Amulet

GEMstudio Pro

Beginner's Guide
2018

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Welcome

Congratulations on your Amulet purchase! Please take a few minutes to read this file which contains the latest information about setting up and using your Amulet product. This documentation is valid starting with GEMstudio Pro software version 3.0.0.0

Overview

The Amulet method of displaying graphics on an LCD is totally different from traditional methods. The Amulet GEM Graphical OS Chip handles all the LCD and touchpanel functions so your microcontroller doesn't have to. Hardware-wise, the only requirement is that your microcontroller needs a UART or USB in order to use the Amulet system. On the software side, you need to create an Amulet serial protocol handler. Generally, the only thing that is being sent via the serial link is data.

Here's the Amulet system in a nutshell.

1. GUI authoring tool called GEMstudio Pro is used to create a Graphical User Interface(GUI).
2. GEMstudio Pro is used to compile your GUI to a small binary file which is then downloaded into the Amulet module.
3. The Amulet module displays the GUI and handles all touchpanel interaction.
4. The Amulet module receives input data from your host microcontroller via the serial link and also sends command messages back to your microcontroller based upon timer-based or touchpanel events.

There are two types of variables in the Amulet system. External variables (byte, word, color and string) which reside on your microcontroller's side and InternalRAM variables (byte, word, color and string) which reside on the Amulet module. InternalRAM is a quasi-dual port RAM that can be read from and written to by the Amulet chip through commands inserted in the GEMstudio Pro code. Your microcontroller interfaces to InternalRAM through the serial link. There are specific UART and USB commands that can read from and write to InternalRAM.

There are four major types of serial messages that will be sent between the Amulet module and your microcontroller.

1. A request of a variable (byte, word, color or string)
2. A setting of a variable (byte, word, color or string)
3. A Remote Procedure Call, which is a completely generic message which allows the Amulet module to inform your microcontroller of a certain event. You can have up to 256 unique RPC's. What those RPC's signify is entirely up to you.
4. A raw byte, or group of bytes, can be sent from the Amulet module to your microcontroller. This option is not part of the Amulet serial protocol, but rather it gives you the flexibility to have the Amulet module send you small commands that do not need to be answered. In addition, a scripting language gives access to the serial receive byte interrupt and a custom handler can be written to define your own serial protocol.

Please see the Amulet UART Protocol documentation for more details.

Your LCD's user interface is created using GEMstudio Pro. Amulet has created a number of I/O objects, referred to as Amulet Widgets. There are two types of Amulet Widgets, Control Widgets and View Widgets. Control Widgets are input objects, like function buttons, sliders, radio buttons, etc... Control Widgets have a function, or a set of functions, that can be applied

to them. For instance, a function button can be set to send a Remote Procedure Call #5 out the UART or USB every time it is pressed. View Widgets are output objects, like bargraphs, numeric fields, string fields, etc... View Widgets call a function which returns the data used as the input for that particular widget. For instance, a bargraph can have a function which requests external byte variable #3 every 100ms over the UART or USB. When the Host microcontroller replies to that message, the bargraph automatically redraws itself with the new value.

The complexity of the serial protocol handler depends upon the type of communication you will be using in your system. You can set up your project so that the Amulet module is the master, requesting data at given update rates and sending command messages asynchronously. Or your microcontroller can be the master, sending data to the Amulet module unsolicited. And you can also use a dual master setup, where the Amulet module is sending asynchronous command messages to your microcontroller, yet your microcontroller is also sending unsolicited data to the Amulet.

Embedded GUI Video Tutorials

If you haven't already done so, please take the time to look at the Online Video Tutorials. The tutorials will provide you with an overview of how to create, compile and simulate your GUI. To get to the tutorials, pull down the menu for Help when you open a GEMstudio window and select "Online Video Tutorials". For additional examples, please go to your GEMstudio directory and click on the .gemp files.

What will I learn in the tutorials?

• Creating and Compiling a GUI.

• Simulate the GUI

• Introduction to GEMscript

Click [here](#) for the videos.

Creating a Project

Creating a new project in GEMstudio is easy! We will guide you through the following:

Creating a Project
Adding objects to your project
Adding Buttons
Adding a new page to your project
Adding a function to the page
Simulate your project
Program your project or page

To start GEMstudio, please launch GEMstudio either from the shortcut or from your start menu. An intro page will pop up as shown in the Figure below.
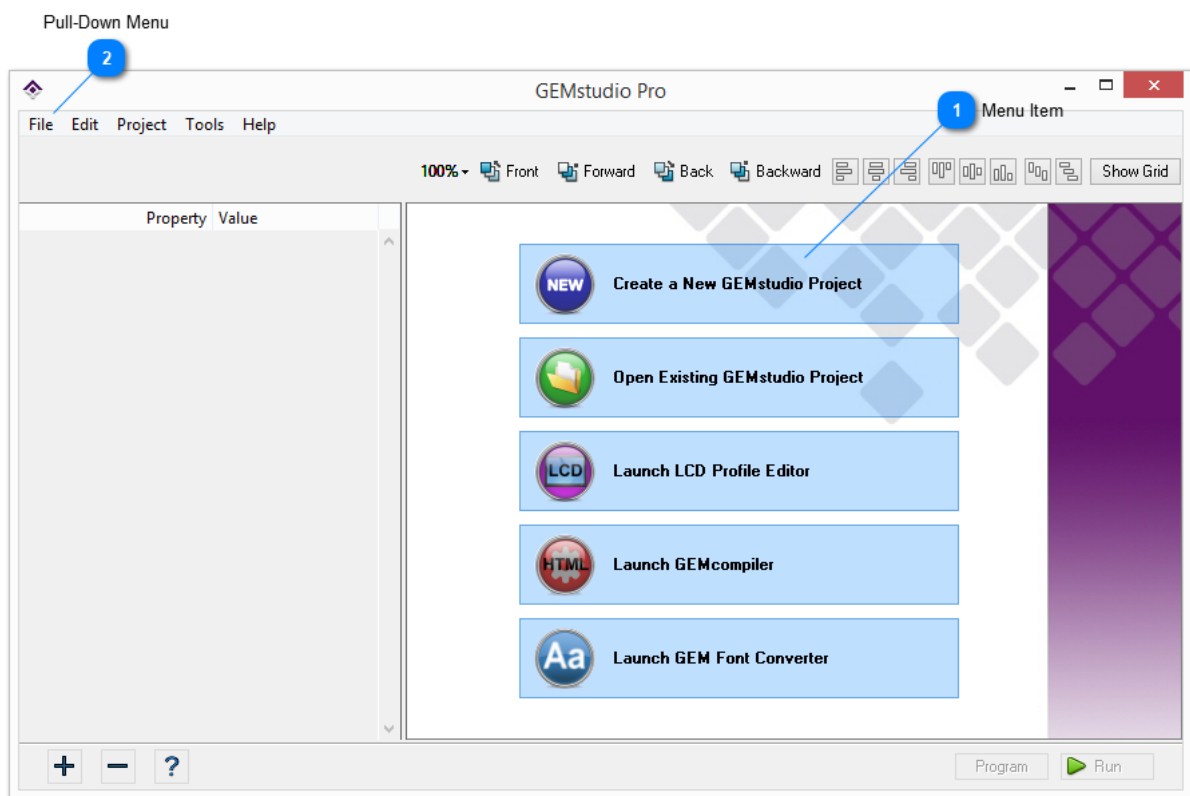
This GEMstudio intro page allows the user to create a new project, open an existing project, create a new LCD profile (only in full version), launch the GEMcompiler, and launch the GEM Font Converter.

To create a new GEMstudio project, please either click on the button "Create a new GEMstudio Project" (Menu Item 1) or the pull down File menu (Pull-Down Menu 2) on the top left hand corner and click "New Project". A New Project Wizard will appear as shown below:
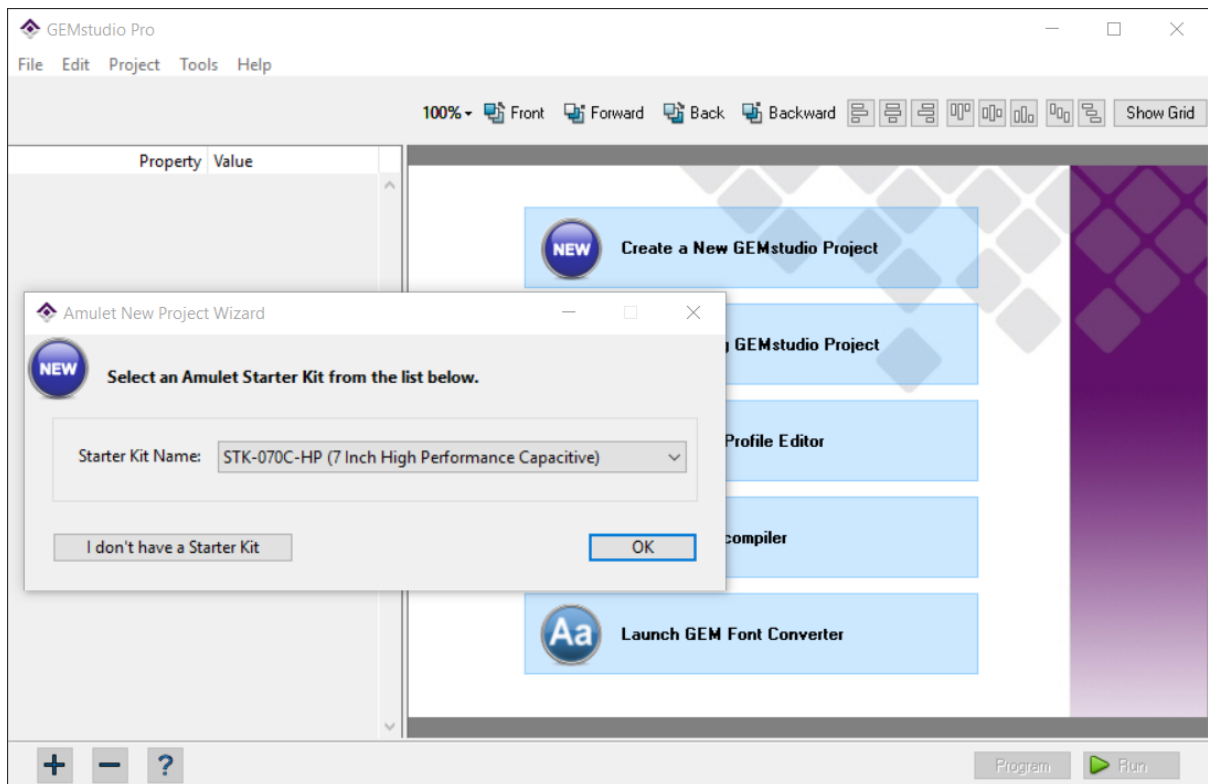
From the drop-down menu, pick the Amulet Starter Kit that you want to design for. If you have an Amulet Starter Kit, the New Project Wizard will choose the appropriate LCD and board file as well as set the project settings to the most common settings. You can skip all the steps below if using the New Project Wizard, but you can enter the Project Properties window at any later time to further customize your project's settings by selecting Project > Project Properties from within GEMstudio Pro.

