

Application Note: Banner Engineering Corp Driver v1.10.02 How To Guide

Introduction

This Application Note is intended to assist users in using the GP-Pro EX Version 2..X\2.10.X Banner Engineering Corp. Vision Sensor Driver v1.10.02. The AGP3000 HMI product family, along with GP-Pro EX interface development software, supports a wide range of communication drivers. The Banner Engineering Corp. Vision Sensor driver extends the capability of the Banner Vision Sensor to the front panel of the machine. Without the use of an expensive computer view Pass\Fail data, change camera inspections, save images of failed parts for review, and much more.

Benefits of using a Pro-face AGP with a Banner Engineering Corp. Vision Sensor:

Banner Engineering Camera Driver

- Extend the Banner Engineering Corp. Vision Sensor Capability without an expensive computer:
 - Display live camera image and camera data simultaneously on the AGP
 - Display camera image full screen or select part of the image on the AGP
 - Make changes to the camera image on the AGP (size and position)
 - Zoom in on a part and move the focus of the image display using an image offset
- Add up to 16 Banner Presence PLUS Vision Sensors per AGP
- Save still images in BMP format to USB or CF Card
- Pause, Resume or Shutdown the driver

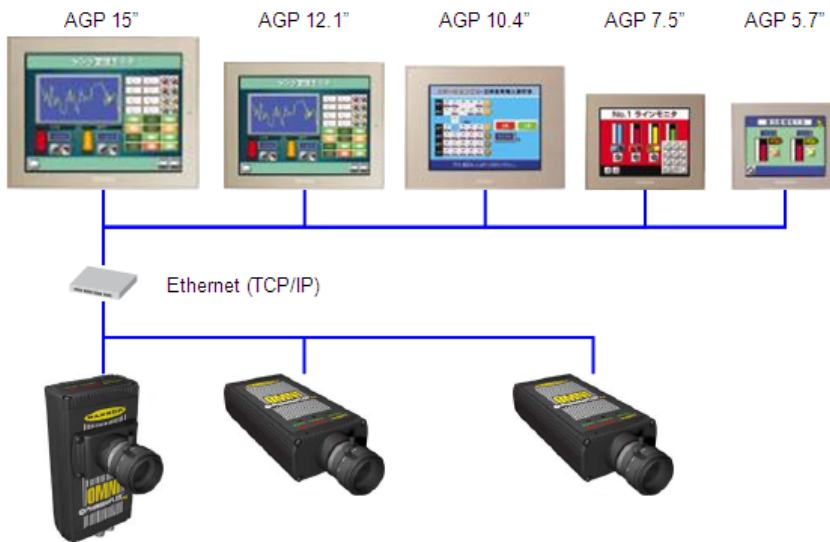
Pro-face AGP

- Camera driver + Up to 3 additional drivers available per AGP For example, use in conjunction with a PLC, Inverter, and Temperature Controller
- Data Logging function saves camera data to CF or USB memory
- Recipe function allows defining camera preset data or commands
- Wide range of operator interface choices, including units with built in multimedia or control (I/O) functions

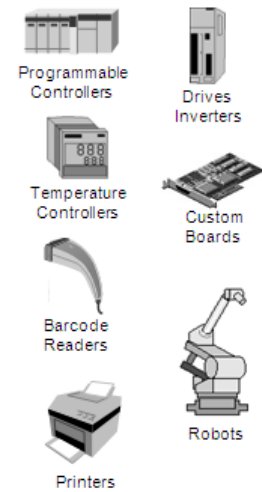
Included in the Banner Engineering Corp. driver package from Pro-face America:

- Banner Engineering Corp. v1.10.02 Manual
- "How To" Application Note
- AGP\Banner Engineering Flyer
- Two GP-Pro EX 2.10.100 demonstration projects (Simple and Advanced)
- Symbol Name Import CSV file
- Symbol Name to Modbus Register Cross Reference XLS file
- Two sample Banner PresencePlus Inspection Files for use as reference
 - 1 for a Color P4 Plus
 - 1 for a Black and White P4 Plus

Pro-face AGP3000 Series Operator Interface with Built In Ethernet



In addition to the Banner Camera Interface the AGP Series allow simultaneous connections using Ethernet, Serial Ports and USB



