LED Matrix Studio v0.8.13

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www.freshney.org // paul@freshney.org

www.maximumoctopus.com/electronics/builder.htm

Application: www.maximumoctopus.com/electronics/downloads/LEDMatrixStudio.zip

Source code: www.maximumoctopus.com/electronics/downloads/LEDMatrixStudioSource.zip

In this document the word *matrix* and *frame* mean the same thing. It's an arrangement of pixels with a specific set of dimensions.

Animation refers to all the frames in the current project.

Basic usage

Left mouse button draws on the matrix in the ON colour

Right mouse button draws on the matrix in the OFF colour.

When using drawing modes (rectangle, circle etc.), the button that is first clicked determines the final draw colour.

In bicolour or RGB mode, the colour selection for each button is shown on the left of the draw tools toolbar.

In gradient mode (RGB and bicolour only) the middle mouse button is used to draw with the gradient.

Menus

File

New

Create a new project. See page 18 for more details.

Open

Load a previously saved animation or single frame.

Import from bitmap

Use a bitmap image as the basis of a new animation of single frame.

Import in to current frame

Load a previously saved single frame in to the currently visible frame.

Merge in to animation

Appends frames from a file to the end of the current animation.

Combine with the animation

Combines the frames from a file in to the animation, starting at frame 1.

Save

Save the current animation or single frame to a file.

Save as

Save the current animation or single frame to a file to a new file name.

Save single frame as

Save the currently selected frame to a file.

Save as LED Matrix Studio Font

Save the current frames in a format that can be used as a font within the application. Select a font by pressing the right mouse button on the Font button within the drawing tools draw menu.

Preferences

Open application settings.

Exit

Close the application. If an animation is running the application will not close, the animation will stop playing.

Edit

Undo

Undo the last editing action.

Redo

Redo the last undo.

Copy

Copy the current frame to the clipboard.

Copy from previous

Copy the frame before the selected frame to the clipboard (if the current frame > 1).

Paste

Pastes the frame on the clipboard in to the selected frame.

Paste special

Paste and shift left

Paste and shift right

Paste and shift up

Paste and shift down

Pastes the frame on the clipboard in to the selected frame. The contents of the clipboard are then modified depending on which special action is selected.

Shift left

Shift the entire frame one pixel to the left.

Shift right

Shift the entire frame one pixel to the right.

Shift up

Shift the entire frame one pixel upwards.

Shift down

Shift the entire frame one pixel downwards.

Rotate anti-clockwise

Rotate the entire frame 90 degrees anti-clockwise.

Rotate clockwise

Rotate the entire frame 90 degrees clockwise.

Flip

Flips the current frame in the X-axis.

Mirror

Flips the current frame in the Y-axis.

Invert

“on” pixels become “off”, and “off” pixels become “on”.

Edit comment

Edit the comment that will be saved with the current animation/single frame.

Set dead pixels

If you have a device with dead pixels, are a device with missing LEDs then you can set them here and they will be ignored when drawing.

View

Column/row data toolbar

Show or hide the simple export toolbar.

Show animation toolbar

Show or hide the animation toolbar.

Column / row toolbar appearance

Hex output

Enable/disable hex output of values

Hex output prefix

Select either **$** or **0x** for hex values.

Pad output

Ensure all values are a minimum length. Value is padded with zeroes.

Brackets

Select which brackets to use for the output.

Use format embedded in save files

Change the selections above based on the settings of the current file.

Font mode

Toggle font mode.

Change start ASCII code (default is 32)

By default font mode starts at ASCII code 32 (the space character); change it here.

Previous frame

Move to the previous frame in the animation. If this action is performed on the first frame, then it will navigate the last frame.

Next frame

Move to the next frame in the animation. If this action is performed on the last frame, then it will navigate to the first frame.

Grid

Enabled/disable a grid in the matrix display.

Preview

Show/hide the preview display.

Shows the matrix in a smaller size, it makes designing graphics and fonts much easier.

Preview size

Select the size of the preview display.

Preview view

Select from two different display modes:

Square

Exactly how it looks in the main display, except smaller.

Radial

Maps the pixels around a circle. This ideal if your design is composed of LEDs in a circular pattern.