If you are unsure of what to pick, or you don't have an Amulet Starter Kit, click on the I don't have a Starter Kit button and you will be taken immediately to the Project Properties window.

A Project Properties window will pop up where you can define the display you would like to design for. There are 5 tabs which can be used to customize the project: LCD, Communication, Color Depth, Transitions and Miscellaneous. The first tab is the LCD properties. Please choose the appropriate LCD size, manufacturer, and part number. If you don't see your LCD choice, please make a new LCD profile (for full versions only).
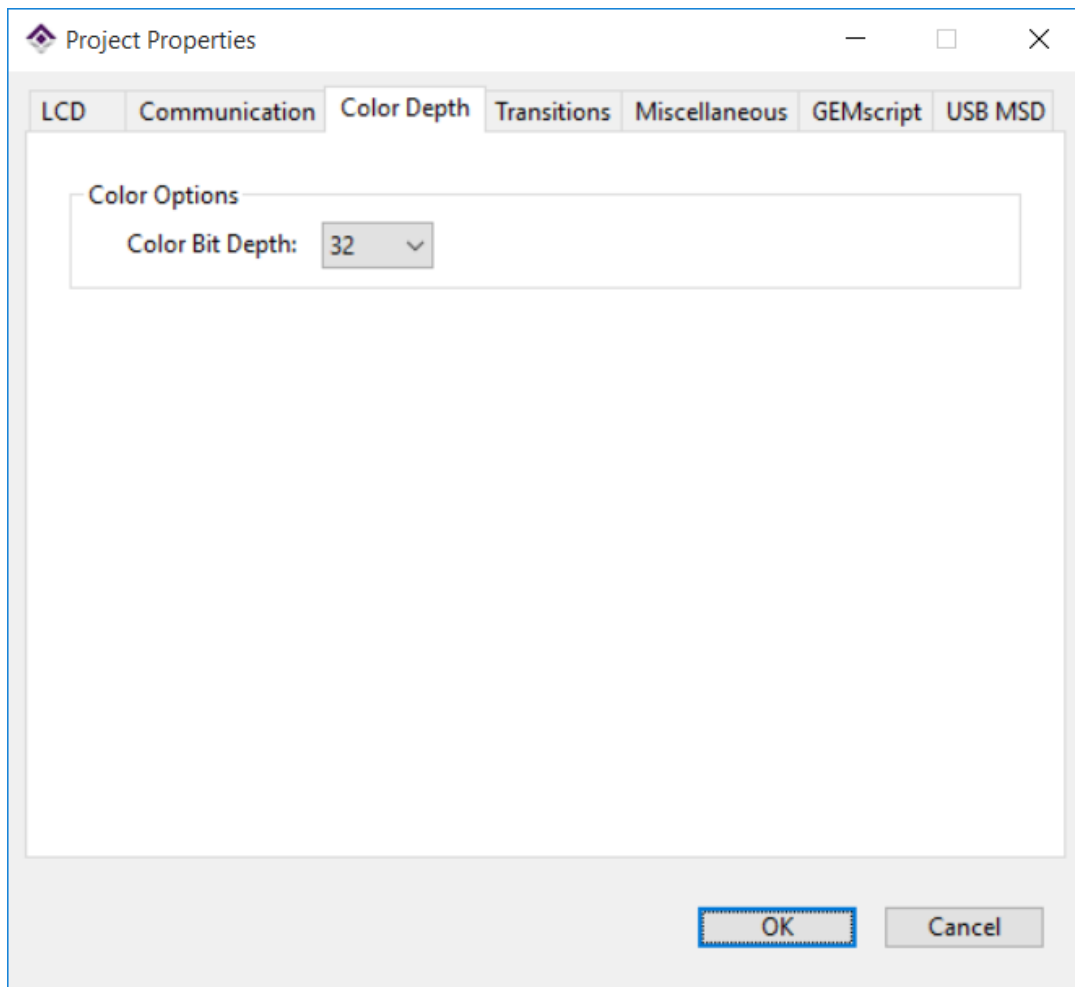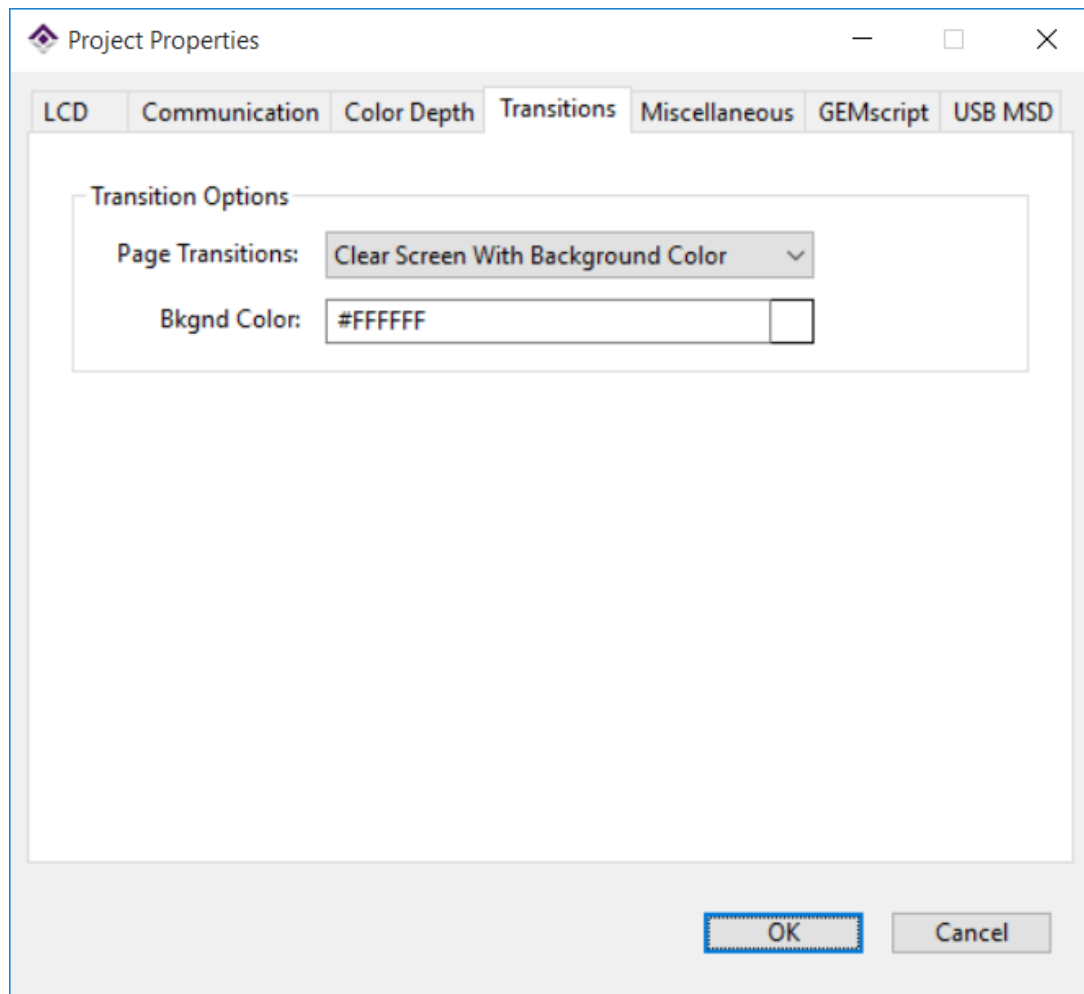
Project Properties
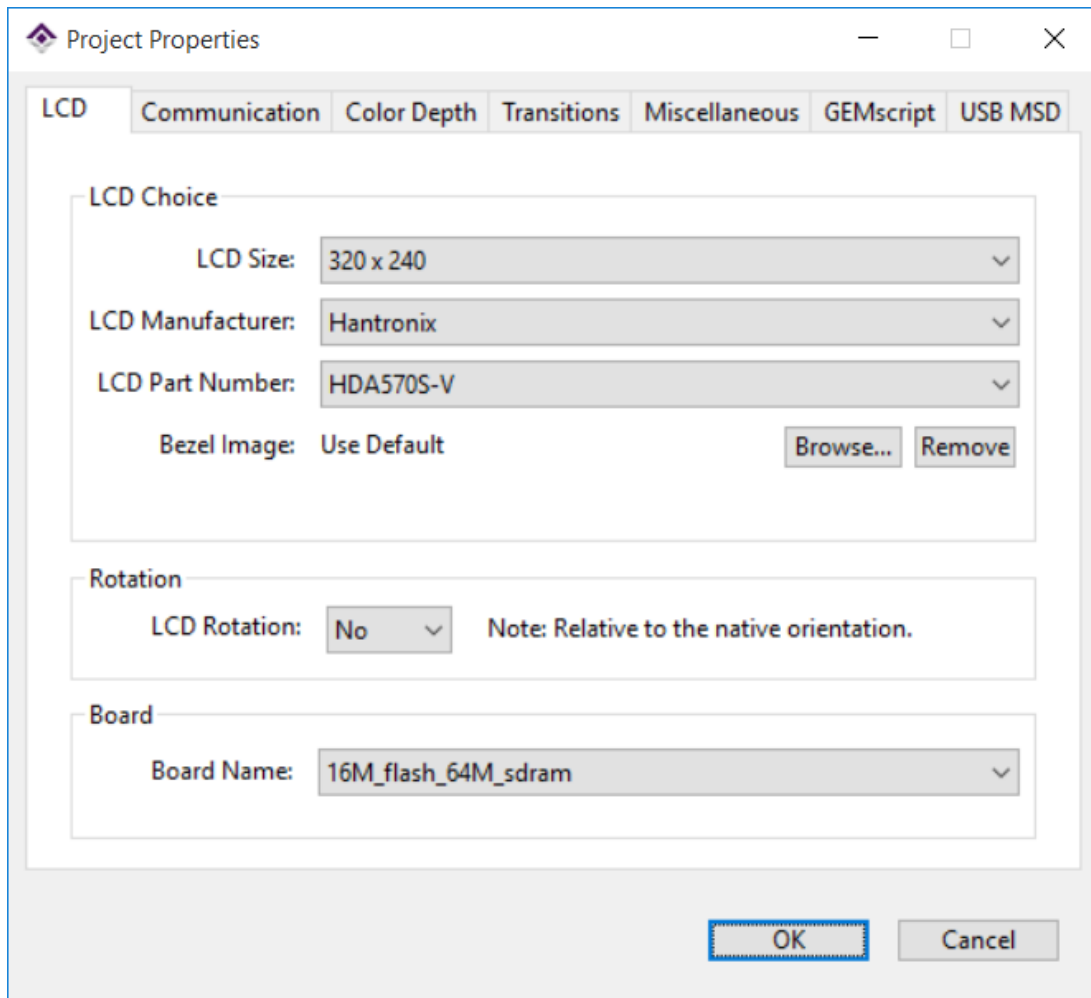
To set up communication for the project, click on the Communication tab as shown in the figure below. User can choose between a CRC or ASCII protocol type when the user clicks on the down arrow by Protocol Type. Amulet ID is only valid if CRC protocol type is chosen. It has to be different than the Host ID. The range for both Amulet and Host ID is 1 to 254. Timeout in seconds from 0.03 seconds to 2 seconds can be selected from a drop down menu. The Amulet Slave Response and Null Terminate Messages options are only available when ASCII protocol type is selected.
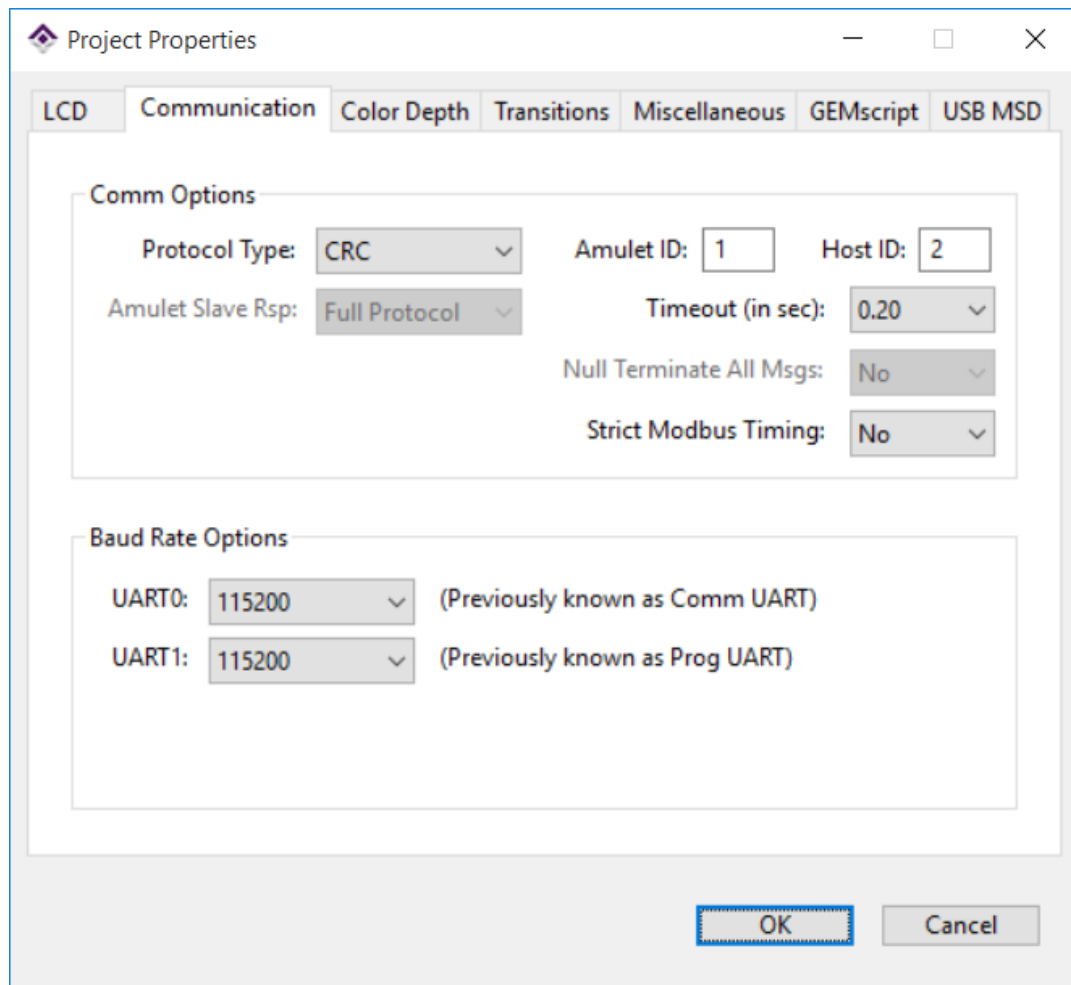
The next tab is the Color Depth tab. A pull down menu with options of 32-bit or 8-bit color depth is available. If you intend to run this project on Amulet's 7 inch resisitive display module, 8-bit color depth is the recommended setting.

