APPLICATION NOTES

4D SYSTEMS
TURNING TECHNOLOGY INTO ART

# Designer Displaying Images from the uSD Card - GC FAT16

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## Description

This application note shows how to display an image in Designer. Before getting started, the following are required:

- Any of the following 4D Picaso display modules:

  gen4-uLCD-24PT gen4-uLCD-28PT gen4-uLCD-32PT
  uLCD-24PTU uLCD-28PTU uVGA-III

  and other superseded modules which support the Designer environment.

- The target module can also be a Diablo16 display

  gen4-uLCD-24D series gen4-uLCD-28D series gen4-uLCD-32D series
  gen4-uLCD-38D series gen4-uLCD-43D series gen4-uLCD-50D series
  gen4-uLCD-70D series
  uLCD-35DT uLCD-43D Series uLCD-70DT

  Visit www.4dsystems.com.au/products to see the latest display module products that use the Diablo16 processor.

- 4D Programming Cable / µUSB-PA5/uUSBPA5-II for non-gen4 displays (uLCD-xxx)
- 4D Programming Cable & gen4-IB / 4D-UPA / gen4-PA for gen4 displays (gen4-uLCD-xxx)
- micro-SD (µSD) memory card
- Workshop 4 IDE (installed according to the installation document)

When downloading an application note, a list of recommended application notes is shown. It is assumed that the user has read or has a working knowledge of the topics presented in these recommended application notes.

# Content

## Application Overview

For this application note, the images to be displayed on the screen will come from the uSD card. These images need to be saved onto the uSD card in a format readable by 4D-LAB's processors. The images therefore are not saved onto the uSD card in their original format (jpeg/gif/png/bmp/etc) but are converted and combined by Workshop into a single graphics file, which is called the "GCI" file. The same concept applies to animations, movie clips, widgets, and other objects (common animation and movie file formats are flv, mov, mpeg, etc). GCI stands for Graphics Composer Image and it has its own format. The Graphics Composer or GC is a program used by Workshop to convert multimedia graphics files into a GCI file.

When designing in the Designer environment, the user will need to manually use the Graphics Composer. The general procedure is:

1. Add the images to the GC window.
2. Insert a uSD card into the PC.
3. Build or generate the GCI file and other supporting files and copy them to the uSD card.
4. Write the 4DGL code for accessing the uSD card and displaying the images on the screen.
5. Compile the code and upload the program to the display.
6. Unmount the uSD card from the PC and insert it to the display module.
7. The program should now run on the display module and the images should now be shown.

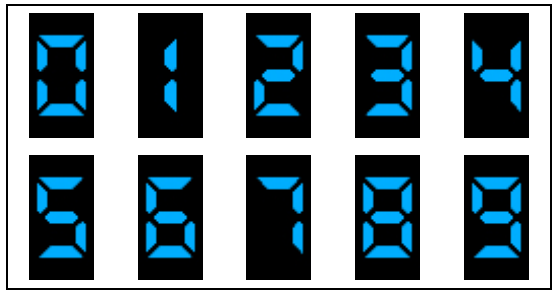
When designing in both the ViSi and ViSi-Genie environments, the Graphics Composer is invisible to the user. Instead, the user sees only the WYSIWYG (What-You-See-Is-What-You-Get) screen during design time. The general procedure is:

1. Place the images on the WYSIWYG screen.
2. For the codeless ViSi-Genie environment, configure the properties of the image objects using the Object Inspector.
3. For the ViSi environment, the code area is beside the WYSIWYG screen. Write the code for the program.
4. Click on the Build/Compile and Upload button.
5. Workshop will prompt for the uSD card drive to which the GCI file and other supporting files will be copied. Insert the uSD card to the PC and select the correct drive. Workshop transfers the files to the uSD card.
6. Workshop uploads the program to the display module.
7. Remove the uSD card from the PC and insert it to the display module.
8. The program should now run on the display module and the images should now be shown.

For more information on the use of the Visi and ViSi-Genie environments, refer to the relevant application notes. The user will realize that using the WYSIWYG screen is much easier than using the Graphics Composer. For this reason, ViSi is the recommended environment for users intending to design GUIs (Graphical User Interface) thru coding and drag-and-drop methods at the same time.

A simple program is developed for this application note. It flashes the digits 0 to 9 on the screen. The images for the digits can come from image files of

any of the common formats (in this example, png image files are used). The png files are added as image entries into the Graphics Composer window, the graphics file is generated, and a program for accessing this graphics file is written. Attached to this document is a zip file containing all the files used in the project. The digits are shown below.



**Manual use of the Graphics Composer is not recommended since the ViSi and ViSi-Genie environments are meant to "automate" the process for the user.**

## Setup Procedure

For instructions on how to launch Workshop 4, how to open a **Designer** project, and how to change the target display, kindly refer to the section "**Setup Procedure**" of the application note
**Designer Getting Started - First Project**

## Create a New Project

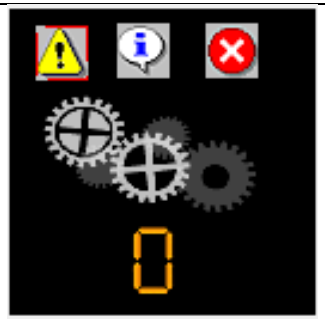
For instructions on how to create a new **Designer** project, please refer to the section "**Create a New Project**" of the application note
**Designer Getting Started - First Project**