Preview void (radial)

The distance from the centre of the circle to the first pixel. Use this to tweak the display for a better idea of how your project might look.

Larger voids will generally mean larger pixels in the preview, smaller voids will give you smaller pixels.

Font viewer

View all of the fonts available to the application. See every character in normal and RGB mode.

Project

Clear all frames

Clear all frames in the current animation. Does not remove any frames.

Clear all frames with gradient

Flip all frames

Flip all animation frames in the Y-axis.

Mirror all frames

Flip all animation frames in the X-axis.

Invert all frames

Perform the invert action on all frames in the animation. “on” pixels become “off”, “off” pixels become “on”.

Apply gradient to all frames

Applies the current gradient to all “on” pixels.

Fade First -> Last (RGB mode only)

Fades each pixel individually. The colour in the first frame is faded to the colour of the pixel in the last frame.

Export

See page 20.

Code templates

Export the animation/frame to a code template. See page 23 for more information on code templates.

Export to bitmap

Exports the current animation to a single bitmap image.

Memories

LED Matrix Studio has 10 scratchpad memories that can be used to store frames. One frame per memory.

They are erased whenever a new project is started; they are not erased when clearing a single frame, or clearing the entire animation.

Copy current to

Copy the currently displayed frame to one of the 10 memories.

Restore current from

Copy the selected memory to the currently selected frame.

Export user memories

Save the contents of the 10 user memories.

Clear all user memories

Erase the contents of the 10 user memories. This cannot be undone.

Tools

Auto-save

Enable auto-save mode.

Auto-save interval

Change the interval between auto-saves.

Open auto-save folder

Show the folder where auto-saves are located. Opens in Explorer.

Automate

Simple animation system. See page 23 for more details.

Help

Help

Opens this help file!

Example code

Opens the *\example code* folder.

Check for updates

Checks *maximumoctopus.com* for a new version.

Website

Opens *maximumoctopus.com/electronics/builder.htm*

About ☺

Important information

Toolbars

Top Toolbar (left to right)

New

Create a new matrix.

Open

Load a previously saved matrix, font, or animation.

Save

Save the current frame or animation.

Export

Export one or more frames from the current animation to a format suitable for development. See page 20 for more information.

Pixel size (Tiny, Small, Medium, Large, Massive, Ultra)

Choose how big each "pixel" should be within the software.

Pixel shape (Square or Circular)

The shape of each "pixel" on screen.

Preset

Press the right mouse button on this button for the following options:

> Load an already saved preset.
>
> Save the current preset.

Presets contain the matrix size and row data orientations.

Using X bytes.

Displays the amount of memory required for the current animation.

Middle toolbar (left to right)

Clear

Clears the current frame.

Clear *all* frames from menu: Project -> Clear all frames.

Flip

Flips the current matrix horizontally.

A separate menu item exists for flipping every frame in the current animation.

Mirror

Flips the matrix vertically.

A separate menu item exists for mirroring every frame in the current animation.

Invert

Inverts the pixels so "on" becomes "off" and "off" becomes "on".

A separate menu item exists for inverting every frame in the current animation.

Left / Right / Up / Down

Scrolls the matrix one pixel in the specified direction.

Rotate L / Rotate R

Rotates the matrix 90' in the selection direction.

Rotate

Creates a selected number of frames where each frame is rotated a set number of degrees further than the preceding frame, starting from the current frame.

This feature works much better with higher sized displays, but will still require some user tweaking.

5' to 90'

Select the amount of degrees to rotate for each frame.

1 to 72

Select the number of frames to create.

Drawing tools (left to right)

Press ESCAPE or click the left-most button to cancel the current drawing.

Standard Draw (mouse cursor)

Right mouse button on the button to select brush size (1 pixel, 2x2 pixels and 3x3 pixels).

Left mouse button (on the matrix) to toggle the pixel on/off.

Right mouse button (on the matrix) to draw freehand. The first pixel that is selected sets the mode.

Select an "on" pixel to turn "off" pixels "on", select an "off" pixel to turn "on" pixels "off".