Banner Engineering Corp, Presence PLUS 4 Series Vision Sensors

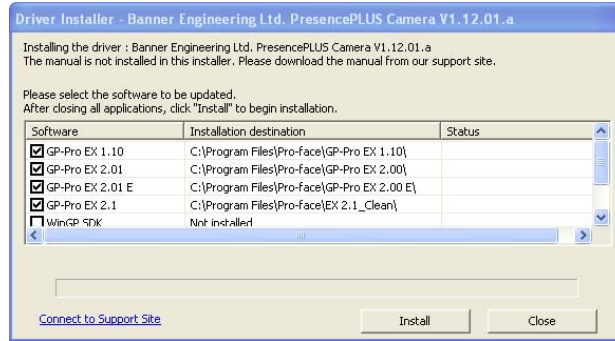
Prerequisites:

- 1.) GP-Pro EX 2.00.X or 2.10.X installed
- 2.) AGP3000 Ethernet Enabled HMI (excluding 3.8" AGP3200)
- 3.) Banner Engineering Camera Driver v1.10.02
- 4.) Banner Engineering Corp. Presence Plus 4 Black and White Vision Sensor
- 5.) Banner Engineering Corp. Presence Plus 4 Color Vision Sensor (**Set to Grayscale**)
- 6.) Banner Engineering Corp. Vision Sensor Inspection File Configured to Use Industrial Ethernet (Modbus TCP)
- 7.) List of Reference Documents:
 - a. GP-Pro EX PresencePLUS_Camera Manual.pdf (Included with Pro-face driver)
 - b. GP-Pro EX Banner Symbol Reference Guide.xls (Included with Pro-face driver)
 - c. GP-Pro EX Reference Manual (Included with GP-Pro EX)
 - d. PPVS_ETIPUsersGuide.PDF (Included with Banner PresencePlus software. This manual is a guide to Modbus Addresses available in Banner Engineering Corp. Vision Sensors)

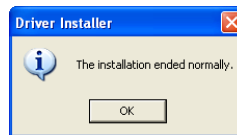
Driver Installation:

The Banner Engineering Corp. Vision Sensor driver is an executable file called BNR_PIMG.exe.

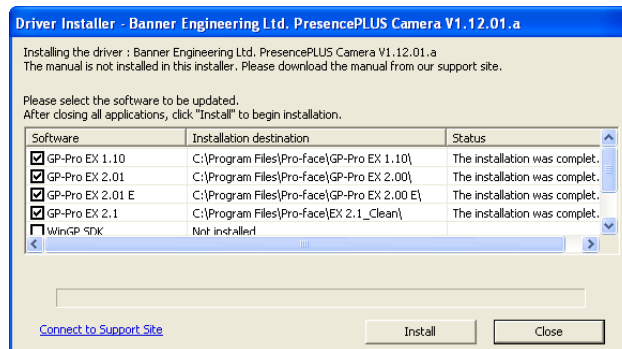
- 1.) Make sure you have GP-Pro EX 2.0X or 2.10.x installed on the computer and that it is not currently open.
- 2.) Double Click the BNR_PIMG.exe executable.
- 3.) The driver installation utility will find all of the applicable installations of GP-Pro EX on the computer.



4.) Click the Install button. Click the OK button once installation is complete.

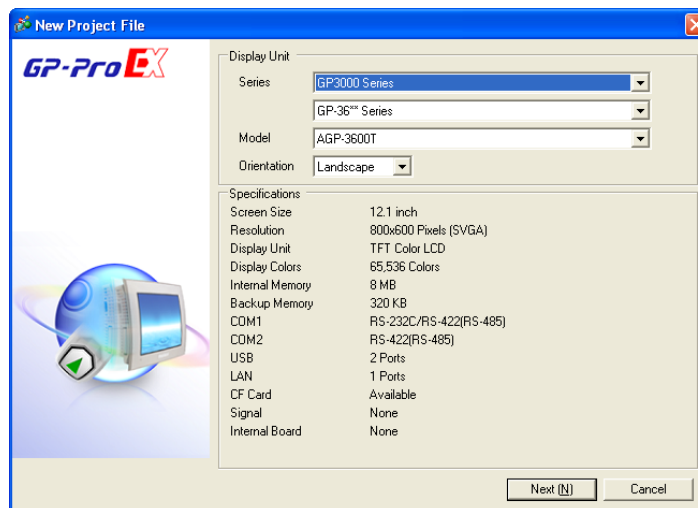


5.) Click the Close button to close the driver Installer dialog box.

