Description of the communication protocol for the Positive Grid Spark amplifiers

By Paul Hamshere with a great acknowledgement to Yury Tsybizov (ytsibizov) and Justin Nelson (jrnelson). Thanks to Ian McKellar for pointing out the MIDI SysEx similarity and that the packed data format is msgpack (www.msgpack.org)

Overview of communication

The Spark amplifiers communicate with the Spark app over Bluetooth. It uses 'serial bluetooth' or 'classic bluetooth' for the Android app and 'BLE' for iOS.

The app sends messages to change preset, change an effect, change the parameter for an effect (eg gain). It can also request the details of each hardware preset, the name of the amp and the serial number.

In return, the amp will send messages when one of the presets is changed or when a knob is moved. This allows the app to mimic the settings on the amp at all points.

When the app starts, it asks the Spark for its name, serial number and all four hardware presets.

Then communication is event driven – either from the app or the amp.

Overview of message format

The bluetooth messages are exchanged in a specific data format. The terminology below is one I created to help understand the underlying structure.

Messages are exchanged in blocks. Each block contains one or more chunks. Each chunk contains data – which is all, or part of, the message.

Blocks and chunks appear to have size limits which means: messages span chunks, and chunks span blocks.

The simple messages are from the app to the amp, and are usually just one block, one chunk and the data.

Sending a preset, or receiving a preset, is more complex and involves multiple blocks and chunks.

Figure 1 shows the relationship between the blocks, chunks and data that make up the message.

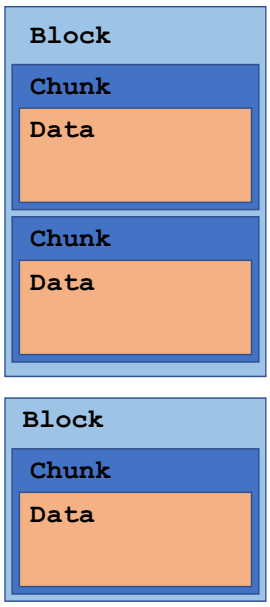


Figure 1

When the app sends a message then the Spark (usually) responds with an acknowledgement message.

Blocks sent to the amp seem to have a maximum size of 0xad.

Blocks sent from the amp seem to have a maximum size of 0x6a.

Block format

Each block has a header and then contains the chunk / data.

Offset	Length	Description
0	4	0x01fe0000
4	2	Direction of the message: 0x41ff – from Spark 0x53fe – to Spark
6	1	Size of this block (including this header)
7	9	Zeros
10		The chunk / data

Figure 2 shows an example of a block header.

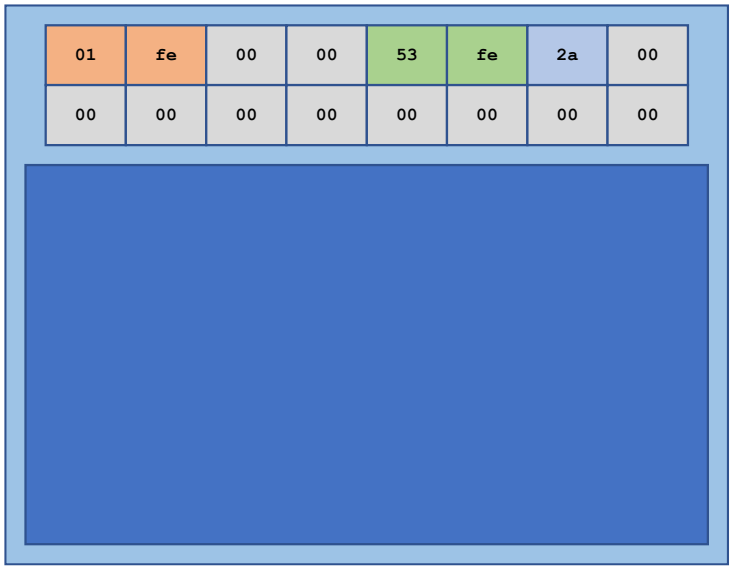


Figure 2

Chunk format

Offset (in block)	Length	Description
10	2	0xf001
12	1	Sequence number
13	1	Checksum (8 bit Xor)
14	1	Command
15	1	Sub-command
16		Data
	1	0xf7

The chunk starts with fixed bytes of 0xf001 and ends with the byte 0xf7. This is very like the MIDI SysEx wrapper of 0xf0 and 0xf7.

The header includes a sequence number which increments with each message (so it remains consistent across chunks and blocks for the same message). When the amp acknowledges a message it contains the sequence number in the acknowledgement message.

The checksum is an 8-bit xor checksum of the data part – it excludes the chunk header and the f7 trailer.

The command and sub-command describe what the change is to the amp or from the amp (eg change gain on the amp model).

Figure 3 shows a block header, chunk header and trailer.

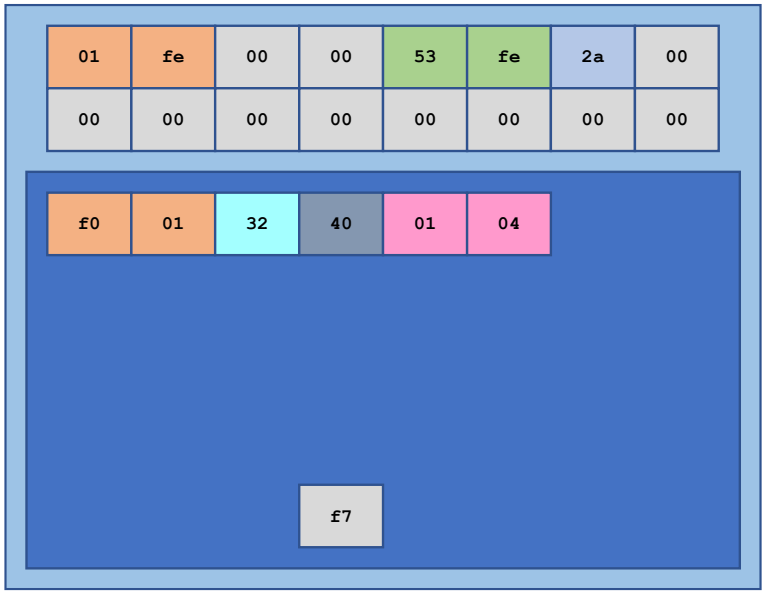


Figure 3

Data format

The message is a sequence of variables. Each variable has a distinct pattern which identifies it.

The variables are stored in the data section in sequences of 8 bytes. In the data section bytes have the top bit set to zero, so only carry 7 bits of data. The remaining 8th bit is packed into another byte which only contains the 8th bit of each of the bytes in the sequence.

So the format is the special byte containing the 8th bits, followed by seven data bytes.

Figure 4 shows the structure of the sequence – the '8th bits' byte followed by up to 7 data bytes.