Transition Options for the project can be selected by clicking on the Transition tab in the same window. On the transition tab window, user can select page transition options and background color.

Project Properties

| LCD | Communication | Color Depth | Transitions | Miscellaneous | GEMscript | USB MSD |

Transition Options

Page Transitions: Clear Screen With Background Color

Bkgnd Color: #FFFFFF

OK   Cancel

Miscellaneous tab on the Project Properties page enables the user to select different types of Frame Buffer, JPEG Compression and touch priority if the user is using a touch panel. For more information on the Macro File, see the GEMstudio Pro User's Guide under "Macro Preprocessor". The default settings here are fine.
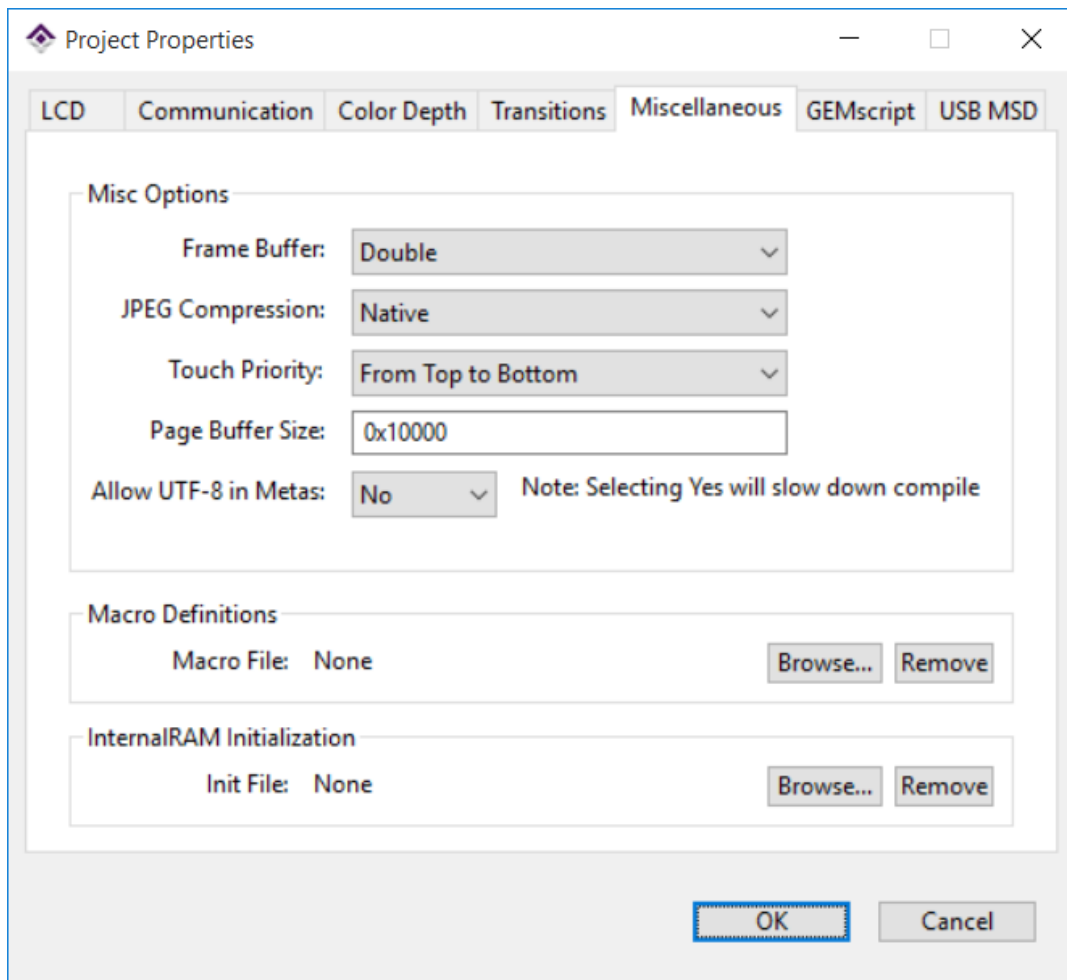
The GEMscript and USB MSD tabs are for the more advanced users. To learn more about this, please read the GEMstudio Pro User's Guide.

Adding Objects

Now that you have a new project created, you need to add to your project. There are four different objects that can be added: Image, Animated Image, Static Text and Background.

To add an image or an animated image, click on the ⊞ button on the lower left hand corner of the project window. A menu will pop up and you can select Image.
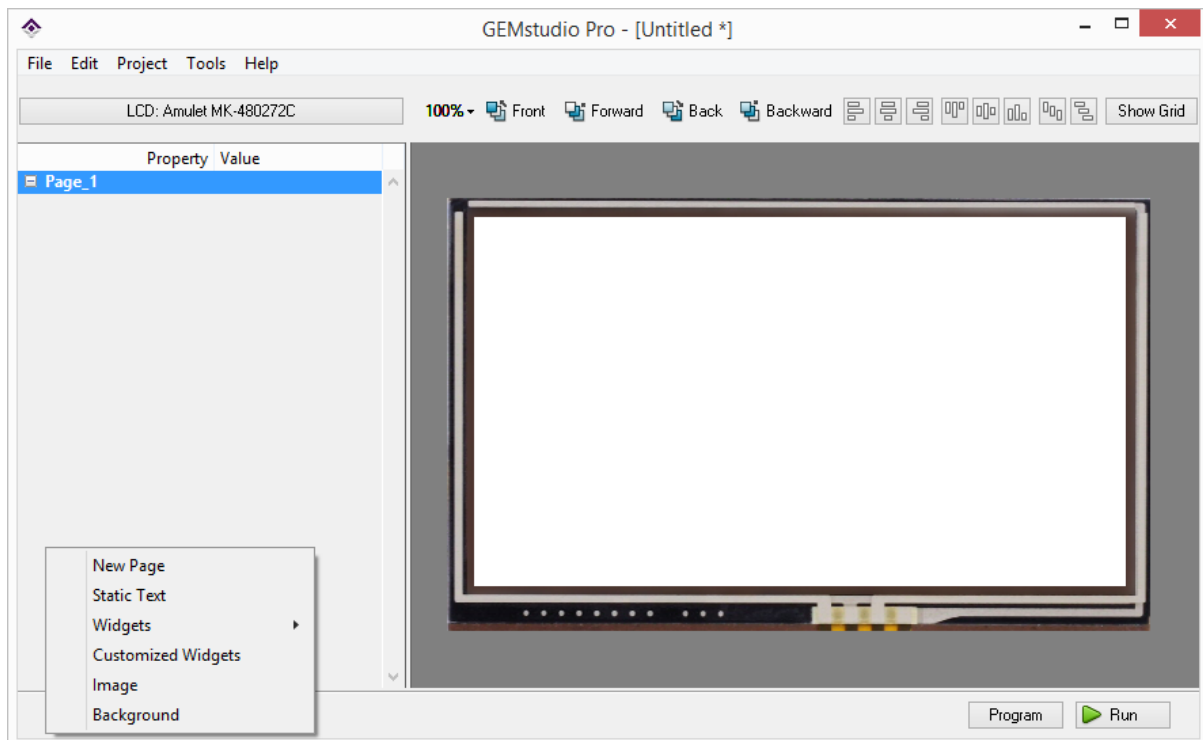
Once you click to add an Image, a file explorer window will pop up for you to browse to the image you want to add. If the image is an animated image, GEMstudio will automatically add it as an animated image. If not, it will be added as a normal image. Click on the value of the image if you want to change the image name.