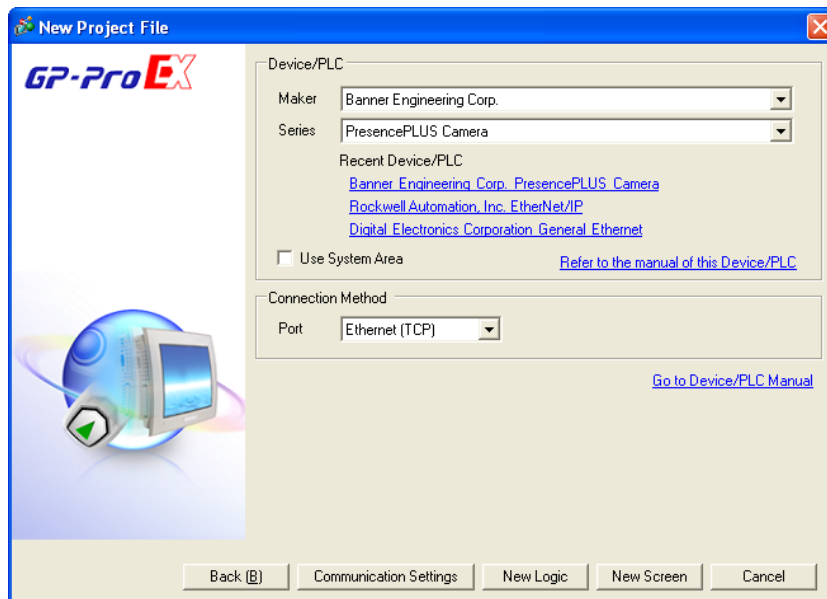


Banner Engineering Corp. Driver v1.10.02 Configuration:

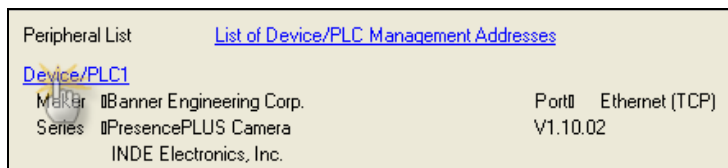
1.) Open GP-Pro EX and create a new Project, select an AGP3000 Ethernet enable model



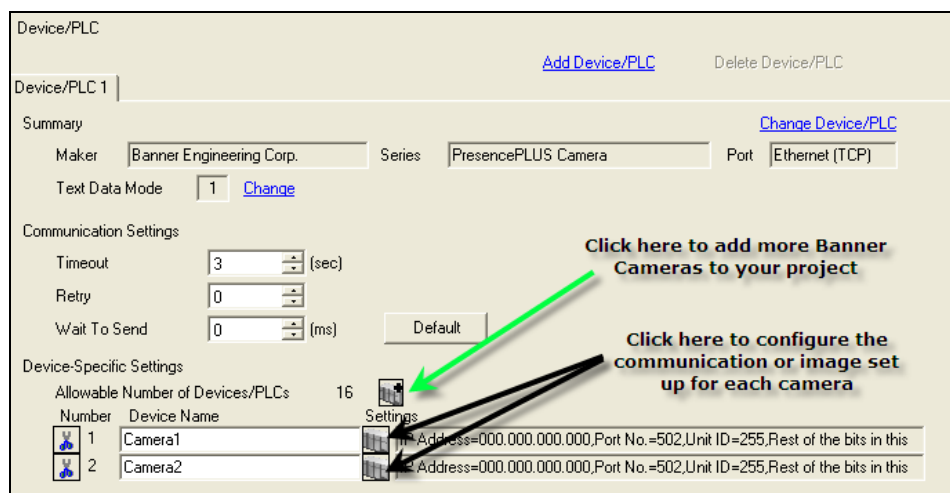
- 2.) Select the Maker "Banner Engineering Corp" and Series "PresencePlus Camera" from the drop down menus for the Device/PLC