## Design the Project

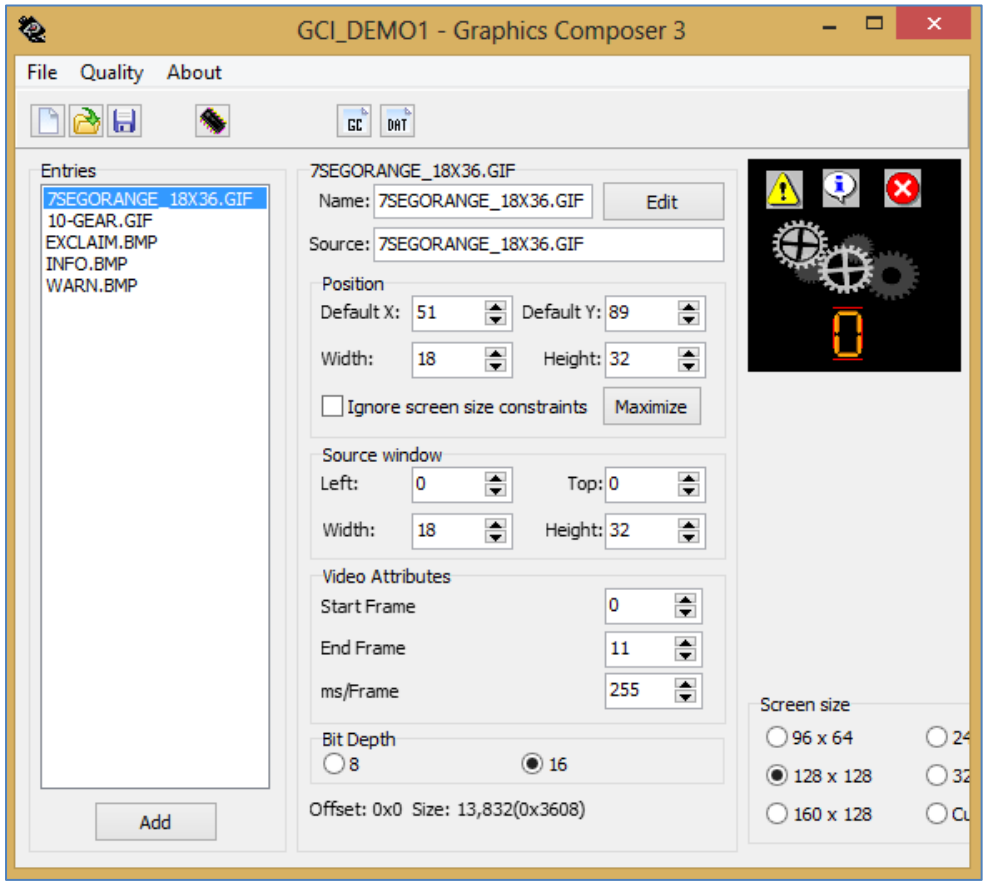
### The DAT and GCI Files

The images or objects inside the GCI file are arranged in a sequential order – that is according to when the user adds them. A list of these objects is created by the Graphics Composer along with the GCI file. This list, which is another separate file – the "DAT" file, contains the names of the object entries, their locations inside the GCI file, and their initial X/Y positions onscreen. To illustrate:

**GCI file** – contains the actual graphics for the objects

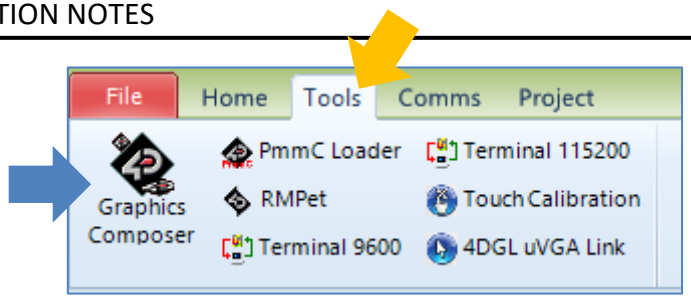


When the user intends to display a hundred images for instance, the Graphics Composer is first used to combine them into a GCI file and to create a DAT file. The user will then write a program to access these two files to be able to display the images on the screen. Below is a screenshot of the Graphics Composer, the use of which is discussed in the following section.

