LED Matrix Studio v0.10.6

April 29th 2022

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www.maximumoctopus.com/electronics/builder.htm

Application and source code: https://sourceforge.net/projects/led-matrix-studio/

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

Animation refers to all of 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 20 for more details.

Open

Load a previously saved animation or single frame.

Recent Files

Open one of the last 20 previously opened files.

Import from bitmap

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

Import from GIF

Import the animation from a GIF

Import into current frame

Load a previously saved single frame into the currently visible frame.

Append to animation

Append a previously saved animation to the currently loaded project.

Merge…

Merge into animation (bottom has priority)

Merges two animations together. The bottom (currently loaded animation will take priority, with the loaded animation appearing beneath.

Merge into animation (top has priority)

Merges two animations together. The top (newly loaded animation will take priority, with the current animation appearing beneath.

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 range as

Save a selection of the currently loaded frames to a new 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.

Export to bitmap

Export the current frame to a bitmap file.

Export animation to bitmap

Export the current animation to a single bitmap file.

Export animation to GIF

Export the animation to an animated GIF.

Preferences

Open application settings.

Exit

Close the application. If an animation is running then 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).

Copy Multiple

Various methods of copying 2 or more layers or frames to another part of the animation.

Paste

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

Brush Actions

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.

View

Show animation toolbar

Show or hide the animation toolbar.

Palette/Gradient toolbar

Show or hide the RGB palette toolbar.

Working area background colour

Set a background/transparent colour for all RGB or bi-colour operations. The application will use this colour to determine “off” pixels and those which will be accepted as transparent for merging and layers.

Font mode

Toggle font mode. Optimises the UI for font design.

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

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.

Radial 3/4

As above, but covers only three quarters of the circumference.

Semi-circle (/inverted)

Maps the pixels around a semi-circle.

Preview void (radial / semi-circle)

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.

Preview offset (radial / semi-circle)

The angle offset from where the matrix is rendered around the display.

Project

Clear all frames (current layer)

Clear the currently selected layer in all frames of the current animation. Does not *remove* any frames.

Clear all frames (all layers)

Clears all layers of all frames in the current animation. Does not *remove* any frames.

Clear all frames with gradient

Clear all frames using the current 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.

Ignored pixels

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

Set from pattern

Set ignored pixels using a pre-determined pattern.

Load / Save pattern

Load (replace) the current ignored pixel pattern.

Save the current ignored pixel pattern to a file.

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 24.

Code templates

Export the animation/frame to a code template. See page 28 for more information on code templates.

Unlock all frames

Unlocks all layers on all frames for editing.

Lock all frames

Locks all frames, prevents editing.

Toggle lock status of a range

Toggles the status of a range of frames to locked or unlocked.

Draw

See page 16 for more information on the available drawing modes.

Freehand brush

Custom brush

Copy/paste

Filled rectangle

Empty rectangle

Filled circle

Empty circle

Line

Multi-draw (draw on multiple frames simultaneously)

Fill

Text

Gradient brush

Gradient

Random(!)

Colour picker

Pattern spiral

Pattern circle

Pattern split ring

Pattern petals

Pattern grid

Pattern pyramid

Pattern left triangle

Pattern right triangle

Frames

Add frame

Add a new frame to the end of the animation.

Add frame copy

Add a new frame as a copy of the current frame.

Add frame multiple

Add multiple frames in one operation.

Delete frame

Delete the current frame. This cannot be undone.

Delete multiple frames

Delete multiple frames in one operation. This cannot be undone.

Layers

The LED Matrix Studio has a powerful layer system. There is always a single layer, though for normal operation this will be transparent to the user. When you need multiple layers they can be handled through the layer panel and these useful menu options.

Toggle layer panel

Unlocks all frames for editing.

Clear layer (all frames)

Locks all frames, prevents editing.

Flatten all layers

Toggles the status of a range of frames to locked or unlocked.

Colours

Change colours in this frame/layer

Change a colour in a single frame to another colour.

Change colours globally (current layer)

Change a colour to another colour across the current layer of the entire animation.

Change colours globally (all layers/frames)

Change a colour to another colour across the entire animation.

Count colours

Displays the number of colours in the current animation (all layers).

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.

Optimise data

Uses a simple run length encoding system to compress and optimise your matrix data.

Font viewer

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

Help

Help

Opens this help file!

Show shortcut keys

Opens a separate file that lists all LED Matrix Studio shortcut keys.

Example code

Opens the \example code\\ folder.

Check for updates

Checks *maximumoctopus.com* for a new version.

Website

Opens https://sourceforge.net/projects/led-matrix-studio/

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.

Generate Code

Populates a chosen code template (see page 18) using the current animation.

Pixel size (Tiny, Small, Medium, Large, Massive, Ultra, X-Ultra, and Auto(matic))

Choose how large each "pixel" should appear on screen.

Pixel shape (Square, Circular, Square(r))

The shape of each "pixel" on screen. Square (default), circular, or square with rounded corners.

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 (on the target device) for the current animation. This is raw value, and may change depending on export options.

Middle toolbar (left to right)

Clear

Clears the current frame.

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

Mirror

Flips the matrix vertically.

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

Flip

Flips the current matrix horizontally.