To add static text, click on the ⊞ button on the lower left hand corner of the project window and select Static Text. A Static Text object will be added to the current page. To change the name of the Static Text object, click on the value of the Static Text.

To use a background image on your current page, page, click on the ⊞ button on the lower left hand corner of the project window and select Background. A file explorer window will pop up for you to browse to the background image you want to add. To rename the background image, click on the value of the Background.
NOTE: If at any time, you need further explanation on objects in your project, select the

object and click on the ❓ button on the lower left hand corner of the project window or press "F1". A help window will pop up explaining the selected object.

Adding Buttons

Buttons are the most porlific of all the objects added in a typical GUI. To add a button, click

on the ➕ button on the lower left hand corner of the project window. A menu will pop up and select Widgets è CustomButton
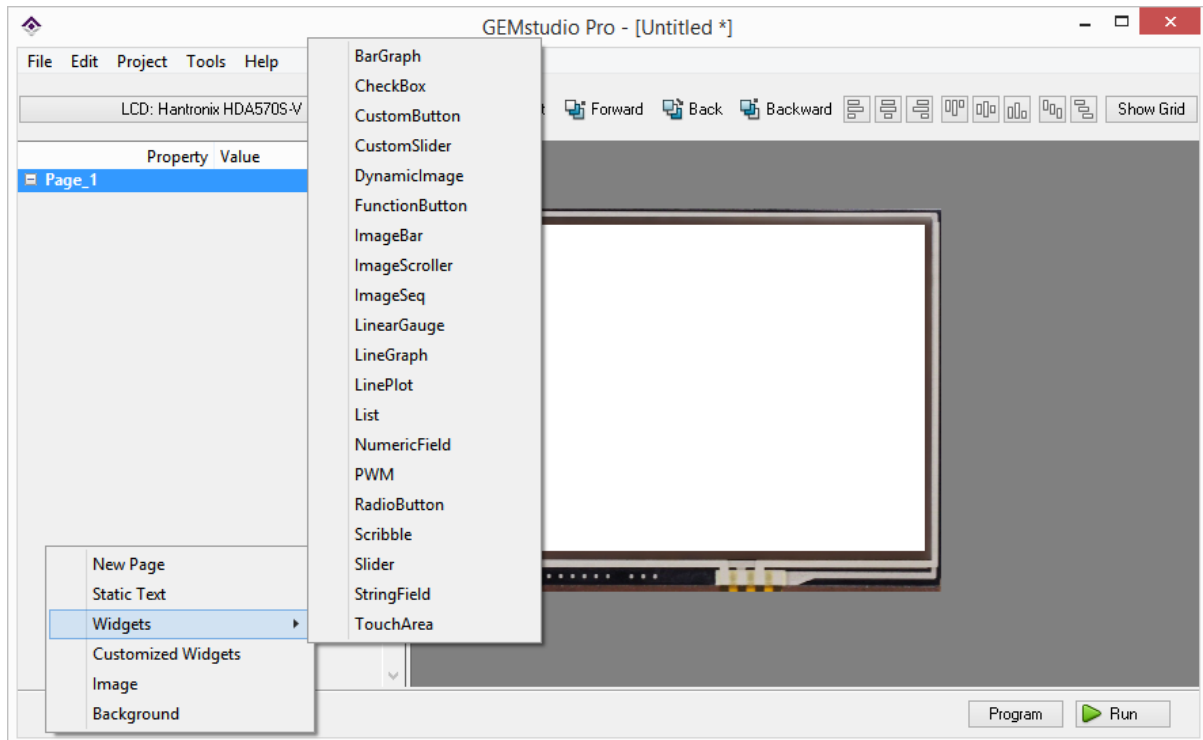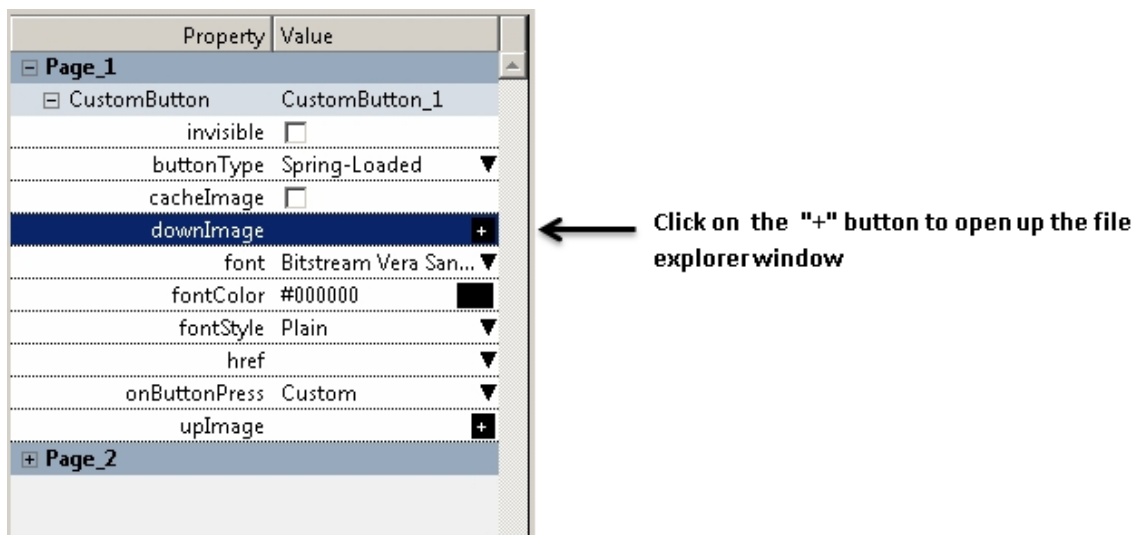

The property window on the left will give the parameters on the widget which was just placed.
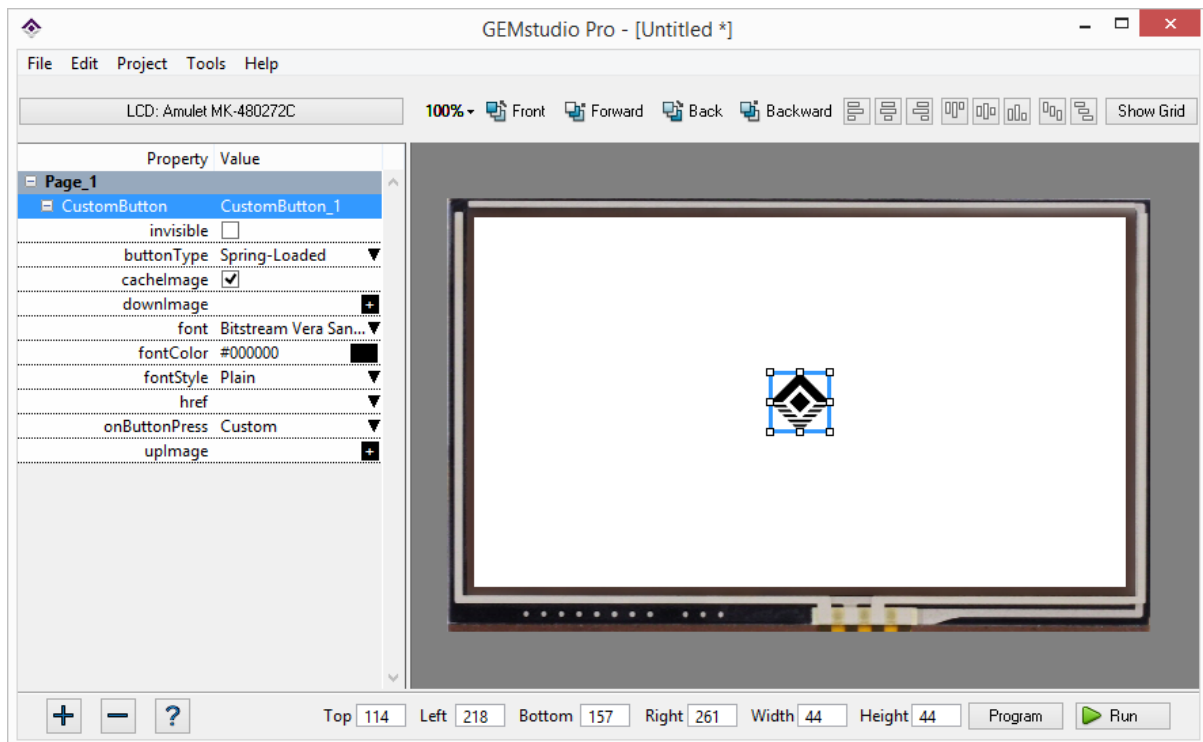
Now we will add an image to the button.

Look into the Property window to find the downImage property.

Click on the "+" button to open up the file explorer window

A file explorer window will appear, which you can navigate through to choose your "down buttom" image.