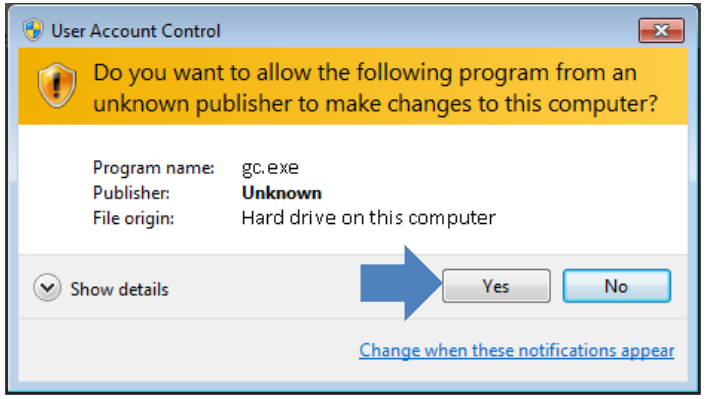



## Using the Graphics Composer

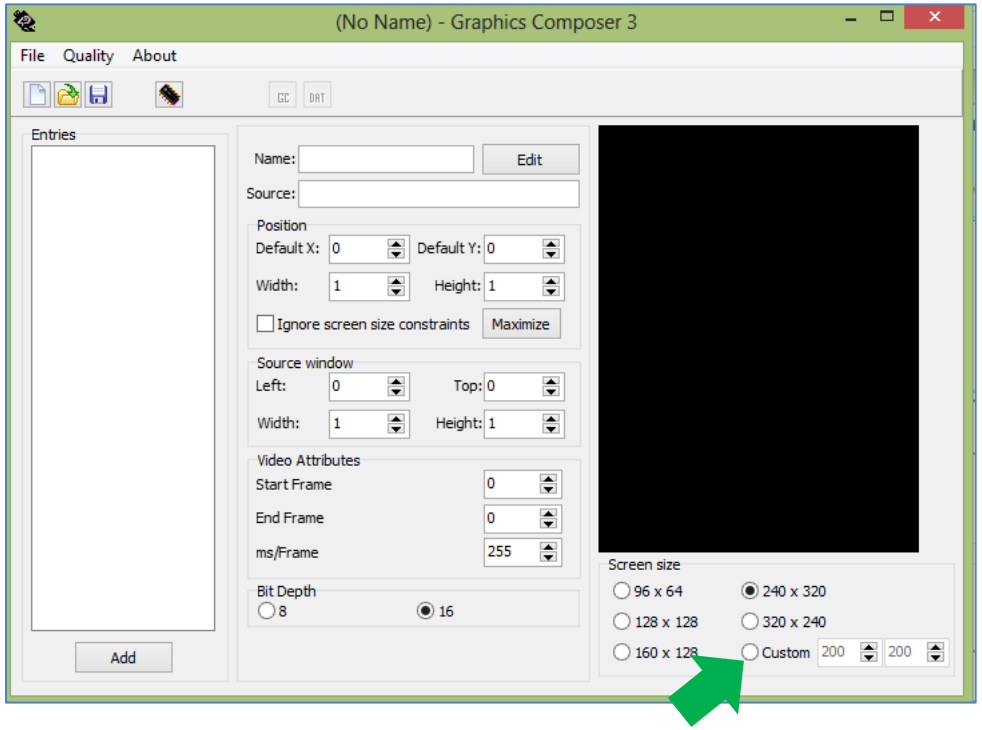
The Graphics Composer has a dedicated user guide which can be downloaded here. In this section only the basics of using the GC are covered. To open the Graphics Composer, go to the Tools menu and click on the Graphics Composer icon.




Depending on the user's PC User Account Control settings, Windows might ask for a confirmation to run the program **gc.exe**. This is the Graphics Composer. Click Yes.

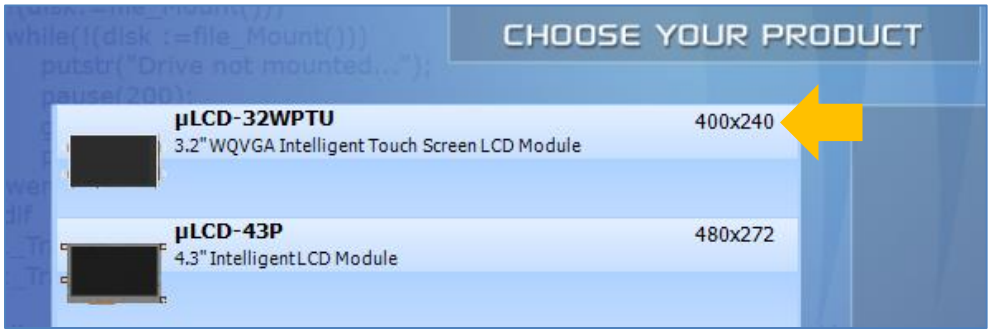


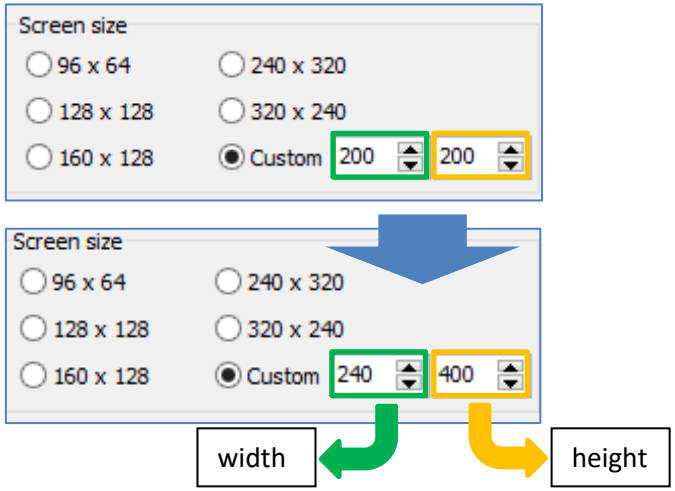

The Graphics Composer now opens.




## Set the Screen Size

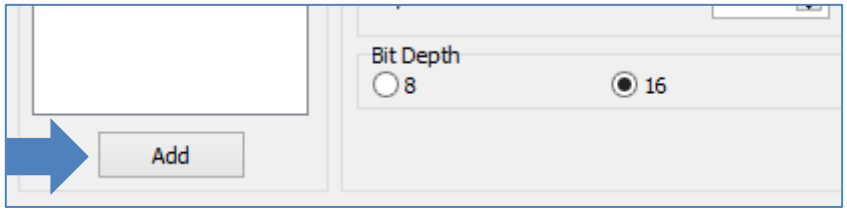
To make the screen size consistent with the selected project display (uLCD-32WPTU Portrait orientation), click on the custom button and change the width from 200 to 240 and the height from 200 to 400. To know the pixel resolution of your display module, consult the datasheet. When creating a new project, the Choose-Your-Product window also displays the pixel resolution of the display module.