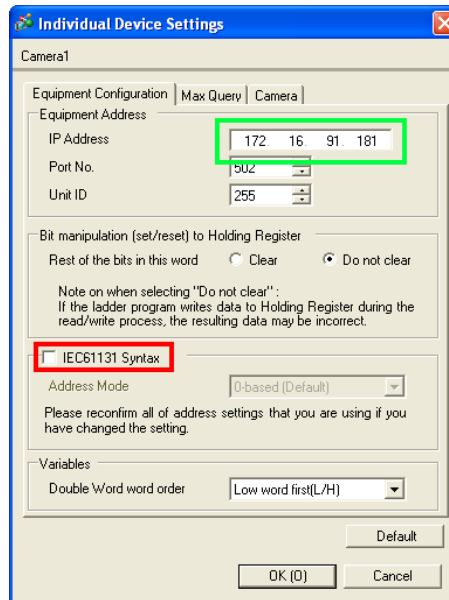
- 3.) Click on the Communication Settings button then click on the Device/PLC1 blue link in order to configure the camera.



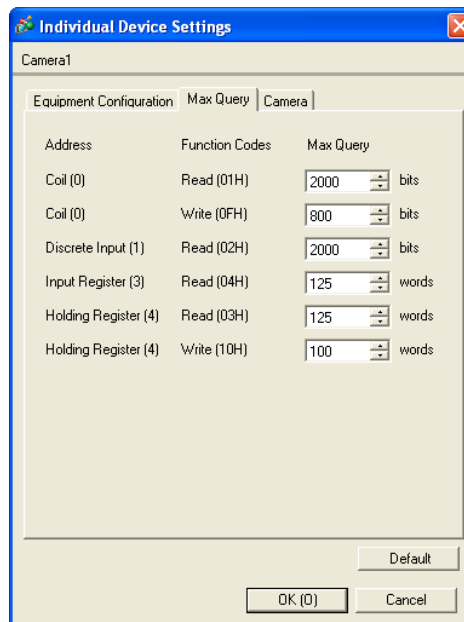
- 4.) Click on the button next to the Device Name field to configure the communication and default image settings for the Banner Camera