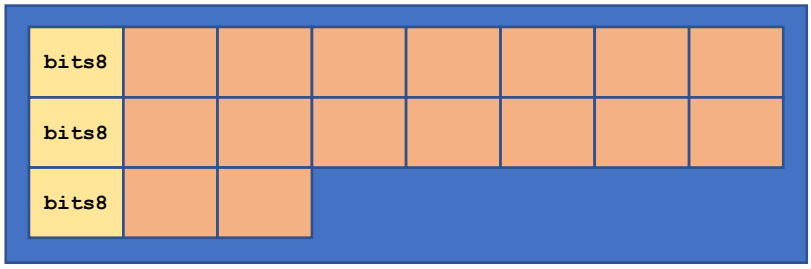


Figure 4

Figure 3 shows an example of the mapping for the missing 8th bit. In this example, the data in the fourth data byte in the first sequence should have its 8th bit added back (represented by bit 3 being set in the '8th bits' byte. And the same for the third and sixth bytes in the second sequence (bits 2 and 5 set in the '8th bits' byte.

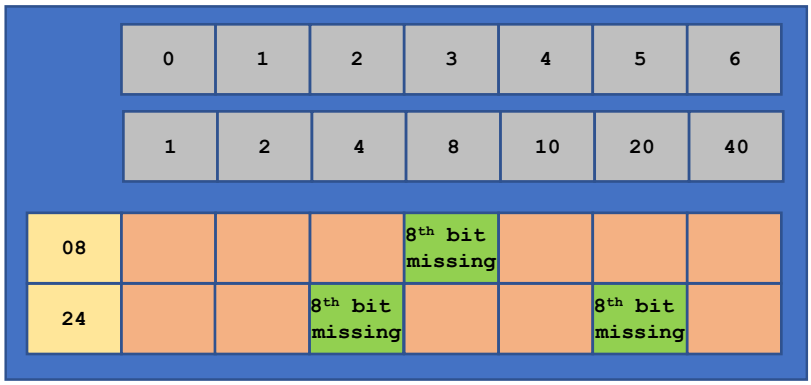


Figure 5

To interpret the data it is therefore essential to add back these bits.

Overall structure

Figure 6 shows a representation of the overall structure, including headers, trailers and format bytes. Figure 7 shows an example of the headers and footers.

These both show a single block / single chunk message and summarise the description so far.

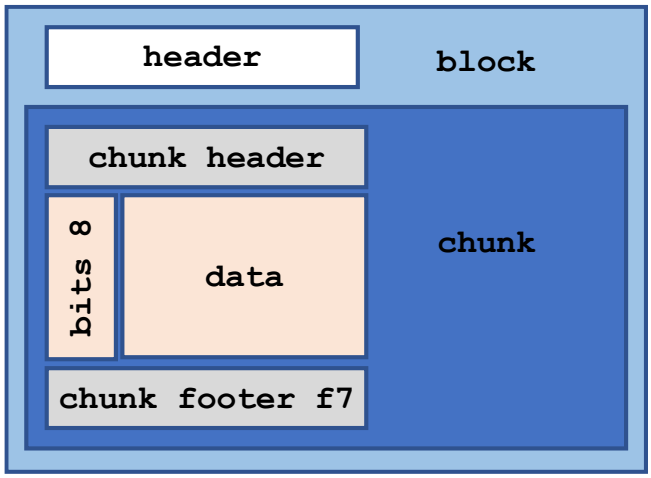


Figure 6

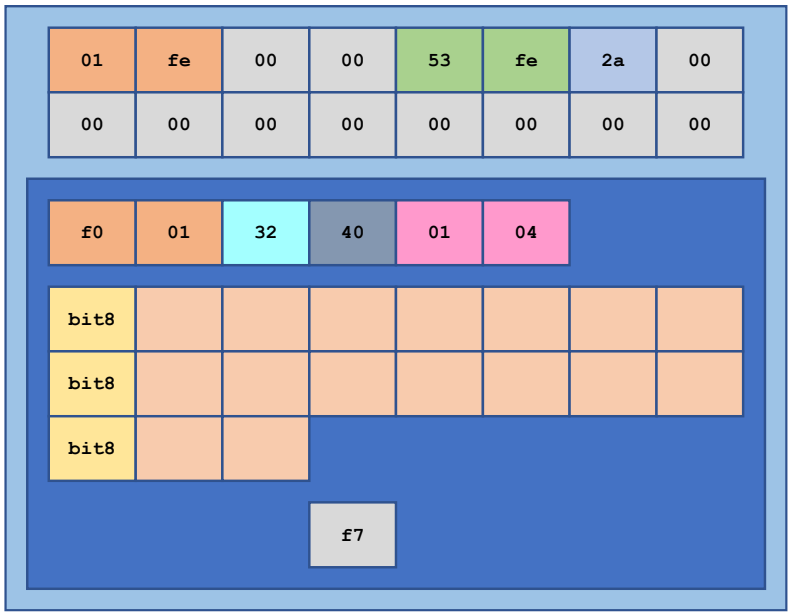


Figure 7

Variable types

The data format is based on msgpack (www.msgpack.org).

The data in the message is a set of variables – integers, strings, Booleans and floating-point values.

Type	Length	Description	First byte range
Short Integer	1	Data value from 0x00 to 0x07f. How is this distinguished from 0x00 as the start of an integer. How is this distinguished from the first byte of the alternative short string?	0x00 – 0x7f
Integer	2	Data value from 0x80 to 0xff. Prefixed by 0xcc.	0xcc 0x80 – 0xff
Fixed array size	n+1	Data value from 0x00 to 0x0f, stored as data value + 0x90.	Ox90 -0x9f
Short string (1-31 characters)	n+1	First byte is the length + 0xa0, then the bytes of the string in ASCII encoding	0xa0 – 0xbf
Alternative short string (1-31 characters)	n+2	First byte is the length, next byte is the length + 0xa0, then the bytes of the string in ASCII encoding (Unsure if this is limited to 15 characters but it would be logical given the apparent use of the first byte to describe the data type.)	0x01 – 0x1f
Long string	n+2	First byte is 0xd9, then the length, then the bytes of the string	0xd9
Boolean Off	1	A single byte representing effect Off	0xc2
Boolean On	1	A single byte representing effect On	0xc3
Float	5	A float value – 4 bytes big endian with a preceding byte of 0xca	0xca

Figure 8 shows these data types in a visual format

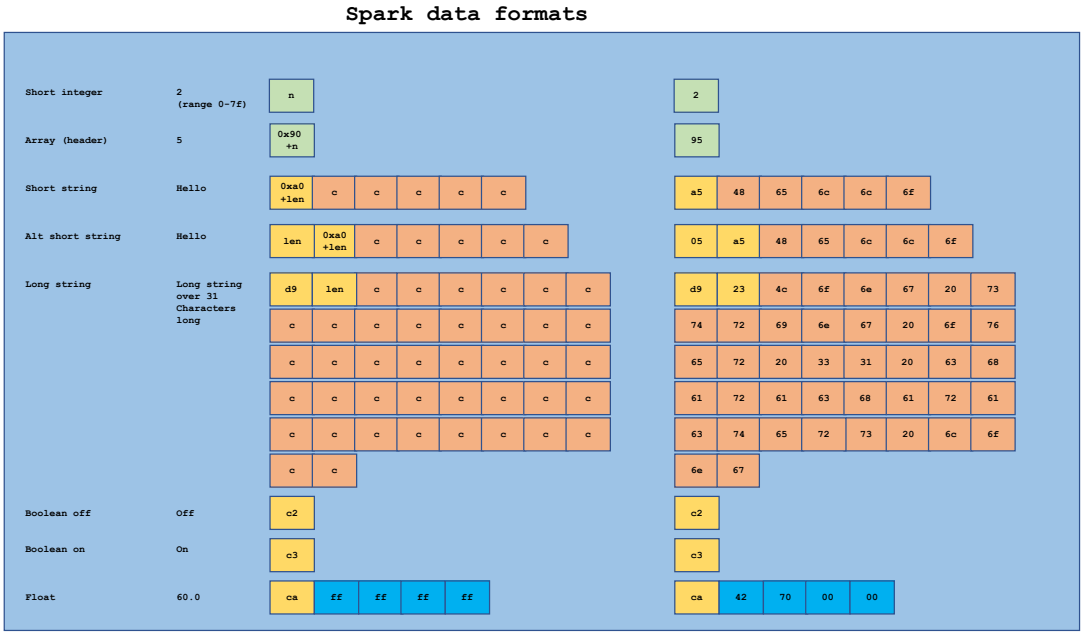


Figure 8

Figure 9 shows a completed message, with all headers, footers, data and format bytes.