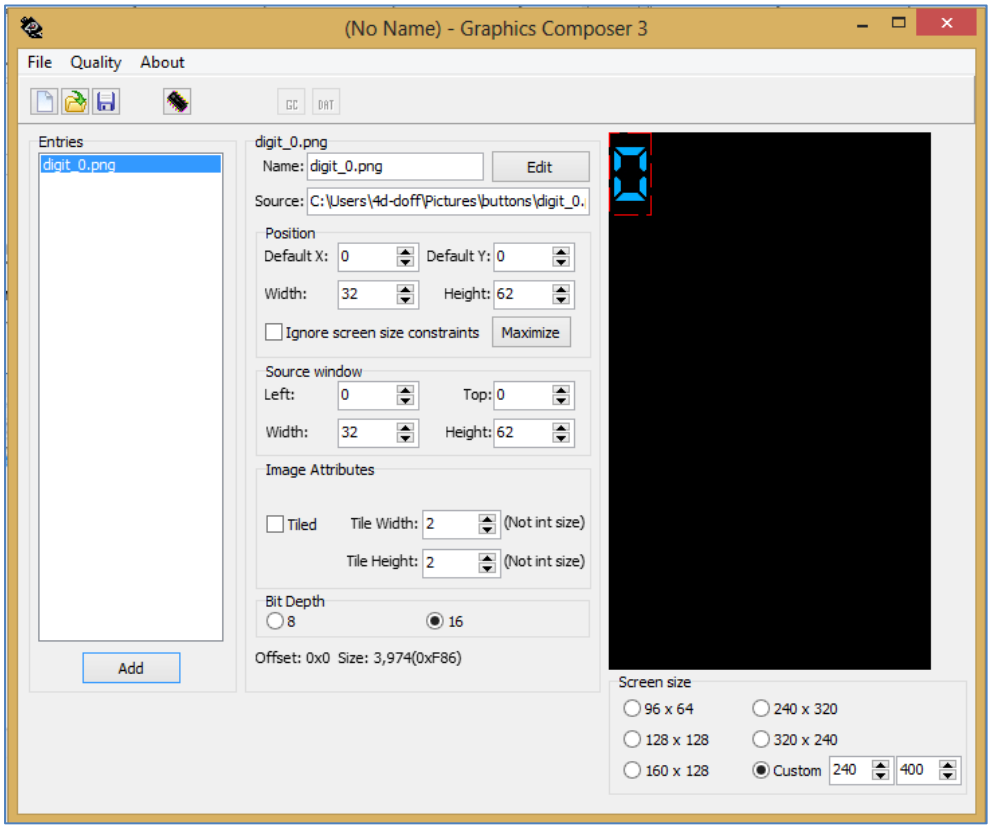




## How to Add an Image

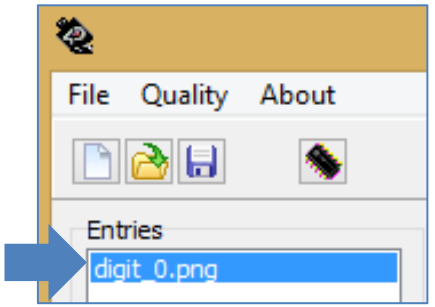
To add an image, click on the Add button on the left lower part of the window.



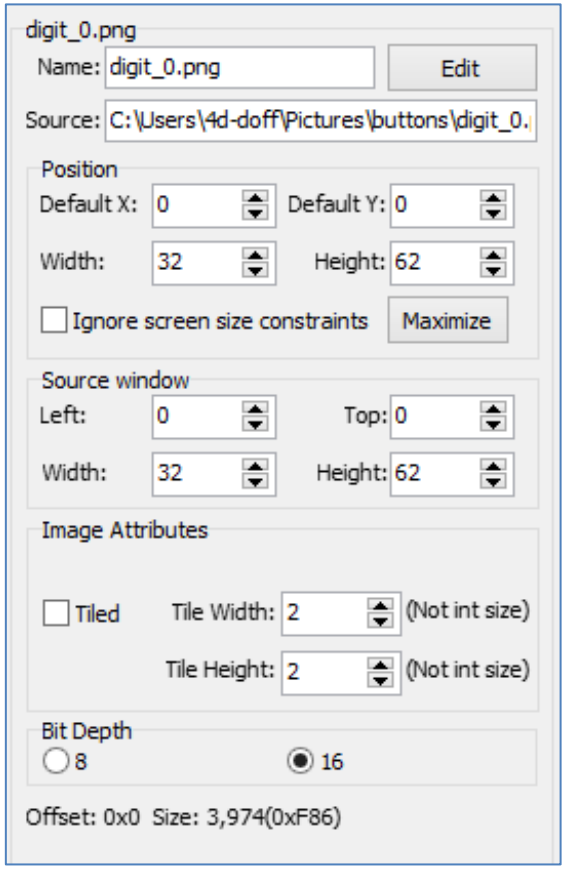

The standard Open window opens. Select the desired image file. The screen will be updated. The image files used in this tutorial are inside the attached zip file.



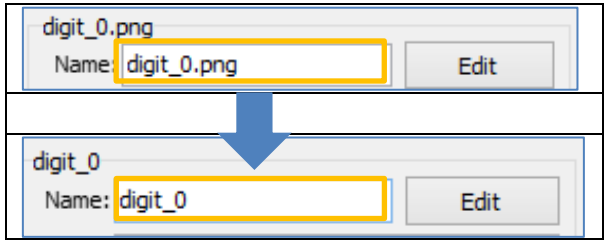

In this example, a seven segment display digit is chosen. Notice that under Entries, the image file **digit_0.png** is listed.