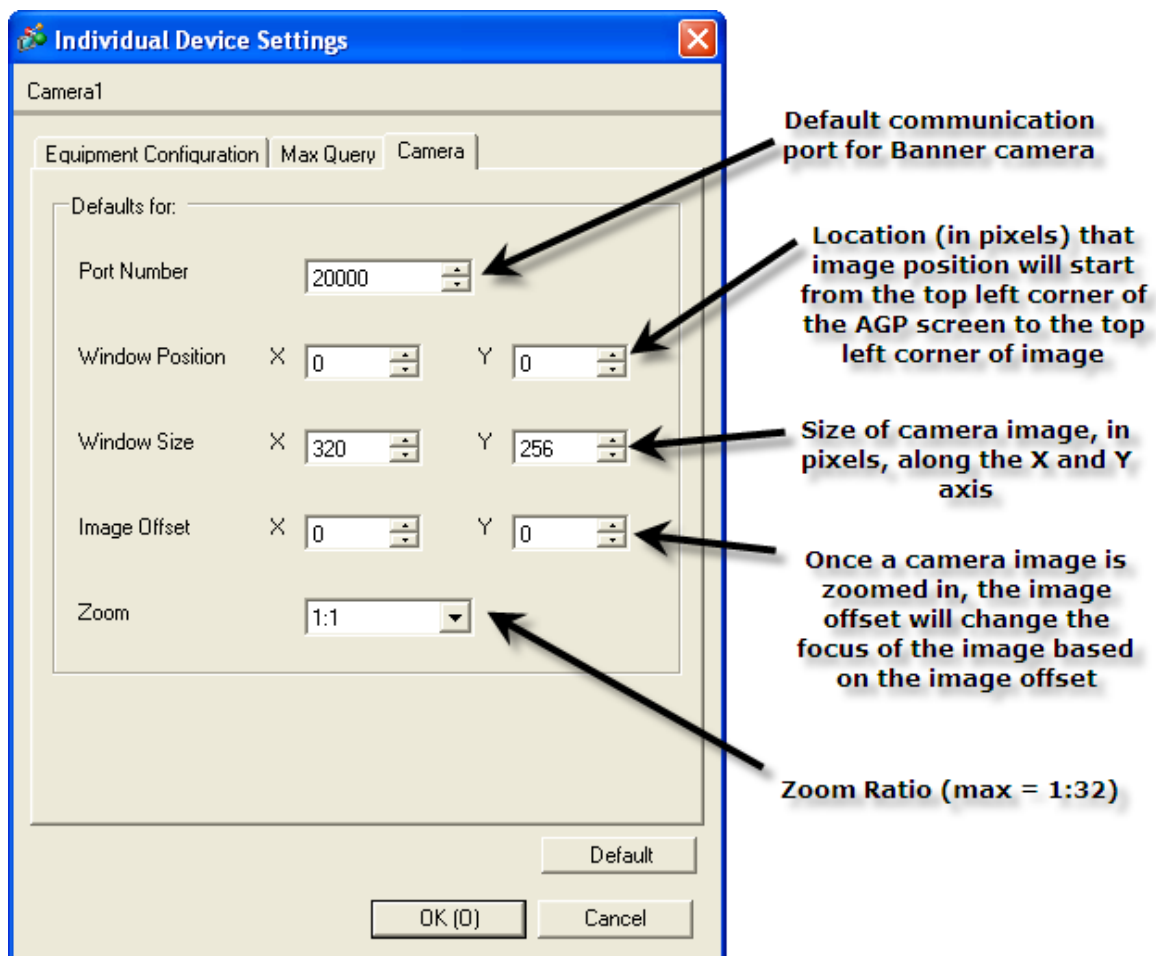
- 5.) Enter the IP Address of the Banner Camera (highlighted in GREEN in the following image) on the Equipment Configuration Tab. In most cases, leave all other settings at the default.
 - a. Note the option to change from traditional Modbus Syntax (i.e. 400001, 300001, 100001 or 000001) to IEC61131 Syntax (highlighted in RED in the following image).
 - b. It is recommended to use traditional Modbus Syntax in the GP-Pro EX project for the Banner Camera as more data types are supported. (See GP-Pro EX Banner Symbol Reference Guide.xls for details)



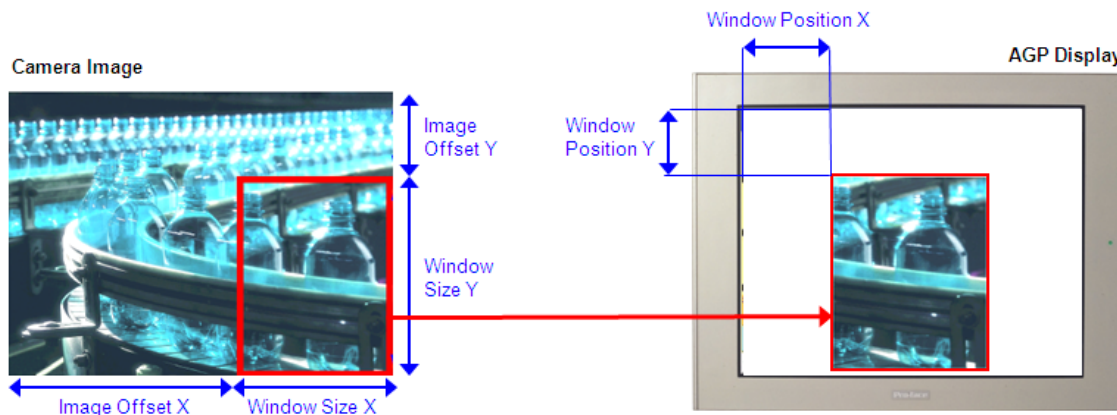
- 6.) On the Max Query tab, the number of Bits or Words that are requested by the AGP3000 from the camera during each scan is shown. Leave these settings at the default for the initial set up. These can always be adjusted later, if needed.