Repeat the procedure for "upImage"

| Property	Value
□ **Page_1**	
□ CustomButton	CustomButton_1
invisible	☐
buttonType	Spring-Loaded ▼
cacheImage	☐
downImage	RightArrow_dow... ＋
font	Bitstream Vera San... ▼
fontColor	#000000 ■
fontStyle	Plain ▼
href	▼
onButtonPress	Custom ▼
upImage	＋
⊞ **Page_2**	

← **Click on the "+" button to open up the file explorer window**

Add/Remove Parameter in Project

The user can also add or remove a parameter from a selected widget in the project window to customize it. To do that, right click on the widget and select "Add/Remove Parameter".
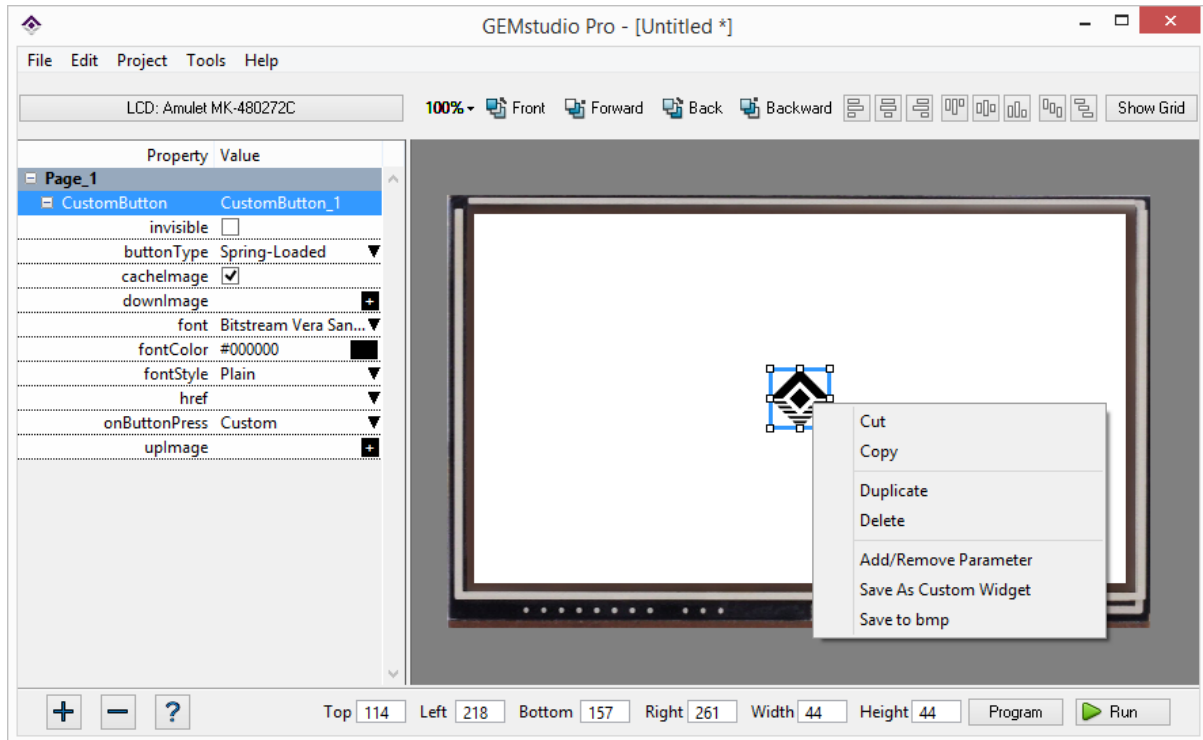

 A Parameter List window will pop up. You can choose whether to include or remove parameters from the list. This way of customization only affects that selected widget in that project. In other words, the customized is not reusable in other projects.
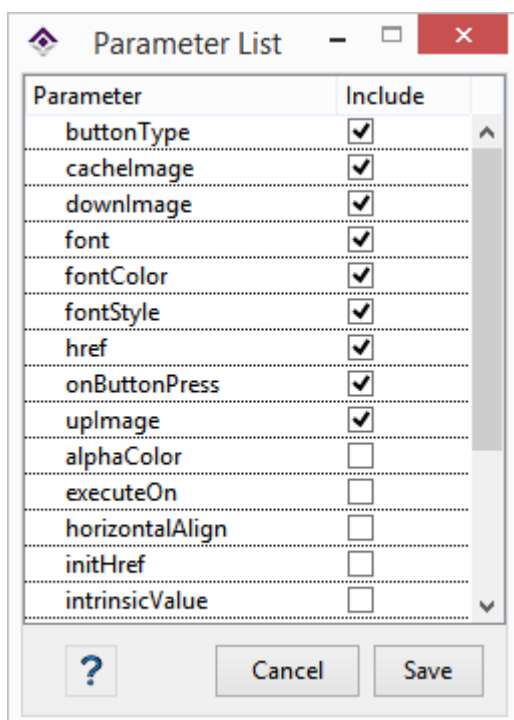
NOTE: If at any time, you need further explanation on widget or parameter in your project,

select the widget or parameter and click on the button on the lower left hand corner of the project window or press "F1". A help window will pop up and explain the selected widget or parameter.

Add a New Page

If the project needs a new page, click on the [+] button at the lower left corner of the project window and select "New Page".
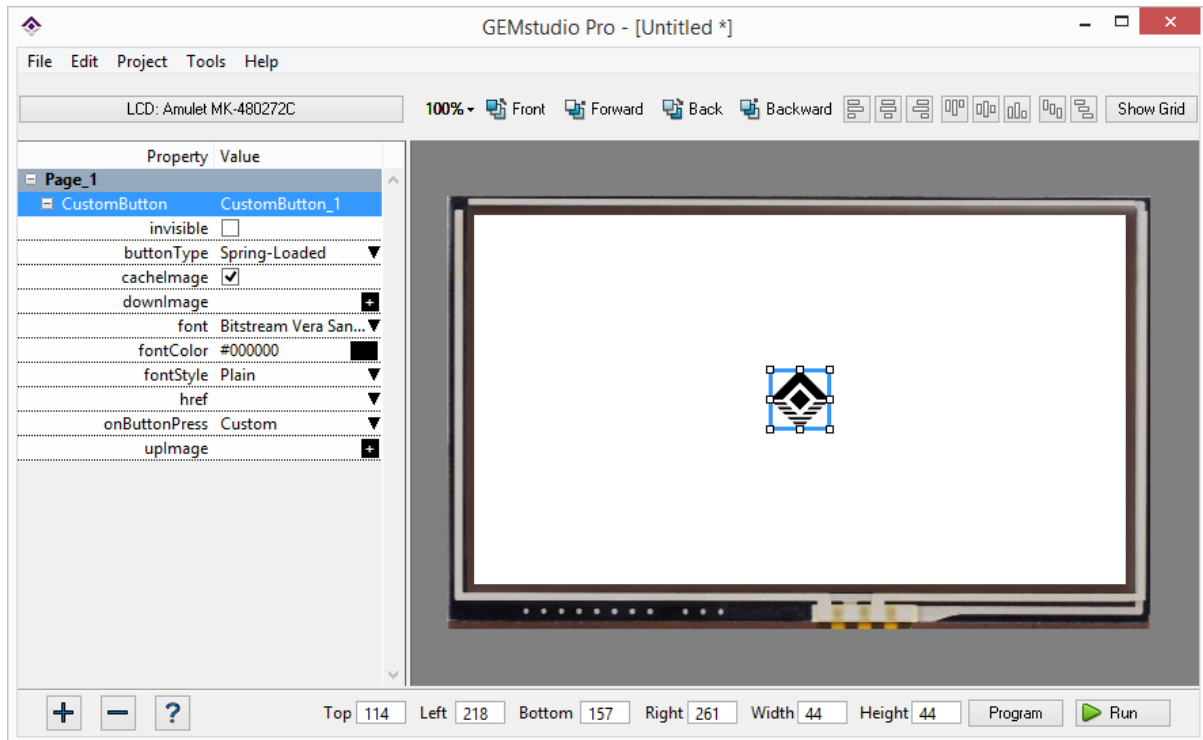
A page options window will pop up and you can customize the page.
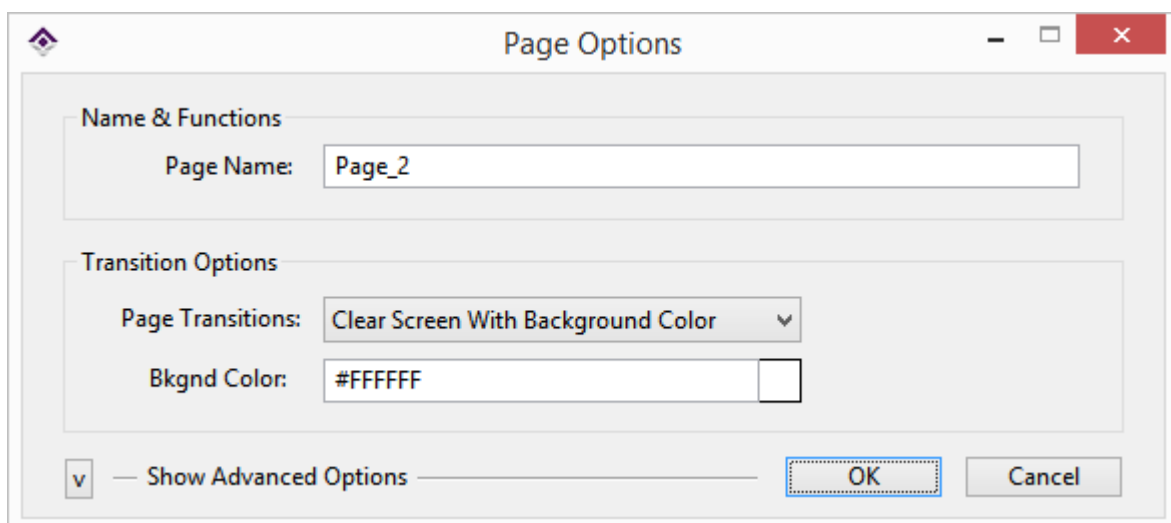
For advanced options, click the arrow on the lower left hand corner of the page options window. The window expands to include selections of Communications options, Frame Buffer options and JPEG Compression options.

Page Options

Name & Functions

Page Name: `Page_2`

Transition Options

Page Transitions: `Clear Screen With Background Color`

Bkgnd Color: `#FFFFFF`

↑ — Hide Advanced Options

Comm Options

Amulet Slave Rsp: `Full Protocol`

Timeout (in sec): `0.20`

Null Terminate All Msgs: `No`

Misc Options

Frame Buffer: `Double`

Touch Priority: `From Top to Bottom`

GEMscript Options

String Buffer Size (bytes): `100`

(Used by methods that return a string, i.e. append())
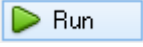
☐ Compress Binary

BOLD name signifies using page specific option

Use Project Defaults   OK   Cancel

Add Page Functions

Please check out Amulet's Page Functions Editor and Page Functions section in "GEMstudio Pro User's Guide"

Simulate a Project

Simulating a project, enables the user to preview and test the GUI before programming the project into the hardware. To simulate the entire project, click on the ▷ Run button on the lower right corner of the project window. To simulate only one page, right click on the page and select "Run This Page Only" on the pop up menu. A window will pop up to display your GUI.