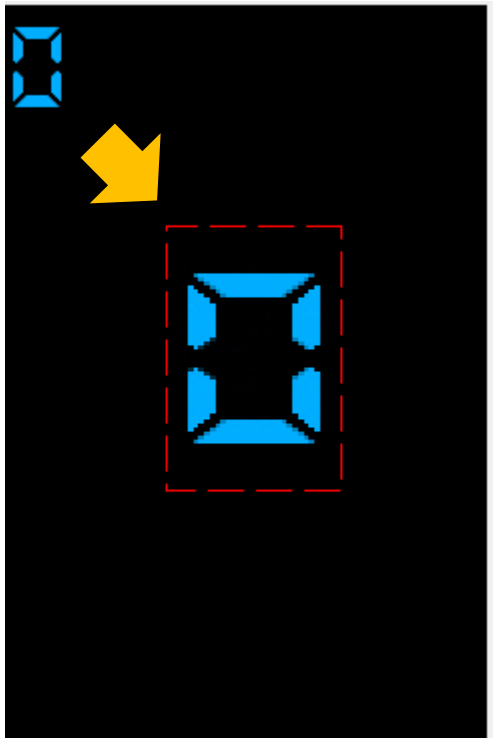
The middle part of the window shows the properties of the image.



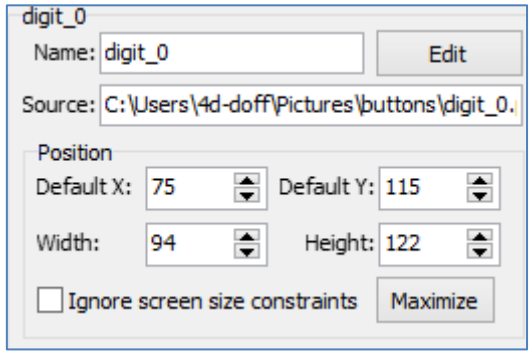

The object entry name can be changed by removing the file extension.




The user can drag and resize the image to the desired location and dimensions.

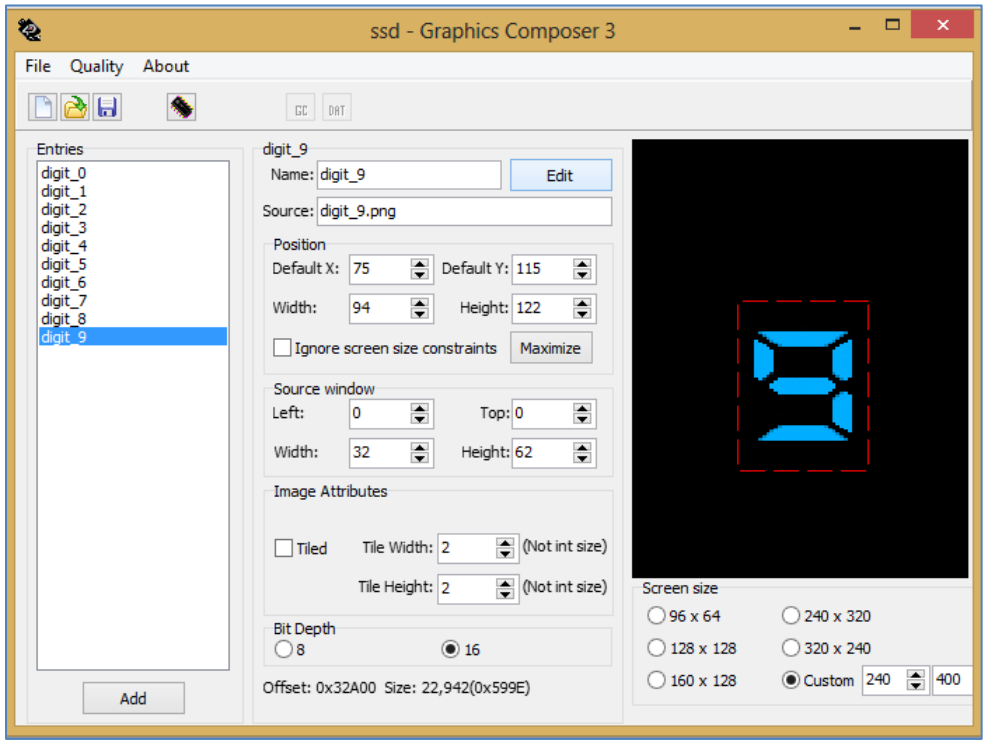


The properties will be updated accordingly. The figure below shows the new X/Y position and dimension properties of the image.




## Add More Images

Add the rest of the **.png** files (digits 1 to 9). Note that the files have the same pixel dimensions. Resize and drag all the entries to the same size and location on the screen. It is also possible to directly edit the property values. The objective here is to have all the entries, which have a common size, located at a common position on the screen. A program will then be written to display each of these image entries. When finished, the Graphics Composer window will look similar to that shown below.



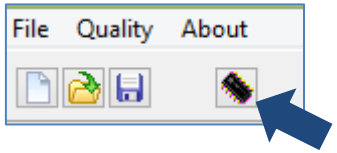

## Save the Graphics Composer File

Click on the Save icon under the File menu.

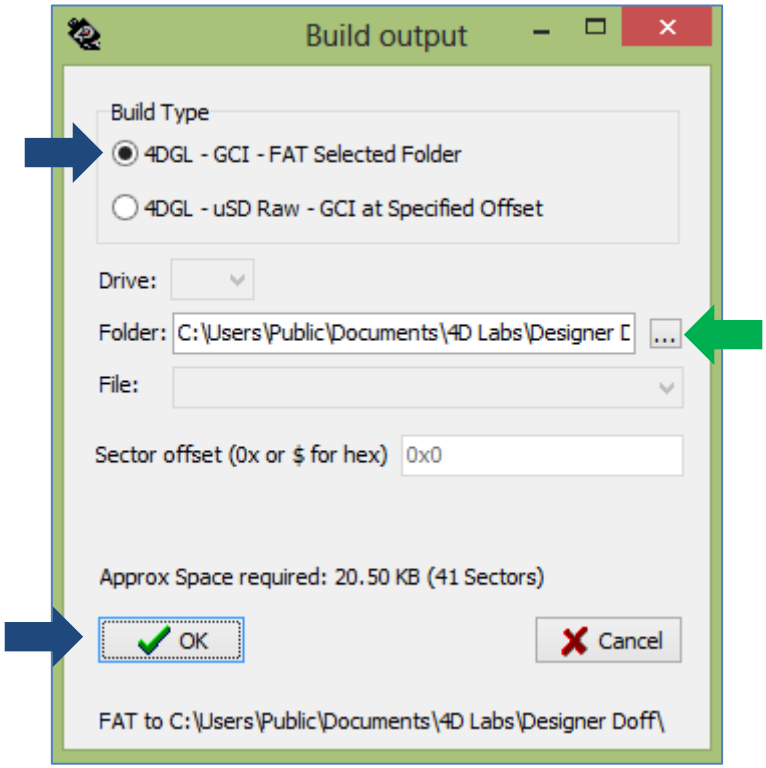
The Save As window opens. Type in the desired file name and click Save. The file in this example is saved with the name "**ssd**". Note that the file extension is "**.gcs**".