- 7.) On the Camera tab, set up the default settings for the Banner camera image on the AGP3000 runtime. The following diagram shows the default settings to show a camera image starting in the top left corner of the AGP3000 screen with a screen size of 320x256 and a zoom ratio of 1:1.
- NOTE: If you do not change these values in the AGP3000 Runtime, either by D-Scripts or Switches, these will be the settings that the driver uses to display the camera image on each screen that you choose.
 - Example: If screens 1, 3, and 5 of the GP-Pro EX project are configured to display the camera image, then the camera image will be 320 x 256 pixels in size, zoom ratio of 1:1, and will start in the top left corner of the screen on all 3 HMI screens in the AGP3000 Runtime.



- 8.) The following diagram shows how the camera image (Window) size, position, and offset are related.
- Window Size is simply the number of pixels (on the X and Y axis) that will be used on the AGP3000 screen to display the camera image. Example: Window Size X of 320 equals 320 pixels in width. Window Size Y of 256 equals 256 pixels in height.
 - Window Position determines where the Window is displayed on the screen from the starting point of 0, 0 (X, Y) in the top left corner of the AGP3000 screen. Example: Window Position X of 100 equals 100 pixels across the AGP3000 screen from the top left corner. Window Position Y of 200 equals 200 pixels down from the top left corner of the screen.
 - Image Offset only comes into consideration when the camera image is zoomed in and becomes larger than the Window Size of X, Y. In the diagram below, assume that the display area is 320x256. When an operator zooms in on the image, only a portion of the camera image (usually in the center) is seen. In order to move the focus to the bottle on the right, the operator can adjust the Image Offset using Switches or Numeric Displays on the HMI screen to move over X number of pixels to the right and Y number of pixels (or none at all). This area will now fill the Window Size of X, Y.

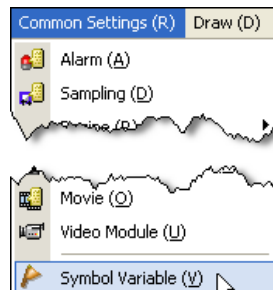


GP-Pro EX Symbol Import:

Pro-face has created a Symbol Import CSV File that will reduce development time by mapping common Modbus Data Registers in the Banner Engineering Camera to common language names in GP-Pro EX. These common language names are called Symbols.

Follow these directions to import the Symbol CSV File into GP-Pro EX.

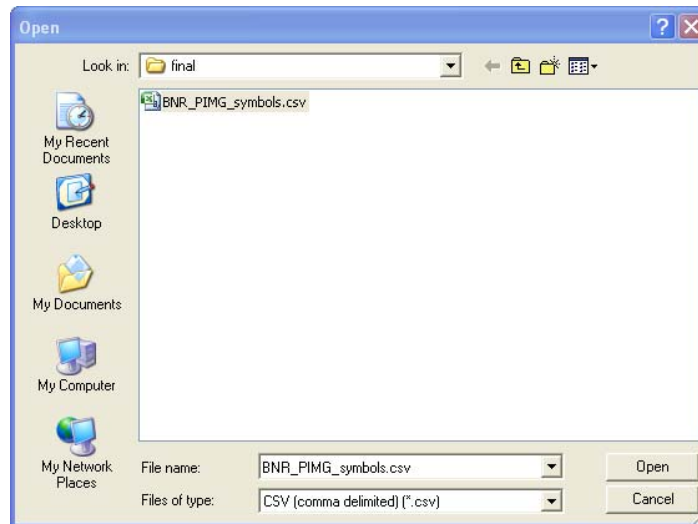
- Click on the Common Settings menu at the top of GP-Pro EX editor then select Symbol Variable.



2.) On the right side of the Symbol Variable interface, click on Utility then Import.



3.) Browse to the “BNR_PIMG_symbols.csv” file then click Open



4.) Verify that all the Symbols have Modbus or Internal addresses assigned to them. If any Symbols come into GP-Pro EX as –undefined-, use the CSV file to fix the addresses for the undefined Symbols. Otherwise, communication errors or project compile errors may occur.