This is data with a string "LA2AComp", a short integer of 1 and a float represented by 0x3f4d42c4 (with the 8th bit added back to the final 0x44)

Figure 9

Figure 10 shows this with explanatory labelling.

Figure 10

Float representation

Floats are based on the 4-byte IEEE-754 encoding. (As with all the other data section formats, the bytes are 7-bit only and the missing 8th bits are in the first byte of any 8 byte sequence.)

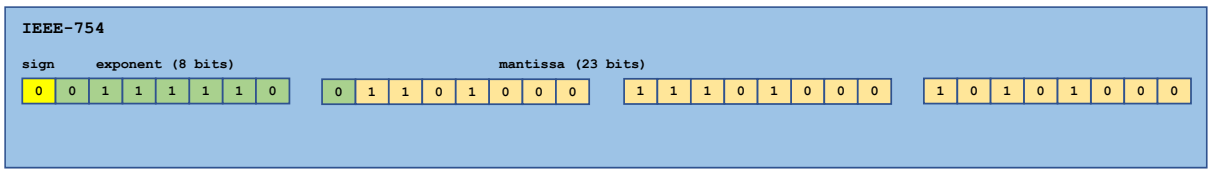


Figure 11

Special values are shown below

Effects with toggle switches (such as Multi Head delay)

Hex	Float	Special meaning
00 00 00 00	0.0	False (for a toggle switch)
3f 80 00 00	1.0	True (for a toggle switch)

Digital delay

Hex	Float	Special meaning
3f 38 51 ec	0.72	1s
3f 19 99 9a	0.60	500ms
3e cc cc cd	0.40	200ms
3e 99 99 9a	0.30	50ms

Multi Head delay

Hex	Float	Special meaning
00 00 00 00	0.00	Head 0 + 2
3e b3 33 33	0.35	Head 0 + 1
3f 26 66 66	0.65	Head 1 + 2
3f 73 33 33	0.95	Head 0 + 1 + 2

Messages that span chunks and blocks

The only messages large enough to span multiple chunks and blocks are those sending a complete preset, either to or from the amp. They can be identified by the command and sub-command (see later).

In these cases, the first three bytes of the data (after the format byte) represent which sub-chunk this is.

The size of the chunks and the data in these bytes depends on the direction of the message.

Multi-chunk messages sent to the amp

In this case, whilst the message spans multiple chunks, each chunk fills a block. The maximum sending block size is 0xad bytes, so the size of the chunk is 0x9b.

This is calculated as block size – block header – chunk header – chunk trailer (0xad – 0x10 – 0x06 – 0x01 = 0x9b)

The first four bytes of the chunk data are as in the table below - representing the format byte and the multi-chunk sub-header.

Offset (in chunk)	Length	Description
6	1	First '8th bits' byte
7	1	Total number of chunks
8	1	Reference number of this chunk (0 to total number of chunks – 1)
9	1	Size of this chunk (in data bytes which therefore excludes counting the '8th bit' bytes, max 0x80)

The number of data bytes remaining is a count of useful data bytes - total bytes less the '8th bit' bytes.

Figure 12 shows the overall structure of a multi-chunk message sent to the amp.

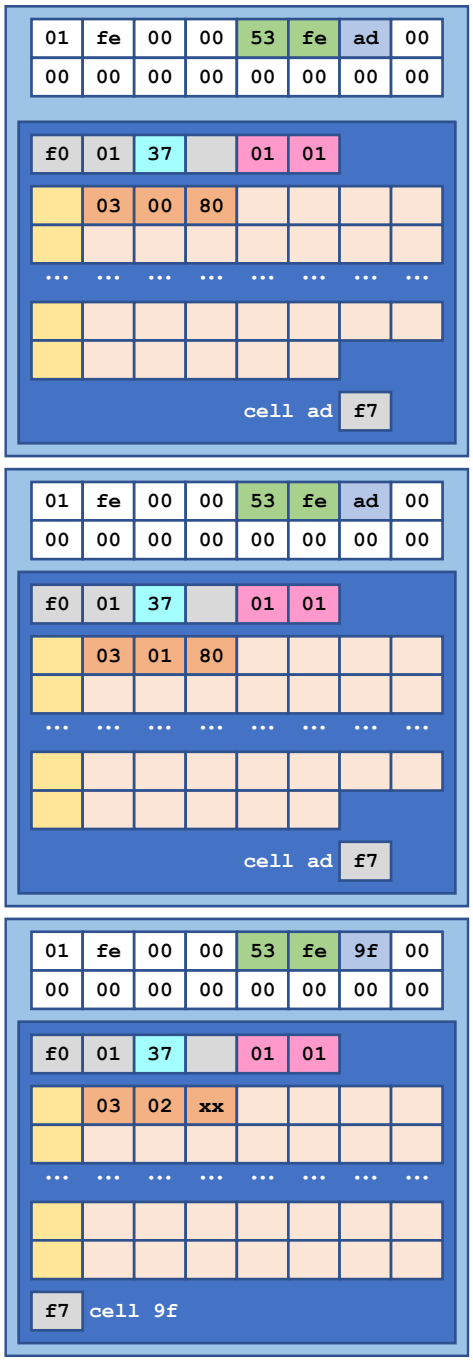


Figure 12

Multi-chunk messages received from the amp

In this case, whilst the message spans multiple chunks, there are multiple chunks in each block. Each chunk has a maximum size of 0x27 and the block has a maximum size of 0x6a.

The first four bytes of the chunk data are as in the table below – representing the format byte and the multi-chunk sub-header.

Offset (in chunk)	Length	Description
6	1	First format byte
7	1	Total number of chunks
8	1	Reference number of this chunk (0 to total number of chunks – 1)
9	1	For all chunks: Size of this chunk (in useful data bytes, so ignoring the '8th bit' bytes)

The number of data bytes remaining is a count of bytes excluding the '8th bit' bytes and is present in each chunk. In all full chunks this is 0x19.

Figure 13 shows the overall structure of a multi-chunk message received from the amp.