### Build the GCI and DAT Files

Click on the Build icon.

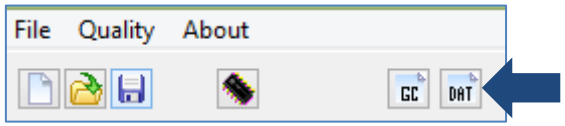



The Build Output window appears. Choose the first option for the build type. Select a convenient folder for saving the GCI and DAT files. By default, the folder where the Graphics Composer file was saved is selected. The DAT and the GCI files will be transferred later to a FAT-formatted uSD card. Click OK when finished.

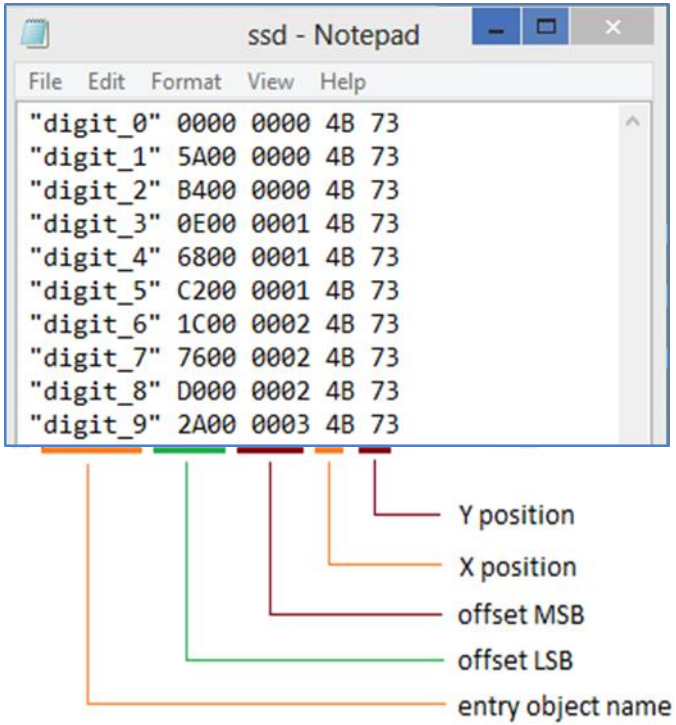



### View the DAT File

To view the DAT file (which is a list of the object entries inside the GCI file), click on the DAT icon.

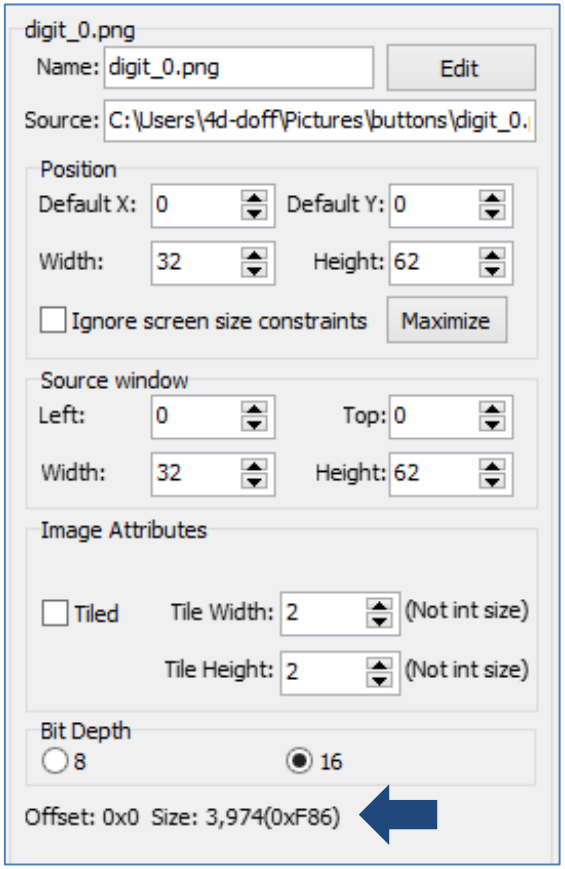


The DAT file opens with Notepad. The contents are labelled below.



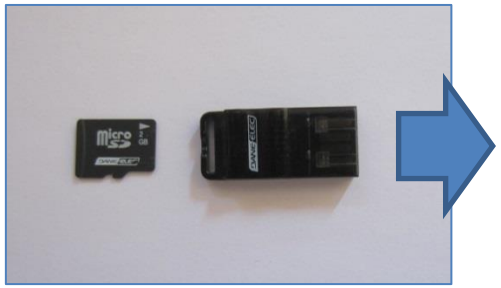

Offset is the location of the entry in the GCI file. Since **digit_0** is the first entry, it has an offset of 0x00000000. Notation is in hexadecimal. This also applies to the X and Y coordinates.