Run Button ①

Program a Project or a Page

Once the project is simulated and completed, the project can be downloaded into the hardware by clicking on the ⬚ Program ⬚ button on the lower right hand corner of the project window.
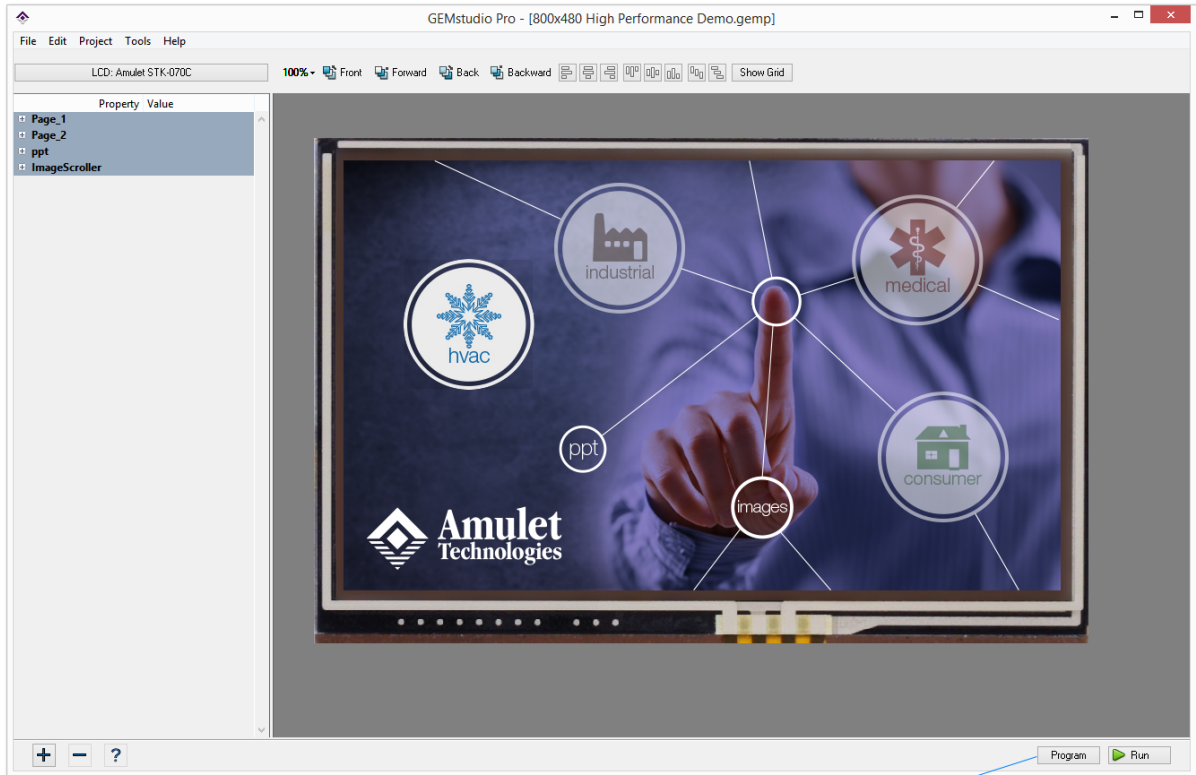


Program Button ①

After the project is compiled, a window will pop up for you to select the COM port and you can select your LCD display. When you are done selecting, click "Begin" on the lower right hand corner.

NOTE: The trial version of GEMstudio Pro is fully functional for the first 30 days. After 30 days, the trial version will only allow you program a project that is at most 5 pages.
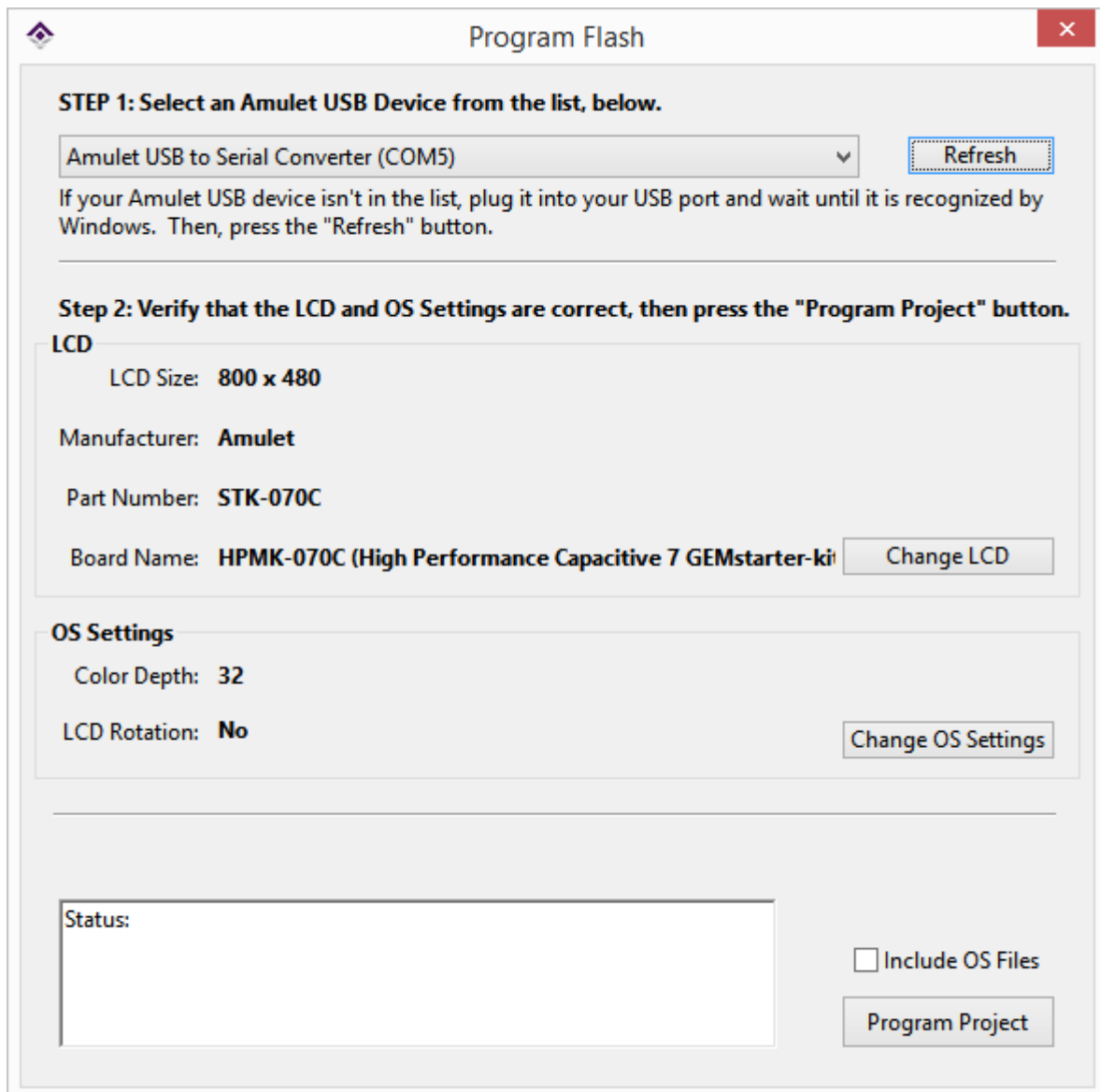
If you would like to program only one page, right click on the page and select "Program This Page Only" in the pop up menu.
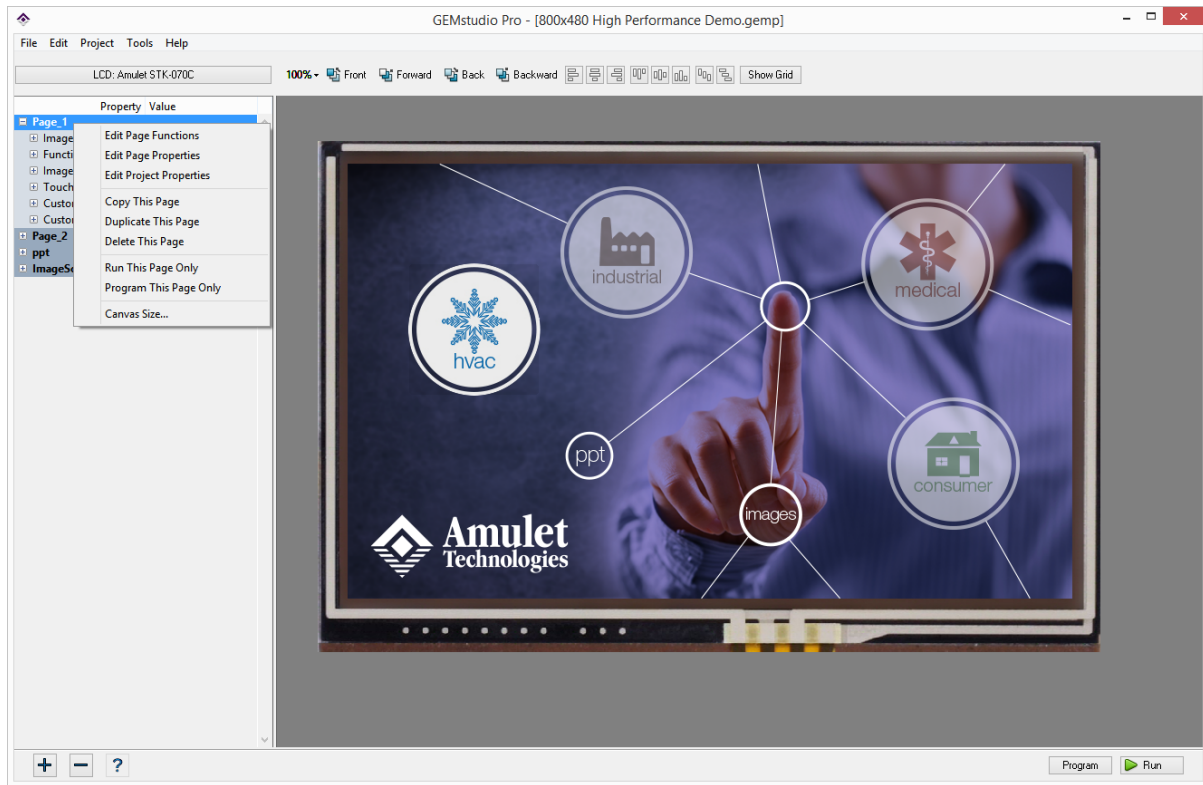
Open Existing Projects