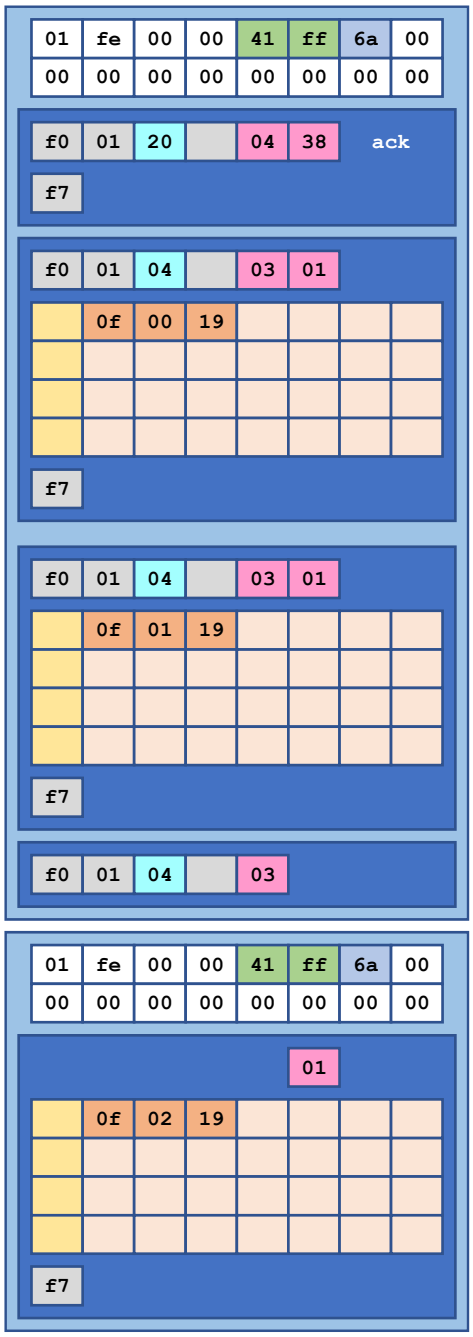


Figure 13

Commands sent to the amp

These are the commands which can be sent to the amp and the responses expected.

Command	Sub-command	Meaning	Response	Model
01	01	Send preset details to the amp	Acknowledge message	All
01	04	Send new effect parameter	None	All
01	06	Change effect to new effect	Acknowledge message	All
01	15	Enable / disable an effect	Acknowledge message	All
01	28	Enable / disable amp volume info	Acknowledge message	All
01	33	Mixer adjustment	Acknowledge message	LIVE
01	38	Change to a different preset	Acknowledge message	All
01	62	Tap tempo		All
01	65	Tuner on/off		All
01	70	Send license key	Acknowledge message	All
01	72	Set power settings	Acknowledge message	LIVE
01	74	Change input impedance	Acknowledge message	LIVE

Command	Sub-command	Meaning	Response	Model
02	01	Get preset details from amp	Preset information	All
02	10	Get current hardware preset number	Preset number information	40 GO MINI
02	11	Get amp name (“Spark 40”)	Amp name	All
02	23	Get amp serial number	Amp serial number	All
02	24	UNKNOWN		
02	2a	Get harware preset stored checksums	Four checksums	40 GO MINI
02	2b	Get LIVE checksums	Eight checksums	LIVE
02	2f	Get firmware version number	Firmware version number	All
02	33	Get mixer setting	Mixer value	LIVE
02	71			
02	72	Get power settings	Power settings	LIVE
02	74	Get input impedence	Impedence	LIVE

Commands sent from the amp

These are the commands / responses sent from the amp. Response to the amp are unknown.

Command	Sub-command	Meaning	Response	Model
03	01	Response to a preset information query command	None	All
03	06	Change of effect (amp model) on the amp	None	All
03	10	Current hardware preset on amp	None	All
03	11	Amp name	None	All
03	15	Enable / disable an effect	None	All
03	1a	Store preset on amp **OR** Response to 0x021a request	None	LIVE
03	23	Amp serial number	None	All
03	27	Store current preset in hardware preset	None	All
03	28	Send amp info (currently volume for the JH wah)	None	All
03	2a	Stored hardware preset checksums	None	40 GO MINI
03	2b	Stored hardware preset checksums		LIVE
03	2f	Firmware version number	None	All
03	33	Value of mixer	None	LIVE
03	37	Change of effect parameter on amp	None	All
03	38	Change of preset selected on the amp	None	40 GO MINI
03	63	Tap tempo	None	All
03	64	Tuner On	None	All
03	65	Tuner Off	None	All
03	6b	Input 1 GUITAR volume	None	LIVE

03	71			
03	72	Power settings	None	LIVE
03	73	Input 2 cable insert	None	LIVE
03	74	Impedance response	None	LIVE

Command	**Sub-command**	**Meaning**	**Response**	**Model**
04	As per command received by amp	Acknowledgement from the amp that it received a message.		All
04	28			
04	70			
04	72			

Detail of commands

0x0101 – see later

0x0104 – change effect parameter

Type	Length	Content	Example
Alternative short string	n+2	Effect name	0x04 0xa4 Twin
Integer	1	Number of the parameter starting at 0	0x00 (Gain)
Float	5	Value for the parameter (0-1.0, with 1.0 representing 10 in the user interface)	0xca 0x3f 0x21 0x72 0x13
Integer	1	Input 0 = Input 1 1 = Input 2	0x00

0x0106 – swap effects

Type	Length	Content	Example
Alternative short string	n+2	Old effect name	0x08 0xa8 LA2AComp
Alternative short string	n+2	New effect name	0x08 0xa8 BlueComp
Integer	1	Input 0 = Input 1 1 = Input 2	0x00

0x0115 – enable / disable effect

Type	Length	Content	Example
Alternative short string	n+2	New effect name	0x08 0xa8 BlueComp
Boolean	1	New status 0xc2 off 0xc3 on	0xc3
Integer	1	Input 0 = Input 1 1 = Input 2	0x00

0x0128 – enable / disable amp info

So far only seen on JH.Vox846 wah – asks the amp to send volume change information back to the app

Type	Length	Content	Example
Alternative short string	n+2	Effect name	0x09 0xa9 JH.Wah846
Boolean	1	New status 0xc2 off 0xc3 on	0xc3

0x0138 – change to a new hardware preset

Type	Length	Content	Example
Integer	1	0	0x00
Integer	1	New preset number 0-3, 0x7f	0x03

0x0162 – send tap tempo

Type	Length	Content	Example
Float	5	Tempo value	0xca 0x3f 0x21 0x72 0x13

0x0165 – tuner on/off

Type	Length	Content	Example
Bool	1	Tuner on or off	0xc2

0x0170 – send license key

Type	Length	Content	Example
Integer	64	64 byte license key	

0x0172 – set power settings

Type	Length	Content	Example
Boolean	1		0xc2
Integer	1	Auto-shutdown time 0 = Never 30 40 50 70	0x00
Integer	1		
Integet	1	Auto standby time 0 = Never 5 10 15 30	0x05

0x0174 – set input impedance

Type	Length	Content	Example
Fixed array	1	Array size	0x91
Integer	1	Input 0 = Input 1 1 = Input 2 1/4” 2 = Input 2 XLR 3 = Input 3 4 = Input 4	0x01
Integet	1	Impedance 0 = Standard 1 = Hi-Z 2 = Line 3 = Mic	0x00

0x0133 – change mixer setting

Type	Length	Content	Example
Integer	1	Mixer channel 0 = Input 1 1 = Input 2 1/4” 2 = Input 2 XLR 3 = Input 3 4 = Input 4 5 = Music 9 = Master	0x03
Float	5	Value	0xca 0x3f 0x21 0x72 0x13

0x0201 – get preset information

Type	Length	Content	Example
Integer	2	hardware preset 0x00-0x03 software preset 0x7f current live preset 0x0100	0x00 0x03
Short integer	1 x 30	30 bytes of 0x00 (which, when adding the 8th bit in a separate byte, looks like 34 bytes of 00 in the raw data)	0x00

0x0210 – get hardware preset number

No data in message for this command

Response is a single string.