Note that **digit_1** has an offset of **0x00005A00**. The offset of an object entry may depend on the size of the previously added entry. Also, each new entry begins on a sector (512 byte) boundary. The lower middle part of the Graphics Composer window shows the size and offset of a highlighted entry.

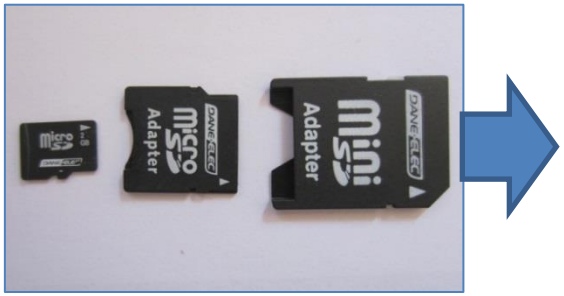


### Insert the µSD Card to the PC

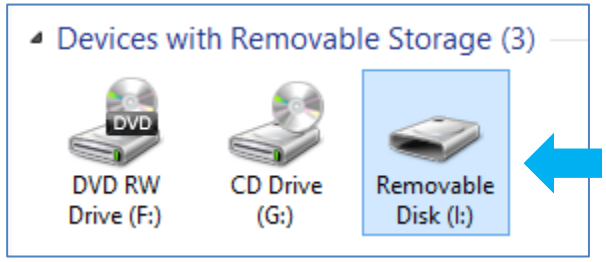
Insert the µSD card into the USB adaptor and plug the USB adaptor into a USB port of the PC.




**OR** insert the µSD card into a µSD to SD card converter and plug the SD card converter into the SD card slot of the PC.

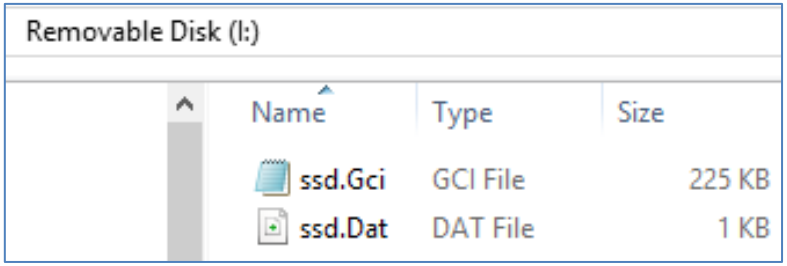



Check if the µSD card is mounted, here it is mounted as drive I:



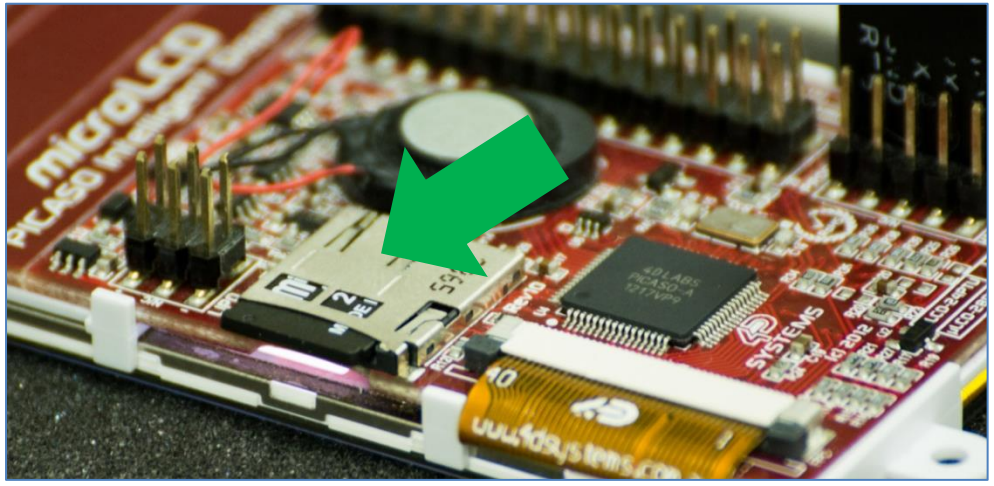

### Copy the DAT and GCI Files to the uSD Card

Go to the folder where the DAT and GCI files are saved. Copy these to the uSD card.




### Insert the µSD Card to the Display Module

Properly disconnect the µSD card from the PC and plug it to the µSD Card slot of the display module. The next step now is to create a program that will access the DAT and GCI files and display the images.



## Understanding the Demo Code

Attached is a ZIP file containing the Designer file, the DAT, the GCI, and the image files used in this application note. Open the Designer file to have a better view of the code. An explanation now follows, giving emphasis to the more important parts.

## Checking the uSD Card

It is necessary to check that the uSD card is mounted before using it. The block containing lines 7 to 14 defines the behaviour of the screen while waiting for a µSD card to be mounted on the slot. If no uSD card is detected, the screen will constantly flash the message "**Drive not mounted…**". The user can consult the Picaso Internal Functions Manual for a detailed explanation of the functions used in this block.

```
7       if (!(disk:=file_Mount()))
8           while(!(disk :=file_Mount()))
9               putstr("Drive not mounted...");
10              pause(200);
11              gfx_Cls();
12              pause(200);
13          wend
14      endif
```

## Clearing the Screen

The function **gfx_Cls()** used in lines 11 and 15 is used to clear the screen.

```
15      gfx_Cls();  //clear the screen
```

## Defining Variables

Lines 17 to 19 show how variables are declared in 4DGL. The purpose of these variables will be explained later.

```
17      var i, handle, idigit_0, idigit_1, idigit_2, idigit_3;
18      var idigit_4, idigit_5, idigit_6, idigit_7, idigit_8;
19      var idigit_9;
```