Each project images and widgets are relative to the .gemp project file. To open an existing GEMstudio project, either click on the "Open Existing GEMstudio Project" button (Menu Item 1)
or pull down the file menu (Pull-Down Menu 2) and click on "Open Project".
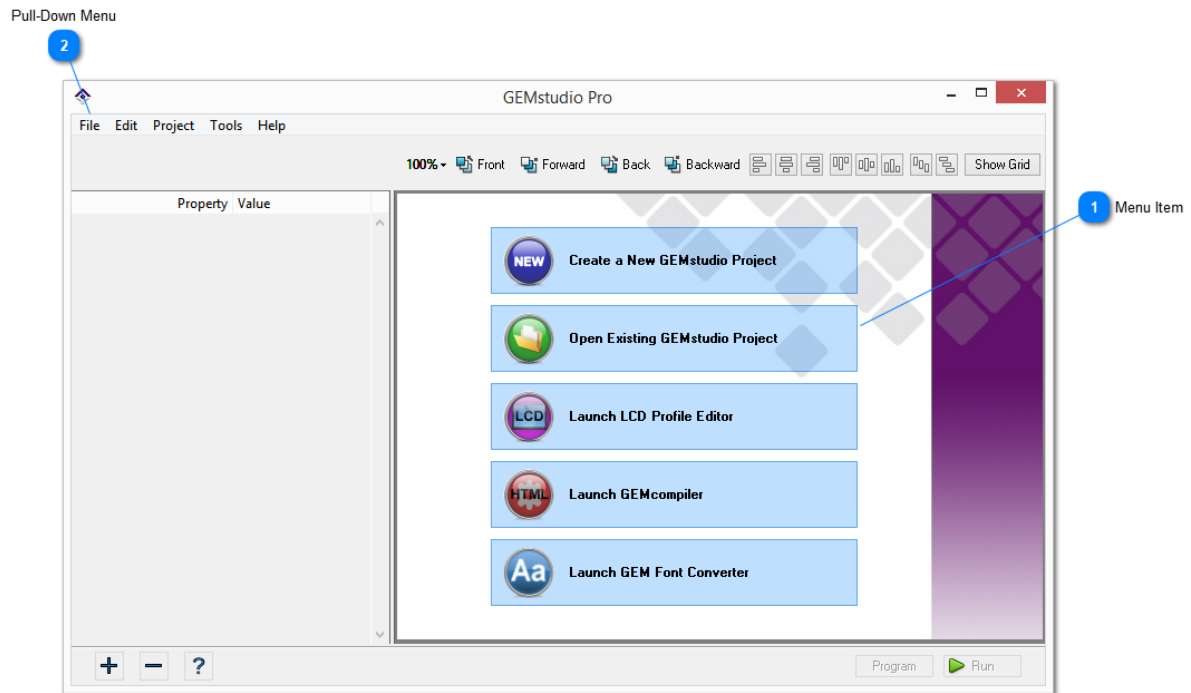
A browser window will pop up for selecting the desired .gemp project file.

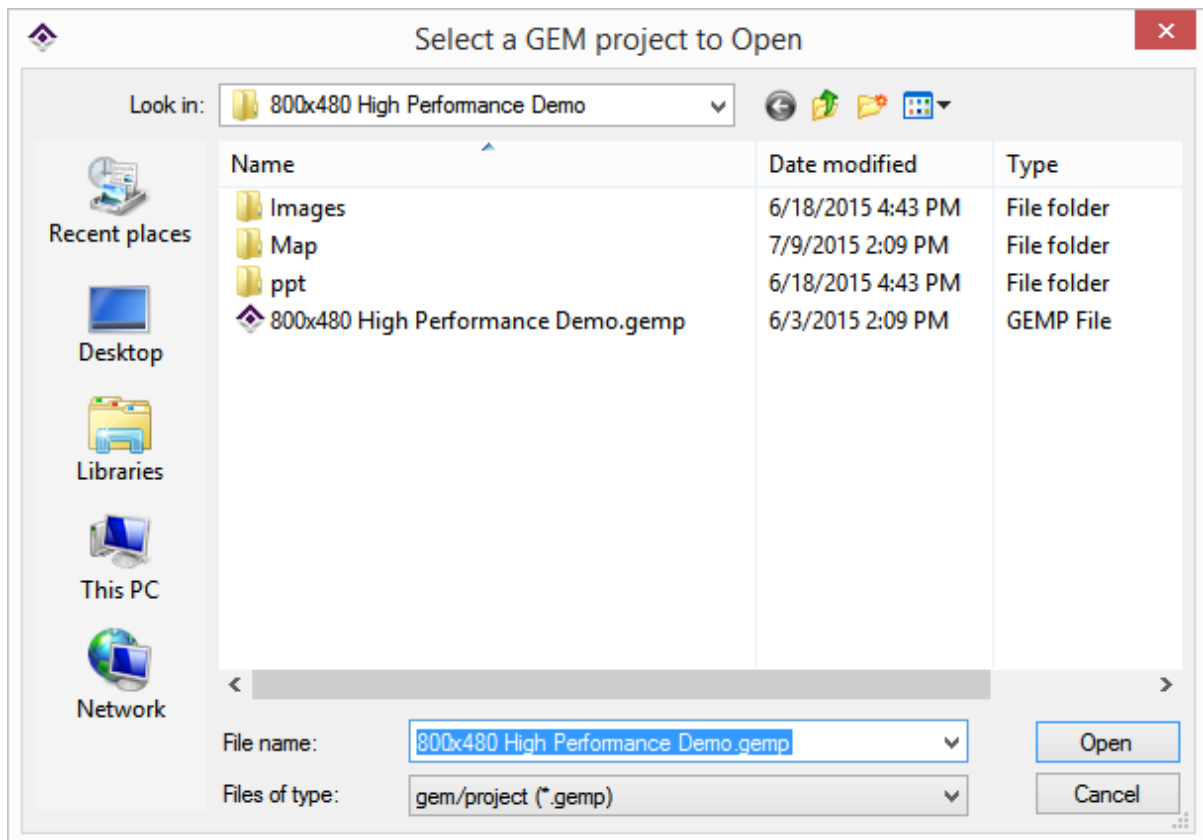Once the project is open, you can make changes to the project by adding a page, or add new objects. After editing the project, you can click on the "Run" button to simulate and "Program" button to download the project to hardware.

NOTE: User can only program five page of the project if not using the full version of GEMstudio.

NOTE: If at any time, you need further explanation on widget or parameter in your project, select the widget or parameter and click on the [?] button on the lower left hand corner of the project window or press "F1". A help window will pop up and explain the selected widget or parameter.

LCD/Board Chooser

The Board Profile Editor can be opened from a drop down menu (Project --> LCD/Board Chooser) on the top of the project window as shown below.
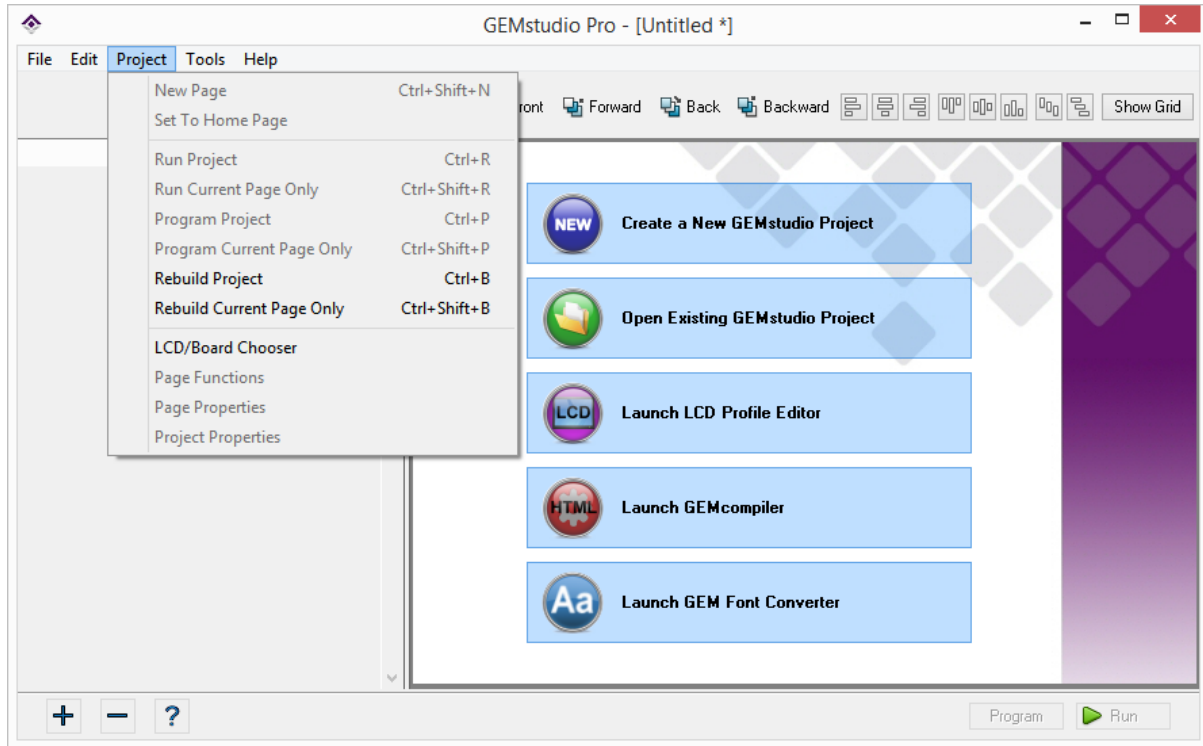
The LCD/Board Chooser provides the user with multiple LCD and Board choices as shown below. For LCD choices, the options includ LCD Size, LCD Manufacturer, and LCD Part Number. For the Board choices, select a board name.
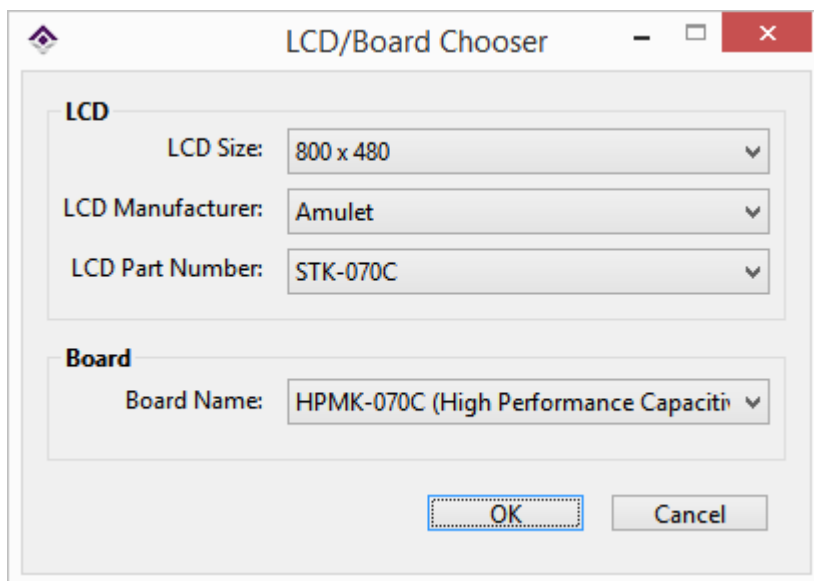
If the board profile you want is not available, please go to Board Profile Editor to make your own board profile

Create a New LCD Configuration

If there is no matching LCD selection available, the user can customize their own LCD setttings and save as a specific LCD profile.