0x0211 – get amp name

No data in message for this command

Response is a single string.

0x021a – get hardware preset information (LIVE)

Type	Length	Content	Example
Fixed array	1	2	0x92
Integer	1	Input 0 = Input 1 1 = Input 2	0x00
Integer	1	Input 0 = Input 1 1 = Input 2	0x01

Retrieves the checksums for the hardware presets.

Response is an array of eight integers.

0x0223 – get amp serial number

No data in message for this command

Response is a single string

0x0224 – UNKNOWN

Type	Length	Content	Example
Integer	1		0x00
Integer	1		0x01
Integer	1		0x02
Integer	1		0x03

0x022a – get hardware preset checksums

Retrieves the checksums for the hardware presets.

Response is an array of 4 integers.

0x022f – get amp firmware version number

No data in message for this command

Response is a msgpack uint32 – 4 byte int.

0x022b – get hardware preset checksums (LIVE)

Type	Length	Content	Example
Integer	1	Input 0 = Input 1 1 = Input 2	0x01

Retrieves the checksums for the hardware presets.

Response is an array of eight integers.

0x0233 – get mixer setting (LIVE)

Type	Length	Content	Example
Integer	1	Mixer channel 0 = Input 1 1 = Input 2 1/4” 2 = Input 2 XLR 3 = Input 3 4 = Input 4 5 = Music 9 = Master	0x01

0x0272 – request power settings

No data in message for this command

0x0273 – request input status

Type	Length	Content	Example
Fixed array	1	Size of array	0x92
Integer	1	Input 0 = Input 1 1 = Input 2 1/4” 2 = Input 2 XLR 3 = Input 3 4 = Input 4	0x00
Integer	1	Input 0 = Input 1 1 = Input 2 1/4” 2 = Input 2 XLR 3 = Input 3 4 = Input 4	0x01

0x0274 – request input impedance

Type	Length	Content	Example
Fixed array	1	Size of array	0x91
Integer	1	Input 0 = Input 1 1 = Input 2 1/4” 2 = Input 2 XLR 3 = Input 3 4 = Input 4	0x00

0x0306 – change of effect (amp model) on the amp

Type	Length	Content	Example
Alternative short string	n+2	Old amp name	0x0d 0xad GK800
Alternative short string	n+2	New amp name	0x05 0xa5 Twin
Integer	1	Input 0 = Input 1 1 = Input 2	0x00

When this is sent to the app, the app responds by sending five parameter messages back to the amp (0x0104). These cover the five parameters (gain, bass, middle, treble and volume). It is not clear how these parameter values are derived.

0x0310 – current hardware preset

Type	Length	Content	Example
Integer	1	New preset current	0x00
Integer	1	New preset number 0-3, 0x7f	0x03

0x0311 – amp name

Type	Length	Content	Example
Alternative short string	n+2	Amp name	0x08 0xa8 Spark 40

0x0315 – enable / disable effect

Type	Length	Content	Example
Alternative short string	n+2	New effect name	0x08 0xa8 BlueComp
Boolean	1	New status 0xc2 off 0xc3 on	0xc3

Only seems to come from the amp when using the Mod or Delay knobs.

0x031a – response to 0x021a request

Type	Length	Content	Example
Fixed array	1	Size of array	0x92
Integer	1	Current preset input 1	0x00
Integer	1	Preset number input 1	0x05
Boolean	1	Content changed 0xc2 hasn't changed 0xc3 has changed	0xc3
Integer	1	Current preset input 2	0x00
Integer	1	Preset number input 2	0x01
Boolean	1	Content changed 0xc2 not changed 0xc3 has changed	0xc2

0x031a – store preset on amp

Type	Length	Content	Example
Fixed array	1	Size of array	0x91
Integer	1	Current preset	0x00
Integer	1	Preset number	0x05
Boolean	1	Unchanged 0xc2	0xc2

0x0323 – amp serial number

Type	Length	Content	Example
Alternative short string	n+2	Amp serial number	0x10 0x30 S1011G1222068464

0x0327 – current preset stored to hardware on the amp

Type	Length	Content	Example
Integer	1	0	0x00
Integer	1	Number of the preset where settings are stored	x02 (2)

0x0328 – amp effect level

Type	Length	Content	Example
Float	5	Value for the parameter (0-1.0, with 1.0 representing 10 in the user interface)	0xca 0x3f 0x21 0x72 0x13

Only seems to come from the amp when using the Mod or Delay knobs.

0x032a – stored presets checksum (40 / GO / MINI)

Type	Length	Content	Example
Fixed array	1	0x98	0x98 (8)
Integer	1 or 2	0x00	0x00
Integer	1 or 2	0x01	0x01
Integer	1 or 2	0x02	0x02
Integer	1 or 2	0x03	0x03

0x032b – stored preset checksum (LIVE)

Type	Length	Content	Example
Fixed array	1	0x98	0x98 (8)
Integer	1 or 2	0x00	0x00
Integer	1 or 2	0x01	0x01
Integer	1 or 2	0x02	0x02
Integer	1 or 2	0x03	0x03
Integer	1 or 2	0x00	0x00
Integer	1 or 2	0x01	0x01
Integer	1 or 2	0x02	0x02
Integer	1 or 2	0x03	0x03

0x0333 – LIVE mixer setting

Type	Length	Content	Example
Float	5	Volume for input	0xca 0x3e 0x6d 0x5b 0x37

0x0337 – change of parameter for effect on the amp

Type	Length	Content	Example
Alternative short string	n+2	Effect name	0x04 0x24 Twin
Integer	1	Parameter number	0x00 (0) (Gain) **OR** 0x03 (3) (Bass) **OR** 0x04 (4) (Master)
Float	5	New value	0xca 0x3e 0x6d 0x5b 0x37
Integer	1	Input 0 = Input 1 1 = Input 2	0x00

0x0338 – change of preset selected on the amp

Type	Length	Content	Example
Integer	1	0	0x00
Integer	2	Number of the new preset	0x02 (2)

0x0363 – tap tempo

Type	Length	Content	Example
Float	5	Tempo value	0xca 0x3f 0x21 0x72 0x13
Integer	1		0x3f
Integer	1		0x3f

0x036b – Input 1 GUITAR volume

Type	Length	Content	Example
Float	5	Volume	0xca 0x3e 0x6d 0x5b 0x37

0x0372 – power settings

Type	Length	Content	Example
Boolean	1		0xc2
Integer	1	Auto-shutdown time 0 = Never 30 40 50 70	0x00
Integer	1		
Integet	1	Auto standby time 0 = Never 5 10 15 30	0x05

0x0373 – Input 2 cable insert

Type	Length	Content	Example
Fixed array	1	Size of array	0x91
Integer	1	Input 1 = Input 2	0x01
Integer	1	Plug type 1 = 1/4” jack 2 = XLR	0x01
Boolean	1	Plug status 0xc2 unplugged 0xc3 plugged in	0xc3

0x0374 – Impedance response

Type	Length	Content	Example
Fixed array	1	Size of array	0x91
Integer	1	Input 0 = Input 1 1 = Input 2 1/4” 2 = Input 2 XLR 3 = Input 3 4 = Input 4	0x01
Integet	1	Impedance 0 = Standard 1 = Hi-Z 2 = Line 3 = Mic	0x00

0x04nn / 0x05nn – acknowledgement

This has command 0x04 and the same sub-command as was issued to the amp. It has the same sequence number as the command issued to the app.