Lines 21 to 23 show how variables are initialized.

```
21      idigit_0 := 0;    idigit_3 := 3;    idigit_6 := 6;
22      idigit_1 := 1;    idigit_4 := 4;    idigit_7 := 7;
23      idigit_2 := 2;    idigit_5 := 5;    idigit_8 := 8;
```

## The Image Control

To access the images inside the GCI file, the function below is used.

```
handle := file_LoadImageControl("ssd.dat", "ssd.gci", 1);
```

In the sample code, this function is used in line 26. It requires two files –the DAT file and GCI file. The names of the DAT and GCI files are passed to the function as the first and second arguments. The third argument (mode) defines the manner by which the image control is built. Remember that the GCI file contains the actual graphics to be displayed and that the DAT file is a list of all the individual images in the GCI file. In the DAT file are lines, each of which contains the name of an image entry, its location (or offset) in the memory card, and its initial x and y coordinates when displayed onscreen. The function

```
file_LoadImageControl("file.dat", "file.gci", mode);
```

therefore, takes the offsets and x/y coordinates of the images from the DAT file and saves them in to the image control. The program can then use the image control to access the actual images in the GCI file. The function returns a handle (pointer to the memory allocation) to the image control list that has been created. This handle will be used to display an image. To learn more about the function for loading an image control, read section 2.14.28 of the Picaso Internal Functions Manual.

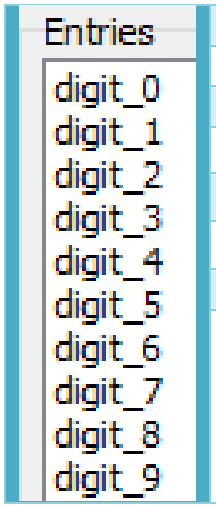
### Use of Index Values to Display Images

After having created the image control, it is now possible to display an image using the function

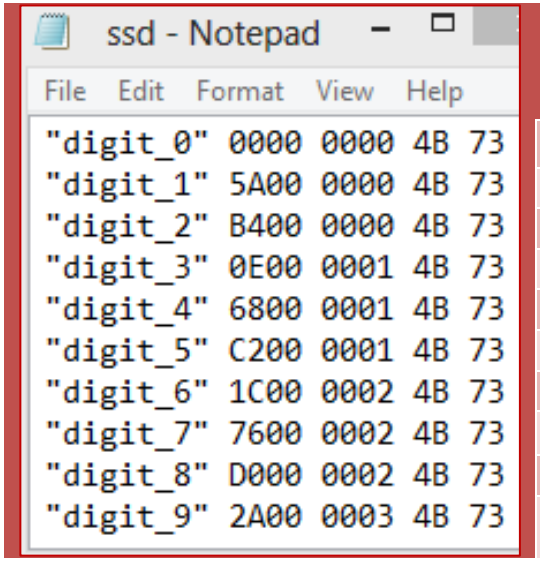
```
img_Show(handle, index)
```

The first argument is the handle, which points to the memory allocation of the image control. The second argument is the **index**. Remember that image entries in the GCI file are indexed by the order by which they are added in the Graphics Composer window. The image **digit_0**, for example, has an index value of 0 since it is the first image added. The image **digit_1** has an index value of 1 since it is the second image added. The third image entry has an index value of 2, and so on. In the Graphics Composer:

| | Sequence | | Index |
|---|---|---|---|
| | First | image added | 0 |
| | Second | image added | 1 |
| | Third | image added | 2 |
| | Fourth | image added | 3 |
| | Fifth | image added | 4 |
| | Sixth | image added | 5 |
| | Seventh | image added | 6 |
| | Eighth | image added | 7 |
| | Ninth | image added | 8 |
| | Tenth | image added | 9 |




It is also convenient to think of the index value as the line number of the image entry in the DAT file.




| Line | Index |
|---|---|
| First | 0 |
| Second | 1 |
| Third | 2 |
| Fourth | 3 |
| Fifth | 4 |
| Sixth | 5 |
| Seventh | 6 |
| Eighth | 7 |
| Ninth | 8 |
| Tenth | 9 |

After knowing how index values are determined, the user can now use variables to define the index values of images. To illustrate:

```
21      idigit_0 := 0;    idigit_3 := 3;    idigit_6 := 6;
22      idigit_1 := 1;    idigit_4 := 4;    idigit_7 := 7;
23      idigit_2 := 2;    idigit_5 := 5;    idigit_8 := 8;
```

### Displaying Images

The lines below show how to display the images after creating the image control and defining the index values.

```
28      img_Show(handle, idigit_0); //show digit 0
29      pause(3000);                //three-second delay
30
31      img_Show(handle, idigit_5); //show digit 5
32      pause(4000);                //four-second delay
33
34      img_Show(handle, idigit_8); //show digit 8
35      pause(5000);                //five-second delay
36
37      //display all digits
38      for(i := 0; i <=9; i++)
39          img_Show(handle, i);
40          pause(1000);        //one-second delay
41      next
```

Note that a delay is used after an image is displayed.

```
29      pause(3000);                //three-second delay
```

This allows the observer to see the image before it is replaced with something else.

### The for Loop

The block below shows how a for loop is used in 4DGL.

```
37      //display all digits
38      for(i := 0; i <=9; i++)
39          img_Show(handle, i);
40          pause(1000);        //one-second delay
41      next
```

The loop displays all the digits with a one-second interval.

## Build and Upload the Project

For instructions on how to save a **Designer** project, how to connect the target display to the PC, how to select the program destination, and how to compile and upload a program, please refer to the section "**Run the Program**" of the application note

**Designer Getting Started - First Project**

## Proprietary Information



## Disclaimer of Warranties & Limitation of Liability