A separate menu item exists for flipping 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, in degrees, to rotate each frame.

1 to 72

Select the number of frames to create.

Ideally, the above two values should multiply together to make 360 (degrees in a circle).

Drawing tools (left to right)

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

Standard drawing (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".

Brush

Create and paint a brush on to the selected layer of the selected frame.

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 filled 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.

Draw on all frames simultaneously

Similar to the normal draw mode, but it draws on every in the current layer of every frame.

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 using random colours.

Colour picker

Selects a new colour using the selected mouse button. Click any of the 16 user preset colours on the RGB palette toolbar to select a new colour for that preset.

Mirrored drawing mode (drop-down list)

Will mirror any drawing either vertically or horizontal across the matrix (or all frames if a multi-frame drawing mode is being used. Options are: *None*, *Horizontal*, *Vertical*.

Preset pattern list

A selection of patterns for making animation creation easier. These are best used with radial and semi-circle designs.

Use CTRL + Mouse Wheel Up/Down to modify the pattern in real time.

RGB and RGB 3bpp palette toolbars

Three sections of colours. The mouse button used to click on these will set the corresponding colour to that mouse button when drawing. Click with the middle mouse button to draw with that colour when holding the middle mouse button

16 customisable colours. These will be saved when the application is closed. To change a colour either a) click the colour picker icon in the tools toolbar, or b) hold down the CTRL key when clicking any of the colours.

16 shades of the last selected colour. RGB mode only.

10 presets (cannot be changed). RGB mode only.

Current colours toolbar (visible in RGB and RGB 3bpp modes only)

Background

The application will use this to determine what is transparent (when flattening frames) or background for exporting and some other functions.

L, M, R

The colours currently assigned the left, middle, and right mouse buttons respectively.

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

Play

Starts the animation.

Press the right mouse button on this button to select from a range of predetermined playback speeds, or to create a custom 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.

Delete Multiple

Delete a range of frames.

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.

New project 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.

RGB (3BPP)

A colour mode that uses 3 bits per pixel. This allows for a maximum of 8 colours per animation but a much-reduced memory usage compared to RGB.

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 to the application without changing any settings.

Import Bitmap dialog

Single Image

To import a bitmap into the LED Matrix studio using *Single Image* mode you'll need to ensure that each frame of the incoming animation is laid out at the top of the image, horizontally, side-by-side (with no gaps between frames).

Click *select* to open the source bitmap file.

Multiple Images

Multiple images mode assumes each frame of animation is stored in a separate bitmap file. The file names must be in sequential numerical order, and padded to a set width (e.g. 0001, 0002, 0003, etc.).

After selecting the first image of the group, the *import bitmap dialog* will attempt to guess the pattern used for the sequence.

First frame is the number of the first frame of the sequence (e.g. 1). Index length is the size of the token holding the sequence value. For the example 0001, above, this would be 4.

The *pattern* box shows how the file names with be read, with `$$` used a token to represent the changing sequence number.

Common settings

Selecting *RGB Import* will force the application to read the selected image(s) as full colour. Without this option selected, the following rule is used: black (#000000) is an *off* pixel, every other colour is an *on* pixel.

Create new matrix (will clear all data) will erase current matrix settings and animation detail. If this option is not selected. then the import will happen into the current frame size where clipping may occur.

Clicking *auto* will guess the frame width and size. This may not always be correct, so check before accepting values.

There are example bitmaps in the following folders, to be found where you installed LED Matrix Studio:

```
\bitmaps\
```

Contains a selection of simple bitmaps to import.

```
\saves\examples\bitmap_export\smiley_face
```

Contains an example of "multiple" image import. Select the first image (sf_001.bmp), and the application should fill in the other details for you. Make sure you set the correct number of frames to import.

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 range of frames to export.

Optimise output (if possible).

Performs a simple (run length encoding) optimisation of the export data.

Least significant bit (LSB)

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

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

Take this example 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/C++ (1 dimensional)

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

C/C++ (2 dimensional)

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

C/C++ (FastLED)

Special format for using with the FastLED libraries.

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.

Microchip

For Microchip assembler format.

Pascal

Outputs in a generic Pascal format.

Number Format

Decimal | Binary | Hex

Select the numeric format.

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 set 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-bit (one byte per colour)

This option will output three bytes per pixel. Eg. red (FF0000): 0xFF, 0x00, 0x00

32-bit

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.

Rotate (90’ anti-clockwise or clockwise)

Rotate the frame

Jiggle

Bounce

Alternate

Brush #1 (every frame or first frame)

Positions brush #1 on the frame

Brush #2 (every frame or first frame)

Positions brush #2 on the frame

Colour cycle (linear or bounce)

Cycles the specific colours in each frame. Linear moves through the colours in order, once at the end of the list, it repeats from the first colour. Bounce moves through the colours in order, and once at the end of the list it reverses through the colours from high to low, and repeats.

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 into a preconfigured template - instant code or 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	Rutherford, Freeman, and Maxwell. www.MaximumOctopus.com/developmentcats.htm
Lines of code	29168 (April 28th 2022) *27191 (April 29th 2020)*

Dedicated to Julie, Dyanne, and Adam.