The possible acknowledgements are:

Type	Length	Example
Preset chunk	0	0x04 01
Preset final chunk	0	0x05 01
Change amp model	0	0x04 06
Turn on/off	0	0x04 15
Turn amp info on/off	1	0x04 28 c2
Change preset number	0	0x04 38
License key	1	0x04 70 xx
Power settings	1	0x04 72 00

For 70, 28 and 72 there is a 1 byte body to the message, for the rest they are empty - just the chunk header and the trailer (0xf7)

0x0101 – send preset

A new preset is a multi-chunk message, so the first three bytes of each new chunk are the chunk sub-header.

The preset format contains data for the preset, and then information for each effect – 7 in total.

Each effect contains data for the effect, and then a value for each parameter in the effect.

The final byte of the preset is a checksum.

Type	**Length**	**Content**	**Example**
Integer	1	Current indicator	0x00
Integer	1	Hardware preset 0-3 Software preset 0x7f	0x7f
Long string	36	UUID of preset	
Short string	n+1	Name	0xad Spooky Melody
Short string	n+1	Version	0xa3 0.7
Short string / Long string	n+1 / n+2	Description	0xb7 Description for Alternative Preset 1
Short string	n+1	Icon name	0xa8 icon.png
Float	5	BPM	0xca 0x42 0x70 0x00 0x00 (60.0)
Fixed array	1	Number of effects	0x97 (7)
Effect 0		*See below*	
Parameter 0		*See below*	
Parameter 1		*See below*	
Effect 1		*See below*	
Parameter 0		*See below*	
Effect 2		*See below*	
Effect 3		*See below*	
Effect 4		*See below*	
Effect 5		*See below*	
Effect 6		*See below*	
Integer	1	Checksum of the **msgpack formatted data** – excluding preset location (first two bytes) Sum of all bytes modulo 256.	

Each effect then has a section describing the effect (7 effects in total)

Type	**Length**	**Content**	**Example**
Short string	n+1	Effect name	0x08 0xa8 BlueComp
Boolean	1	Status 0xc2 off 0xc3 on	0xc3(On)
Fixed array	1	Number of parameters for this effect	0x94 (4)

And then each parameter has a section describing the value for the parameter

Type	Length	Content	Example
Integer	1	Parameter reference	0x01 (1)
Fixed array	1	Number of values (always 1)	0x91
Float	5	Value for this parameter	0xca 0x3e 0x35 0x55 0x3f

It seems this is a broken implementation of msgpack, because the fixed array for each parameter looks more like it should be key:value pairs, and the fixed array wrapping the float seems redundant.

What should be:

fixmap(3) = {{1, float}, {2, float}, {3, float}}

is actually:

fixarray(3)=[0, fixarray(1)[float], 1], fixarray(1)[float], 2, fixarray(1)[float]

Parsing can be achieved by ignoring any integer within a fixarray and by extracting the float from within a fixarray of length 1 – but this is a workaround for a broken implementation.

It seems the amp and app do not pack or unpack msgpack properly – they must be looking for the specific data rather than unpacking and indexing the unpacked data

Figure 14 shows the overall structure.


Hardware preset number
00 7f
UUID
0 7 0 7 9 0 6 3 - 9 4 A 9 -
4 1 B 1 - A B 1 D - 0 2 C B
5 D 0 0 7 9 0
Name
D a r k S o u l
Version
0 . 7
Description
1 - C l e a n
Icon
i c o n . p n g
BPM
120
Number of effects (fixarray)
97
Effect name
b i a s . n o i s e g a t e
On / off
C3
Number of parameters (fixarray)
93
Parameter 0
00 91 0.52
Parameter 1
01 91 0.88
Parameter 2
02 91 0.13
.....
Effect name
b i a s . r e v e r b
On / off
C3
Number of parameters (fixarray)
97
Parameter 0
00 91 0.52
... ...
...
Parameter 6
06 91 0.13
Checksum
17

Figure 14

Appendix 1 – Preset locations

The amp has 4 presets which can be selected from the top panel. These are hardware presets represented by presets 0x00-0x03 in this document.

When the app sends one of the 'non-hardware' presets this is sent as preset 0x7f.

Preset 0x7f cannot be selected from the top panel.

Preset data is static within the amp, but multiple parameters can be modified either via the amp top panel (amp type, gain, treble, modulation etc) or via the app. When they have been modified the preset led flashes to show the amp state is currently different from the stored preset.

This is the **current state** of the amp – it does not necessarily map to any of the presets because the state has been modified.

It may help to think of the presets as static data sent to the amp and stored. A prest can be selected to make it the **current state**, and changes made will change the **current state**. This could then be saved back to a preset location. But it requires the 'save' – changes made on the app or the amp do not automatically change the preset.

The presets are only updated when the current state is stored into the current prest (on the app), a new named preset (on the app) or via a long press of a hardware preset button (on the amp). This will cause the led to stop flashing.

It is possible to create a preset and send it to any location in the amp – 0c00-0x03, 0x7f – just use the 'send new preset' command with the preset location between 0 and 3.

Sending preset details does not enable that preset – a separate command is needed to move the amp to that preset.

It is possible to retrieve preset details from the amp.

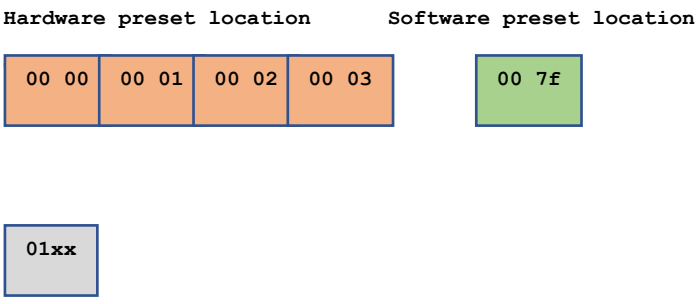
Reading preset 0x0000-0x0003, 0x007f gives the **stored state** of that preset.

Reading preset 0x0100 gives the current effects in use – so **amp current state**.

Sending a preset only uses the low byte as 0-3, 0x7f.

Receiving a preset uses the low byte UNLESS the high byte is 0x01, in which case the current state is retrieved.

If high byte is 0x01 in the retrieved data the low byte should be ignored.



Enhancements for LIVE

With the LIVE there are two channels, each with eight presets.

The channels are selected by changing the first byte in the data.

Channel	**Hardware location prefix byte**	**Current amp state prefix byte**
1	00	01
2	03	04

Reading preset 0x0000-0x0007, 0x007f gives the **stored state** of that preset for channel 1.