Copy section of the matrix

Select the first corner (doesn't matter which) using the left mouse button, then select the second corner, again, use the left mouse button. Press the left mouse button to paste the selection. Hold down the LEFT SHIFT key to paste transparently.

Draw a filled rectangle

Select the first corner (doesn't matter which) using the left mouse button, then select the second corner, again, use the left mouse button.

Draw an empty rectangle

Select the first corner (doesn't matter which) using the left mouse button, then select the second corner, again, use the left mouse button.

Draw an empty circle

Using the left mouse button, select the centre, then select any point on its radius.

Draw a line between two points

Select the start point (doesn't matter which) using the left mouse button, then select the end point again, use the left mouse button.

Draw a line between two points – on every frame

Select the start point (doesn't matter which) using the left mouse button, then select the end point again, use the left mouse button.

Add text to your matrix

Press the right mouse button on the button to select one of the installed fonts.

Press the left mouse button to set the start position for the text then start typing!!

Draw in gradient mode

Pixels will be draw based on the colour of the current gradient.

Draw random colours (RGB and bi-colour only)

Will paint in random colours.

ON 3

Only visible in bi-colour mode. Colour 3, bit pattern 11.

ON 2

Only visible in bi-colour mode. Colour 2, bit pattern 10.

ON 1

Visible for all matrix types. Represents an "on" pixel.

OFF

Visible for all matrix types. Represents an "off" pixel.

SELECTOR

The colour used for all drawing tools. Shows initial corner for rectangle and empty rectangle modes; start location for drawing tool; centre for empty circle tool.

LIGHTBOX

The colour to use when showing the contents of the previous frame, when lightbox mode is on.

Animation toolbar (left to right) [View -> Show animation toolbar]

Play

Press the right mouse button on this button to select playback speed.

Stop

Stops the animation

First

Move to the first frame in the sequence.

Previous

Move back one frame.

x of y

Shows the currently selected frame (x) and the maximum number of frames available (y).

Next

Move forward one frame.

Last

Move to the last frame in the sequence.

Add

Insert a new blank frame after the current frame.

Add Copy

Insert a copy of the current frame after the current frame.

Add Multiple

Add a number of extra (blank) frames to the animation.

Delete

Delete the current frame from the sequence.

Lightbulb

Turn on lightbox/onion skin effect. See the contents of the previous frame (in grey) within the current frame.

Slider

Select a frame from the sequence.

Simple export / import toolbar (left to right) [View -> Column/Row data toolbar]

Located at the bottom of the screen, usually below the animation toolbar. This allows for simplified export and import of data from/to the current matrix (not animation).

Copy the contents of the box to the right for export. Paste in data, press return, for import. Data should be comma delimited and will processed according to the drop down lists selection.

Source

Select either rows or column.

Bit orientation

For each row of data select whether the LSB (least significant bit) or MSB (most significant bit) is at the left of the grid.

Direction

Collate the data from the top of the grid down, or the bottom of the grid up.

Copy

Click the clipboard button to copy the comma-separated data in the adjacent box to the

clipboard.

New dialog

Click the New button on the top toolbar or select New from the File menu to start a new single matrix or animation.

Matrix options

Single colour

Pixels are either on or off. Suitable for the majority of LED displays on sale today.

Bi-colour (sequential)

For displays where there are two LEDs per “pixel”. Pixels can be one of three colours. This option is designed for displays that need the data in sequence.

Example, a display that uses red/blue LEDs. Three in a row: blue, purple, red: 01 11 10 -> 011101

Bi-colour (bitplanes)

For displays where there are two LEDs per “pixel”. Pixels can be one of three colours. This option is designed for displays where the data is separated per LED.

Example, a display that uses red/blue LEDs. Three in a row: blue, purple, red: 01 11 10 -> 011 110

The data for the red LED comes first, then the data for the blue LED.

RGB

For displays that contain RGB LEDs. Allows for full colour graphics and animations.

Size

Choose from 1x1 to 256x256 pixels.

By default, the common sizes are shown. Select All to show all values between 1 and 256.

Pixel Shape

Select either square or circle. This option only affects the on-screen display, but can be very useful when designing graphics.

Animation

Select the number of blank frames to start with (frames can be added and deleted at any time after starting a new project).

