

Meccano MAX – LED array signalling

The tables below give the results of a signal sniffing exercise to read the traffic being sent to the LED array (or “face”) for the options given as part of the programming package.

The first 16 lines in each table are the data bytes sent to the array, derived from measurements of the time between transitions of the waveform. A representative sample of the results, with the derived binary and hexadecimal forms, is:

Time interval between transitions (+ = high, - = low). 1 st interval is the start bit.	Bits	Hex
-132 +564 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +276 -176 +236 -144 +280 -144 +136 -284 +280 -144 +280 -144 +280 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -140 +280 -144 +280 -144 +156 -272 +284 -144 +280 -152 +260 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -144 +276 -144 +280 -144 +148 -272 +280 -144 +284 -140 +280 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -144 +276 -144 +280 -144 +144 -276 +280 -144 +280 -144 +280 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -144 +280 -140 +280 -144 +144 -288 +312 -108 +272 -144 +280 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -140 +284 -140 +280 -144 +160 -260 +280 -144 +280 -140 +284 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -140 +284 -140 +280 -140 +148 -276 +280 -144 +280 -140 +284 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -140 +284 -140 +280 -140 +152 -296 +260 -140 +280 -144 +280 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -144 +280 -140 +280 -144 +144 -276 +280 -144 +280 -144 +280 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -144 +280 -140 +280 -144 +140 -280 +280 -144 +280 -144 +280 -140	1 1 1 1 0 1 1 1	0xEF
+280 -144 +280 -144 +280 -140 +280 -152 +144 -284 +276 -132 +280 -144 +332 -124	1 1 1 1 0 1 1 1	0xEF
+256 -140 +280 -144 +280 -144 +276 -144 +140 -284 +280 -140 +280 -144 +280 -144	1 1 1 1 0 1 1 1	0xEF
+280 -140 +280 -144 +280 -144 +276 -144 +140 -284 +280 -140 +280 -144 +280 -144	1 1 1 1 0 1 1 1	0xEF
+280 -140 +280 -144 +280 -144 +280 -160 +132 -280 +272 -140 +280 -144 +280 -140	1 1 1 1 0 1 1 1	0xEF
+284 -140 +280 -144 +280 -140 +284 -140 +140 -280 +284 -140 +280 -144 +280 -140	1 1 1 1 0 1 1 1	0xEF
+284 -140 +280 -176 +240 -140 +140 -284 +140 -280 +140 -284 +280 -140 +284 -140	1 1 1 0 0 0 1 1	0xC7
+280 -144 +280 -140 +284 -140 +288 -156 +144 -268 +284 -132 +144 -276 +280 -140	1 1 1 1 0 1 0 1	0xAF
+280 -144 +148 -276 +144 -280 +276 -144 +280 -144 +280 -140 +280 -144 +144 -280	1 0 0 1 1 1 1 0	0x79

The bits are sent LSB first, which is reflected in the Hex values. The first 16 rows are the actual data that appears on the display, with the top or first byte giving the left-hand edge of the array (looking at it from the front) and the first bit giving the bottom LED. The 17th row is the same for all displays at 0xAF, and the 18th is most likely some sort of checksum.

The blank display is the easiest to analyse, and gives a simple equation for the checksum – bitwise XOR all data bytes, then XOR the result with 0xAF. Unfortunately, this does not work for the other cases.

Text Messages

BLANK	HELP!	YO!	?	<u>LOL!</u>	HELLO	Zzz	BYE	!!	WOW	YES	OK	Thx
FF	FF	FF	FF	FE	FF	FF	FF	FF	FF	FF	FF	FF
FF	81	FF	FF	FE	81	BB	FF	FF	C7	BF	FF	FF
FF	EF	BF	FF	82	EF	B3	81	FF	FB	DF	FF	DF
FF	81	DF	FF	FA	81	AB	A5	FF	E7	E1	C3	C3
FF	FF	E1	FF	FA	FF	9B	A5	FF	FB	DF	BD	DF
FF	81	DF	9F	FE	81	BB	DB	FF	C7	BF	BD	FF
FF	AD	BF	BF	82	AD	FF	FF	FF	FF	FF	C3	C3
FF	FF	FF	A5	BA	FF	DB	8F	85	C3	81	FF	EF
FF	81	C3	AF	82	81	D3	F1	85	DB	AD	81	C3
FF	FD	BD	8F	FE	FF	CB	8F	FF	C3	AD	E7	FF
FF	FF	BD	FF	82	81	DB	FF	FF	FF	FF	DB	DB
FF	81	C3	FF	FA	FF	FF	81	FF	C7	DD	BD	E7
FF	AF	FF	FF	FA	81	DB	AD	FF	FB	AD	FF	E7
FF	8F	85	FF	FE	BD	D3	AD	FF	E7	AD	FF	DB
FF	FF	FF	8A	81	CB	FF	FF	FB	B3	FF	FF	FF
FF	85	FF	FF	FE	FF	DB	FF	FF	C7	FF	FF	FF
AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF
50	D1	97	21	DB	28	44	0	63	E3	35	20	E2

Default – moving bar (several samples in sequence)

EF												
83	EF	EF	EF	EF	EF	EF	83	EF	EF	EF	EF	EF
EF												
EF												
EF												
EF	EF	EF	EF	EF	EF	C7	EF	EF	EF	EF	EF	EF
EF												
EF												
EF	83	EF	EF	EF	EF	EF	EF	83	EF	EF	EF	EF
EF	EF	EF	EF	EF	83	EF	EF	EF	EF	EF	EF	83
EF												
EF												
EF	EF	C7	EF	EF	EF	EF	EF	EF	C7	EF	EF	EF
EF	EF	EF	EF	C7	EF	EF	EF	EF	EF	C7	EF	EF
EF												
EF	EF	EF	83	EF	EF	EF	EF	EF	EF	83	EF	EF
EF												
AF												
03	03	79	03	79	03	79	03	30	79	03	79	03

Note – The check-sum is not affected by the horizontal position of the vertical bar. This would indicate that there are no shifts or rotations involved in generating the checksum.

Faces:

Happy	Sad	Happiest	Shocked	Laughing	Uninterested	Wink	Impressed	Uncomfortable	Proud	Bored	Surprised
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	9F	DF	FF	FF	FF	FF	FF
8F	FF	8F	9F	AF	93	DF	CF	9F	8F	DF	9F
67	E3	6F	9F	DF	99	DF	B7	9F	87	DF	9F
27	D1	29	FF	FF	99	DB	B7	FB	87	DF	FF
8D	B1	8E	F9	F3	93	DD	CF	F7	87	FB	FF
FE	C3	FE	F5	F1	9F	FE	FD	F7	8D	FB	F3
FE	FF	FE	F5	F1	FF	FE	FD	FB	DD	FB	ED
FE	FF	FE	F5	F1	FF	FE	FD	FD	DD	FB	ED
FE	C3	FE	F5	F1	9F	FE	FD	FD	8D	FB	F3
8D	B1	8E	F9	F3	93	8F	CF	FB	87	FB	FF
67	D1	69	FF	FF	99	67	B7	FF	87	DF	FF
27	E3	2F	9F	DF	99	27	B7	9F	87	DF	9F
8F	FF	8F	9F	AF	93	8F	CF	9F	8F	DF	9F
FF	FF	FF	FF	FF	9F	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF
B4	03	74	24	12	29	OB	C1	C4	FF	47	C8