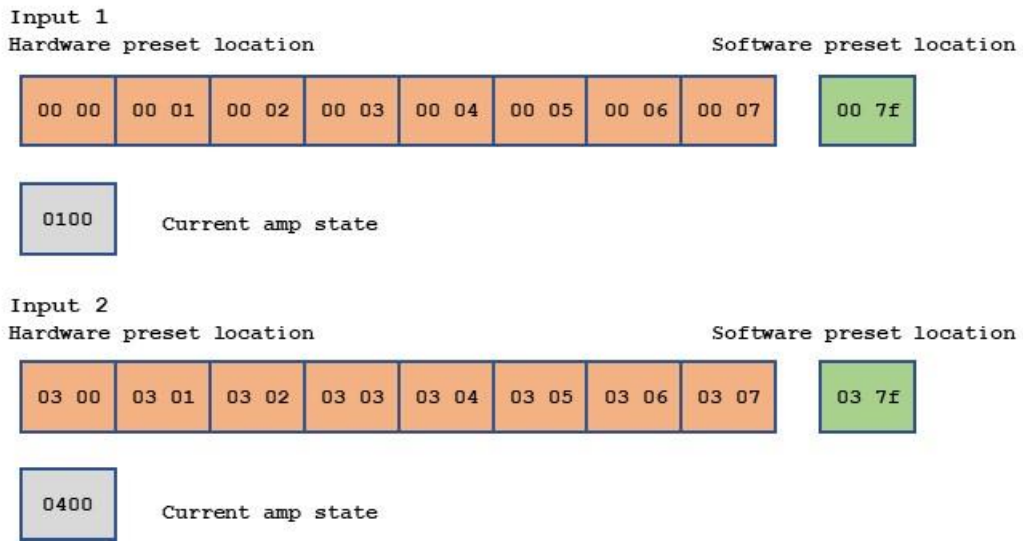
Reading preset 0x0300-0x0307, 0x037f gives the **stored state** of that preset for channel 2.

Reading preset 0x0100 gives the current effects in use for channel 1 – so **amp current state**.

Reading preset 0x0400 gives the current effects in use for channel 2.

Receiving a preset uses the low byte UNLESS the high byte is 0x01 or 0x04, in which case the current state is retrieved for that channel.

If high byte is 0x01 or 0x04 in the retrieved data the low byte should be ignored.



Appendix 2 - Effect and amp names

Noisegate

Name	Spark name
Noisegate	bias.noisegate

Compressors

Name	Spark name
LA Comp	LA2AComp
Sustain Comp	BlueComp
Red Comp	Compressor
Bass Comp	BassComp
Optical Comp	BBEOpticalComp
J.H. Legendary Wah	JH.Vox846

Drive

Name	Spark name
Booster	Booster
Tube Drive	DistortionTS9
Over Drive	Overdrive
Fuzz Face	Fuzz
Black Op	ProCoRat
Bass Muff	BassBigMuff
Guitar Muff	GuitarMuff
Bassmaster	MaestroBassmaster
SAB Driver	SABdriver
Clone Drive	KlonCentaurSilver
J.H. Axle Fuzz	JH.AxisFuzz
J.H. Super Fuzz	JH.SupaFuzz
J.H. Octave Fuzz	JH.Octavia
J.H. Fuzz Tone	JH.FuzzTone

Amps

Name	Spark name
Silver 120	RolandJC120
Black Duo	Twin
AD Clean	ADClean
Match DC	94MatchDCV2
Tweed Bass	Bassman
AC Boost	AC Boost
Checkmate	Checkmate
Two Stone SP50	TwoStoneSP50
American Deluxe	Deluxe65
Plexiglass	Plexi
JM45	OverDrivenJM45
Lux Verb	OverDrivenLuxVerb
RB 101	Bogner
British 30	OrangeAD30
American High Gain	AmericanHighGain
SLO 100	SLO100
YJM100	YJM100
Treadplate	Rectifier
Insane	EVH
Switch Axe	SwitchAxeLead
Rocker V	Invader
BE 101	BE101
Pure Acoustic	Acoustic
Fishboy	AcousticAmpV2

Jumbo	FatAcousticV2
Flat Acoustic	FlatAcoustic
RB-800	GK800
Sunny 3000	Sunny3000
W600	W600
Hammer 500	Hammer500
ODS 50	ODS50CN
J.h. D-Show Master	JH.DualShowman
J.H. Sun 100S	JH.Sunn100
Blues Boy	BluesJrTweed
J.H. 45/100	JH.JTM45
J.H. Bass Master	JH.Bassman50Silver
J.H. Super 100	JH.SuperLead100
J.H. Tone City 100	JH.SoundCity100
Insane 6508	6505Plus

Modulation

Name	**Spark name**
Tremolo	Tremolo
Chorus	ChorusAnalog
Flanger	Flanger
Phaser	Phaser
Vibrato	Vibrato01
UniVibe	UniVibe
Cloner Chorus	Cloner
Classic Vibe	MiniVibe
Tremolator	Tremolator
Tremolo Square	TremoloSquare
JH Legendary Vibe	JH.VoodooVibeJr
Guitar QA	GuitarEQ6
Bass EQ	BassEQ6

Delay

Name	**Spark name**
Digital Delay	DelayMono
Echo Filt	DelayEchoFilt
Vintage Delay	VintageDelay
Reverse Delay	DelayReverse
Multi Head	DelayMultiHead
Echo Tape	DelayRe201

Reverb

Name	**Spark name**
All Reverbs	bias.reverb

Appendix 3 – app startup messages

These are the messages sent when the app connects to the Spark amp.

Sent to amp

Command	Parameter	Description
02 11		Get amp name
02 2a	00 01 02 03	Unknown
02 23		Get serial number
01 70		Send license key
02 01	00 00	Get preset 0
02 01	00 01	Get preset 1
02 01	00 02	Get preset 2
02 01	00 03	Get preset 3
02 10		Get current hardware preset on amp
02 2F		Get firmware version
02 01	01 00	Get current amp settings

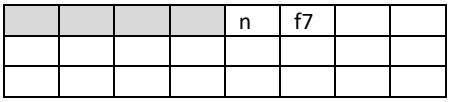
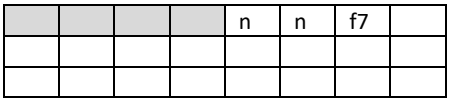
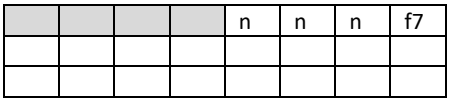
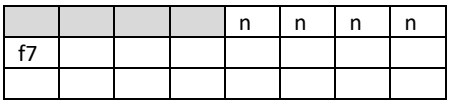
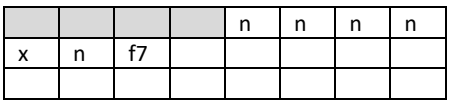
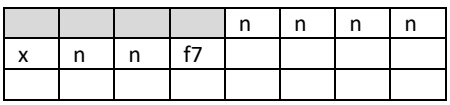
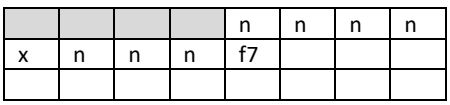
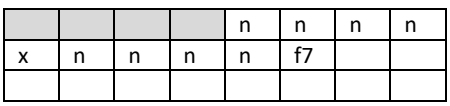
Response from amp

