TX

Tinker with hardware matrix

The complete spacemat is a sandwich of two electronic boards. One with the buttons electrically connected in a matrix, and the other with all the advanced functionalities. A stripped down version of spacemat, buttons matrix only, is available. You have the rows and columns available on a 12 pins female connectors one tenth of an inch spacing.

The 12 ways connector is marked R0 R1 R2 R3 R4 R5 R6 R7 C0 C1 C2 C3 which stands for rows from 0 to 7 (8 rows in total) and columns from 0 to 3 (four columns in total). Each button will connect a row with a column while pressed down. Buttons are connected in a matrix, as most keyboard are.

This can be used:

1) as a pressable spacemat, with no functionalities except decorative one.

The buttons will still mechanically “click” when pressing on them.

If you're not looking for electronic functionalities, but just the aesthetics of KITT, that's an option.

2) attach to your micro-controller boards by designing your own circuits and read a buttons matrix. On the spacemat 1k series resistors are provided for each row and column, so the risk of damaging buttons (short-circuit!) by mistake is reduced.

If you need lower ohm, replace the 1k resistors with 100ohm resistors.

You can also remove resistors altogether and put drop of solders shorting the resistors pads if you need zero series resistance and just the buttons internal resistance in your circuit.

Beware of not frying the buttons by attaching power supply directly if you do so (short circuit!).

3) you can connect all rows electrically together, and all columns electrically together.

Then any button will just act by closing the very same contact, and all buttons exhibit same behaviour in your circuit as if it was a single button. You don't need to program micro-controller to use stripped down spacemat as a single pushbutton.

4) you can connect all columns together, mark that connection “C” common. And use 8 separate rows column, already marked R0 R1 R2 R3 R4 R5 R6 R7. You can use this setup to connect to any electronic board that supports multiple pushbuttons inputs, and need a common connection. There exist Mp4 (video) player boards that support this that you can attach this way. You will have 8 different buttons recognized: that is, all buttons on the same row will exhibit same behaviour, because columns are all connected together electrically.