Clear all animation/matrix data

If you made a mistake and chose dimensions that were too small or too large than you can decide to keep the previous data. No scaling or modification are applied if this option is unchecked.

From Preset

Select from a range of preset projects.

New presets can be created from the Preset button on the application’s top toolbar.

Create

Start the new project using the above settings.

Cancel

Return back to the application without changing any settings.

Export

The LED Matrix Studio has a very powerful export system. It allows for export in to format suitable for almost every development environment.

If the **Auto preview** check box is checked then all changes can be seen in real-time.

Rows | Columns

Selects either the column or row as the source data.

Selecting Rows will give the following options:

Top to bottom | Bottom to top

Chooses the start row and direction. Start at the top and go down, or vice versa.

Left to right | Right to left | Alternate left/right | Alternate right/left

Starting point and direction within the row.

The alternate modes change direction every row. Left/right starts left at row 0, right at row 1, etc. Right/left starts right at row 0, left at row 1, etc.

Selecting Columns will give the following options:

Left to right | Right to left | Sure 24x16

Chooses the starting column and direction.

The Sure 24x16 mode is a special option designed for the Sure 24x16 LED board (a great btw).

Top to bottom | bottom to top | Alternate down/up | Alternate up/down

Start point and direction within the column.

The alternate modes change direction every row. Up/down starts up at column 0, down at column 1, etc. Down/up starts down at column0, up at column 1, etc.

Frames x to y

Select which frames to export.

Optimise output (if possible).

Least significant bit (LSB)

Left | right for row, **top | bottom** for column

Select the location of the least significant bit in the data.

Take the binary value: 00010011

If the LSB is at the right, then in decimal this is 19.

If the LSB is at the left, then in decimal this becomes 200.

`https://en.wikipedia.org/wiki/Bit_numbering#Least_significant_bit`

Export format

Select the format of the exported data. Select from the six possible options:

Comma separated

The simplest output, no language styling, just each value separated by a comma.

PICAXE EEPROM

Designed for the PICAXE development platform.

C-style (1 dimensional)

Suitable for the Arduino IDE, Spark Core, Espruino, and many other platforms.

C-style (2 dimensional)

Suitable for the Arduino IDE, Spark Core, Espruino, and many other platforms.

Python (1 dimensional)

Suitable for the Raspberry Pi, and any other python platform.

Python (2 dimensional)

Suitable for the Raspberry Pi, and any other python platform.

Number Format

Decimal | Binary | Hex

Select the numeric format.

Hex always looks the coolest :)

Number Grouping

8 bit | 16 bit | 32 bit

Select how to group the output values.

8 bit (swap nibbles)

Swap the nibbles when outputting 8 bit values.

The number 176 (10110000) becomes 11 (00001011).

16 bit (swap bytes)

Swap the bytes around when outputting 16 bit values.

The number 43760 (1010101011110000) becomes 61610 (1111000010101010).

The process is easier to see if the values are in hex: 50293 (hex C475) becomes 75C4 = 30148.

Each Line of Output

Organise the exported data, decide how much ore how little to place on a line.

Row | Column

A single row or column (depending on the orientation setting at the top of the export page).

Frame

An entire frame.

Bytes

A number of bytes.

RGB Colour Format (RGB mode only)

RGB | BGR | GRB

Select the output colour format for your device.

Number Grouping (RGB mode only)

8 bits (one byte per colour)

This option will output three bytes per pixel.

Eg red (FF0000): 0xFF, 0x00, 0x00

32 bits

This option will concatenate the bytes (in the order from RGB Colour Format above) in a 32 bit value. The first byte will be zero.

Eg red (FF0000): 0x00FF0000

Automation

Automate one or more actions across a set number of frames. This feature is designed for those using devices with large amounts of memory or very slow microcontrollers that can't manipulate data quick enough to do things in real-time.

Click on an action to add it to the list. Click *Remove* or double click an action to remove it from the action list.

Actions

Mirror | Flip | Invert

Left | Right | Up | Down (scroll)

Rotate L | Rotate R

These nine actions are identical to those found in the application.

Wipe (Vertical) | Wipe (Horiz)

Similar to scroll, but wipes from the centre outwards.