Command	Example	Description
03 11	0x08 Spark 40	Amp name
03 2a	0x94 0x4c 0x56 0x67 0x9c	Preset checksums
03 23	Serial number 0xf7	Serial number
03 01		Preset 0
03 01		Preset 1
03 01		Preset 2
03 01		Preset 3
03 10	00 01	Hardware preset number
03 2F	01 00 02 fd	Firmware version
03 01		Current amp settings in preset format

Appendix 4 – Calculating effective data bytes from total number of bytes including format byte

This visualises how to calculate the number of data bytes to go into the multi-chunk sub-header:

```
total_bytes – int ( (total_bytes+2) / 8 )
```

	bytes	bytes+2	int((bytes+2) / 8)	bytes – int((bytes+2) / 8)
	1	3	0	1
	2	4	0	2
	3	5	0	3
	4	6	0	4
	6	8	1	5
	7	9	1	6
	8	10	1	7
	9	11	1	8

				n	n	n	n
x	n	n	n	n	n	f7	

				n	n	n	n
x	n	n	n	n	n	n	f7

				n	n	n	n
x	n	n	n	n	n	n	n
f7							

				n	n	n	n
x	n	n	n	n	n	n	n
x	n	f7					

10	12	1	9
11	13	1	10
12	14	1	11
14	16	2	12

Appendix 5 – SysEx 7bit/8bit encoding functions

The best reference I could find is in the Arduino MIDI library and refers to Ruin & Wesen's SysEx encoder/decoder - http://ruinwesen.com

Sadly this reference is broken so there is no clarity on whether this encoding has a recognised name.

Ian McKellar

https://git.sr.ht/~ianloic/spark-usb-midi

```
def decode_block(block: bytes)->bytes:
  assert(len(block) > 0)
  top = block[0]
  bottom = block[1:]
  assert(len(bottom) <= 7)
  decoded = []
  for i, b in enumerate(bottom):
    if top & (2**i):
      decoded.append(b | 2**7)
    else:
      decoded.append(b)
  return bytes(decoded)
```

My code

https://github.com/paulhamsh/Spark-Parser/blob/main/MidiControl/SparkClass.py

```
chunk_len = len (chunk)
num_seq = int ((chunk_len + 6) / 7)
bytes7 = b''

for this_seq in range (0, num_seq):
    seq_len = min (7, chunk_len - (this_seq * 7))
    bit8 = 0
    seq = b''
    for ind in range (0,seq_len):
        dat = chunk[this_seq * 7 + ind:
        if dat & 0x80 == 0x80:
            bit8 |= (1<<ind)
        dat &= 0x7f
        seq +=  bytes([dat])
    bytes7 += bytes([bit8]) + seq


chunk_len = len (data7bit)
num_seq = int ((chunk_len + 7) / 8)
data8bit = b''
for this_seq in range (0, num_seq):
    seq_len = min (8, chunk_len - (this_seq * 8))
    seq = b''
    bit8 = data7bit[this_seq * 8]
    for ind in range (0,seq_len-1):
        dat = data7bit[this_seq * 8 + ind + 1]
        if bit8 & (1<<ind) == (1<<ind):
            dat |= 0x80
        seq +=  bytes([dat])
    data8bit += seq
```

Arduino MIDI

https://github.com/FortySevenEffects/arduino_midi_library/blob/master/src/MIDI.cpp

```
/*! \brief Encode System Exclusive messages.
 SysEx messages are encoded to guarantee transmission of data bytes higher than
 127 without breaking the MIDI protocol. Use this static method to convert the
 data you want to send.
 \param inData The data to encode.
 \param outSysEx The output buffer where to store the encoded message.
 \param inLength The length of the input buffer.
 \param inFlipHeaderBits True for Korg and other who store MSB in reverse order
 \return The length of the encoded output buffer.
 @see decodeSysEx
 Code inspired from Ruin & Wesen's SysEx encoder/decoder - http://ruinwesen.com
 */
unsigned encodeSysEx(const byte* inData,
                     byte* outSysEx,
                     unsigned inLength,
                     bool inFlipHeaderBits)
{
    unsigned outLength  = 0;     // Num bytes in output array.
    byte count          = 0;     // Num 7bytes in a block.
    outSysEx[0]         = 0;

    for (unsigned i = 0; i < inLength; ++i)
    {
        const byte data = inData[i];
        const byte msb  = data >> 7;
        const byte body = data & 0x7f;

        outSysEx[0] |= (msb << (inFlipHeaderBits ? count : (6 - count)));
        outSysEx[1 + count] = body;

        if (count++ == 6)
        {
            outSysEx   += 8;
            outLength  += 8;
            outSysEx[0] = 0;
            count       = 0;
        }
    }
    return outLength + count + (count != 0 ? 1 : 0);
}

/*! \brief Decode System Exclusive messages.
 SysEx messages are encoded to guarantee transmission of data bytes higher than
 127 without breaking the MIDI protocol. Use this static method to reassemble
 your received message.
 \param inSysEx The SysEx data received from MIDI in.
 \param outData The output buffer where to store the decrypted message.
 \param inLength The length of the input buffer.
 \param inFlipHeaderBits True for Korg and other who store MSB in reverse order
 \return The length of the output buffer.
 @see encodeSysEx @see getSysExArrayLength
 Code inspired from Ruin & Wesen's SysEx encoder/decoder - http://ruinwesen.com
 */
unsigned decodeSysEx(const byte* inSysEx,
                     byte* outData,
                     unsigned inLength,
                     bool inFlipHeaderBits)
{
    unsigned count  = 0;
    byte msbStorage = 0;
    byte byteIndex  = 0;

    for (unsigned i = 0; i < inLength; ++i)
    {
```

```
        if ((i % 8) == 0)
        {
            msbStorage = inSysEx[i];
            byteIndex  = 6;
        }
        else
        {
            const byte body     = inSysEx[i];
            const byte shift    = inFlipHeaderBits ? 6 - byteIndex : byteIndex;
            const byte msb      = byte(((msbStorage >> shift) & 1) << 7);
            byteIndex--;
            outData[count++] = msb | body;
        }
    }
    return count;
}
```

Appendix 6 – msgpack

This format is described at:

www.msgpack.org

https://github.com/msgpack/msgpack/blob/master/spec.md

There are multiple implementations and the python one is obtained by:

python -m pip install msgpack

The Spark data is not an exact msgpack implementation because it does not start as an array, and the effect and effect parameters are malformed as arrays.

The data is like this:

```
\x97
       \xaebias.noisegate
       \xc2
       \x93
              \x00
              \x91
                     \xca>\r\xa1\xec
              \x01
              \x91
                     \xca>f\x08\xd1
              \x02
              \x91
                     \xca\x00\x00\x00\x00
```

This should be an array of 7 elements – one for each effect. Then each effect has three values – name, on/off status, an array of parameters – best as a key/value pair except that msgpack doesn't allow integers as keys.

But the array content is like this:

```
['bias.noisegate',
True,
[0, [ 0.1201], 1],
[0.3314],
2,
[0.0000]
```

Partly because the array is really three entries per pedal, not one, and partly because each parameter is two entries not one.