On the main window of GEMstudio, click on "Launch LCD Profile Editor" button (Menu Item 1) as indicated in the figure below. By selecting the new LCD profile, a window will pop up for user to enter their customizations.
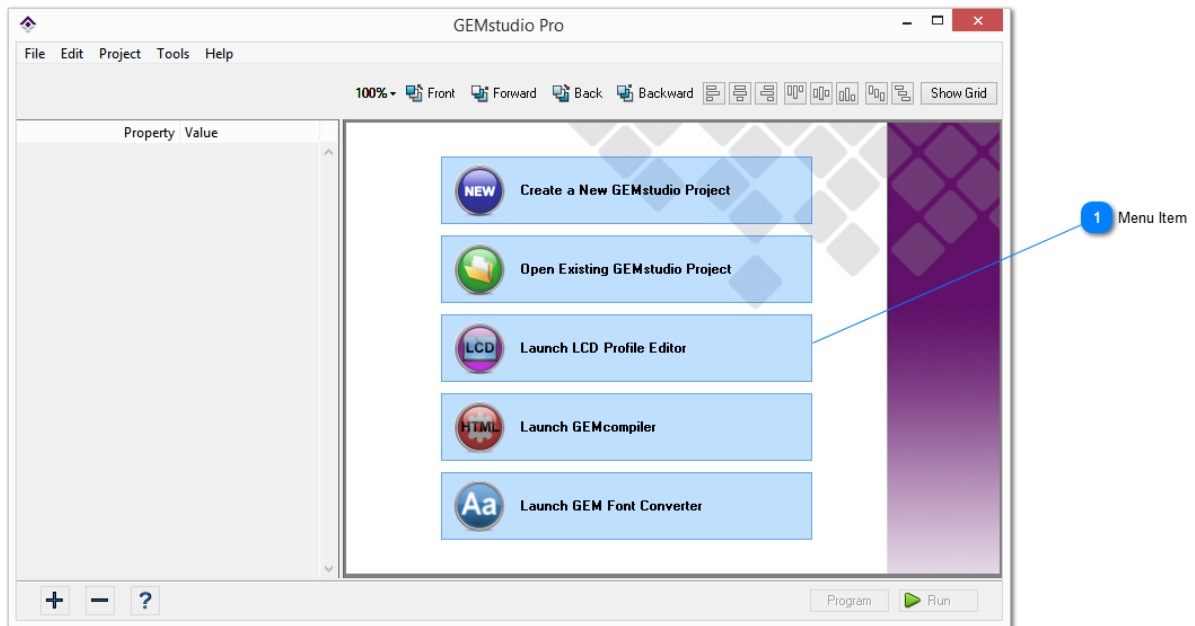
The LCD Profile Editor window enables user to select the manufacturer, width and height, part number and color depth of the LCD display. This is also where initialization files can be specified. The pixel clock, horizontal sync, and vertical sync settings can all be configured based on the requirements of the specific display.

LCD Profile Editor

File   Edit   View   Help

**LCD Profile File:** Untitled.tft   [Show Full Path]

Property	Value
LCD	
Width (Pixels)	Enter Width in Pixels
Height (Pixels)	Enter Height in Pixels
Manufacturer	Enter Manufacturer
Part Number (Name of File)	Enter Part Number
Configuration Files	
Init File	Init None.ini
Touch Panel	4-Wire Resistive
Pixel Clock Settings	
PixClk Freq (MHz)	Enter PixClk Freq
PixClk Active Edge	Enter Pixel Active Edge
Pixel Data Polarity	Enter Pixel Data Polarity
Data Enable Polarity	Enter Data Enable Polarity
Hsync Settings	
Width (PixClks)	Enter # from 0 - 255
Polarity	Enter Hsync Polarity
Back Porch (PixClks)	Enter # from 0 - 255
Front Porch (PixClks)	Enter # from 0 - 255
Vsync Settings	
Width (Hsyncs)	Enter # from 0 - 255
Polarity	Enter Vsync Polarity
Back Porch (Hsyncs)	Enter # from 0 - 255
Front Porch (Hsyncs)	Enter # from 0 - 255
Miscellaneous	
LCD Backlight	255

[Save]   [Cancel]

Board Profile Editor

The Board Profile Editor can be opened from a drop down menu (Tools --> Board Profile Editor) on the top of the project window as shown below.
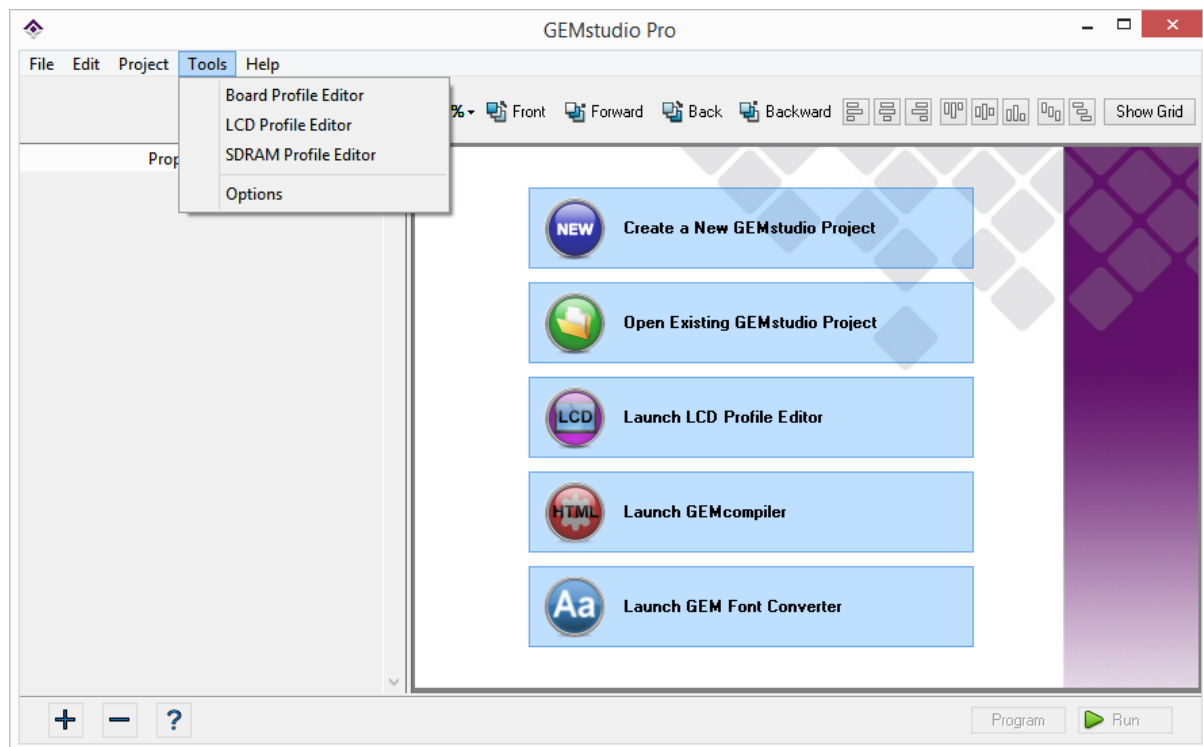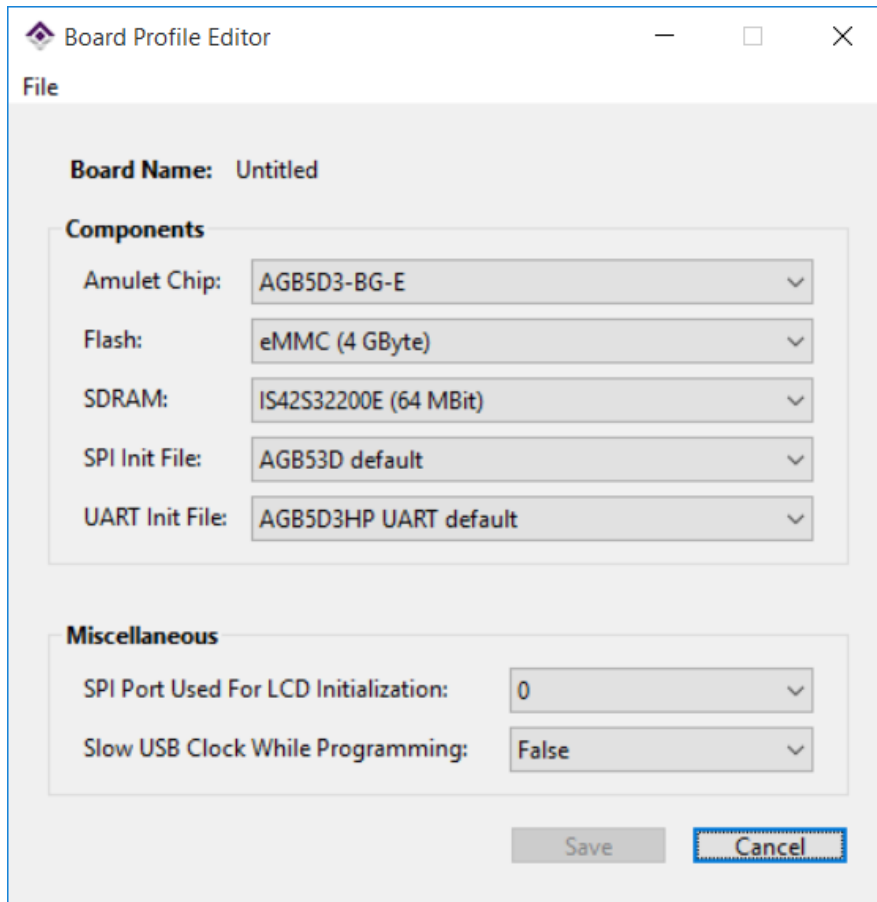
The Board Profile Editor has two sections: supported components and miscellaneous. To name the board, click "Save" at the bottom of the window.

Warranty Information

AMULET TECHNOLOGIES, LLC
Warranty Information

For a period of one (1) year (ninety (90) days for products with glass) from the date of shipment, Seller warrants to Buyer that products delivered hereunder shall comply with the applicable Seller's Data Sheet or the mutually agreed upon specifications and shall be free from defects in material and workmanship under normal use and service. All other products, including but not limited to products which are "loaners", "products shipped on consignment", and/or "prototypes" are sold "AS IS", "WITH ALL FAULTS", and with no warranty whatsoever.

If, during the applicable warranty period, (i)Seller is notified promptly in writing upon discovery of any defect in the products, including a detailed description of such defect; (ii) such products are returned to Seller and Buyer prepays freight cost, accompanied by Seller's Returned Material Authorization form; and (iii) Seller's examination of such products discloses to Seller's satisfaction that such products are defective and such defects are not caused by accident, abuse, alteration, misuse, neglect, improper installation, repair, improper testing, improper maintenance, negligence, improper handling, inadequate packaging, damage by excessive voltage or current or otherwise had its serial number or any other part altered, defaced, or removed or use contrary to any instructions, issued by Seller, Seller shall, at its sole option, either repair or replace such products. No products may be returned to Seller without Seller's Returned Material Authorization form. All defective items replaced hereunder shall become the property of the Seller. Any modifications, changes, or alterations to the products by the Distributor or end customer, voids the warranty.

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