Wipe (Vertical) C | Wipe (Horiz) C

Similar to the above, but clears the data as it gets wiped off-screen.

Code Templates

These can be found in the *\code templates* folder and contain fully working projects that are just missing matrix or animation data.

Export your data to a template using the Project -> Code Templates menu option.

Instead of just exporting the data, it's now possible to export the data in to a preconfigured template - instant code! Instant demo!

Within this folder are two kinds of file:

Code	<filename>.<extension>
Template	<filename>.<extension>.template

The code file contains the source code (specific to the platform folder), complete with special "tokens" that identify areas that should be filled-in by the software.

The template file contains instructions on how the data should be configured so that it's in a format that source code expects.

If you've created some templates (or would like new tokens), or wish to create them, then please get in touch!!

Usage

To populate the template with code and data, use the following tokens:

{$LMS_MATRIX_DATA$}

Inserts the matrix data, based on the .template rules.

{$LMS_FRAMES$}

The number of frames of animation.

{$LMS_BYTES$}

The number of bytes of data (in total).

{$LMS_COUNT$}

The number of entries in the data array.

Each source code file needs a template to go with it, just append *.template* to the source code file name. This tells the software how to export the data so it's in the correct format.

.template construction

```
{RGB  or {
a:
b:
c:
d:
e:
f:
g:
h:
i:
r:
v:
w:
y:
z:
}
```

{ defines a non-RGB output

{RGB will enable RGB output

a: Export how

a:0 = Columns

a:1 = Rows

b: Output order (Rows OR Columns, depending on selection above)

b:0 = Top to bottom OR Left to right

b:1 = Bottom to top OR Right to left

b:2 = Sure 24x16 special output mode

c: LSB (least significant bit)

c:0 = Left

c:1 = Right

d: Programming language format

d:0 = Comma separated

d:1 = PICAXE EEPROM

d:2 = C-style (1 dimensional)

d:3 = C-style (2 dimensional)

d:4 = Python (1 dimensional)

d:5 = Python (2 dimensional)

d:6 = Microchip

e: Number format

e:0 = Decimal (base 10)

e:1 = Binary (base 2)

e:2 = Hex (base 16)

f: Number grouping

f:0 = 8 bits

f:1 = 16 bits

f:2 = 32 bits

f:3 = 8 bits, swap nibbles

f:4 = 16 bits, swap nibbles

f:5 = 64 bits

f:6 = RGB: 8 bits, one byte per colour

f:7 = RGB: 32 bits

g: Output order II (in conjunctions with a: and b:)

g:0 = Left to right OR Top to bottom

g:1 = Right to left OR Bottom to top

g:2 = Alternative Top/Bottom OR Alternative Left/Right

g:3 = Alternative Bottom/Top OR Alternative Right/Left h: Output line structure

h:0 = Row/column

h:1 = Frame

h:2 = Bytes

i: Used for h:2 above

i:x = where is x is the amount of bytes to output per line

r: RGB Mode (only use for RGB output)

r:0 = RGB

r:1 = BGR

r:2 = GRB

Dimension constraints

For some code templates it's highly likely that code expects a matrix of a certain size. These next four parameters allow the code template designer to specify minimum and maximum matrix size.

For instance, code that outputs a matrix to an 8x8 LED display wouldn't want anything else:

v:8

w:8

y:8

z:8

but scrolly message code, across an 8x8 matrix, wouldn't mind how wide the matrix is:

v:8

w:0

y:8

z:8

Use 0 for no limit.

v: Minimum Width

v:a = Where a is the minimum matrix width allowed by the code template.

w: Maximum width

w:a = Where a is the maximum matrix width allowed by the code template.

y: Minimum Height

y:a = Where a is the minimum matrix height allowed by the code template.

z: Maximum Height

z:a = Where a is the maximum matrix height allowed by the code template.

Take a look at the supplied templates for more information and to see them in action.

About

Coding	Paul A Freshney
Development Cats	Rufthterford and Freeman
	www.MaximumOctopus.com/developmentcats.htm
Thanks	Lorenz, Greg, Andrew, Apostolos, David, Peter, Zoltan, Gary and Steve Turner