	Name	Type	Array	Count	Address
1	BC_ACKFlag_BCRStrChangeAck	Bit Address			[Camera1]100025
2	BC_ACKFlag_ProductChangeAck	Bit Address			[Camera1]100019
3	BC_ACKFlag_RemoteTeachAck	Bit Address			[Camera1]100018
4	BC_ACKFlag_TriggerAck	Bit Address			[Camera1]100017
5	BC_InFlag_BCRStringChange	Bit Address			[Camera1]000008
6	BC_InFlag_ProductChange	Bit Address			[Camera1]000003
7	BC_InFlag_RemoteTeach	Bit Address			[Camera1]000002
8	BC_InFlag_Trigger	Bit Address			[Camera1]000001
9	BC_InReg_InFlags	Word Address			[Camera1]400001
10	BC_InReg_ProductSelect	Word Address			[Camera1]400002
11	BC_OutFlag_Error	Bit Address			[Camera1]100003
12	BC_OutFlag_Fail	Bit Address			[Camera1]100002
13	BC_OutFlag_I01	Bit Address			[Camera1]100008
14	BC_OutFlag_I02	Bit Address			[Camera1]100009
15	BC_OutFlag_I03	Bit Address			[Camera1]100010
16	BC_OutFlag_I04	Bit Address			[Camera1]100011
17	BC_OutFlag_I05	Bit Address			[Camera1]100012
18	BC_OutFlag_I06	Bit Address			[Camera1]100013

5.) Included with the Pro-face GP-Pro EX driver is a spreadsheet that shows the relationship between the Symbol name and the Banner camera function or Modbus address. The name of this file is “GP-Pro EX Banner Symbol Reference Guide.xls”.

	A	B	C	D	E	F
16	eBnc_R16_WindowDX	WordAddress	460004	%MW60004	%MW60005	Window Size XThe width of the camera's window frame, from 1 to 32767 pixels.
17	eBnc_R16_WindowDY	WordAddress	460005	%MW60005	%MW60006	Window Size Y The height of the camera's window frame, from 1 to 32767 pixels.
18	eBnc_R16_ImageX	WordAddress	460006	%MW60006	%MW60007	Image Offset X The X-axis offset of the camera's window frame relative to the camera image, from -32768 to 32767 pixels.
19	eBnc_R16_ImageY	WordAddress	460007	%MW60007	%MW60008	Image Offset Y The Y-axis offset of the camera's window frame relative to the camera image, from -32768 to 32767 pixels.
20	eBnc_R16_Zoom2	WordAddress	460008	%MW60008	%MW60009	Zoom Zoom level, from 1 to 32 times. "1" = 1:1, "2" = 1:2, etc.
21	eBnc_R16_SaveToFileVolume	WordAddress	460011	%MW60011	%MW60012	Save To Volume 1 = Save camera image to CF card 2 = Save camera image to USB key
22	eBnc_R16_SaveToFileIndex	WordAddress	460012	%MW60012	%MW60013	Save To Index Defines the suffix for the saved camera image filename. If the value in this device address was "25", then the filename would be BC00025.bmp.
23						
24	BC_InFlag_Trigger	BitAddress	000001	%M00000	%M00001	PPVS Input Coils The Modbus PPVS Input Coils are used to send single bit inputs from the PLC to the PPVS. The 16 bits of Input Coils can also be accessed using the 16 bits of the Input Flags register.
25	BC_InFlag_RemoteTeach	BitAddress	000002	%M00001	%M00002	
26	BC_InFlag_ProductChange	BitAddress	000003	%M00002	%M00003	See the Bannner Manual "PPVS_ETIPUsersGuide.PDF" Section 5 for more details.
27	BC_InFlag_BCRStringChange	BitAddress	000008	%M00007	%M00008	
28						
29	BC_OutFlag_Pass	BitAddress	100001	N/A	N/A	
30	BC_OutFlag_Fail	BitAddress	100002	N/A	N/A	

GP-Pro EX Part Addressing, Screen Set Up, and Usage:

Note: The Banner Vision Sensor can use Industrial Ethernet (Modbus TCP) registers to publish the sensor image and data registers. This needs to be configured within the Banner PresencePlus Software Inspection file stored within the sensor in order for the following steps to work.

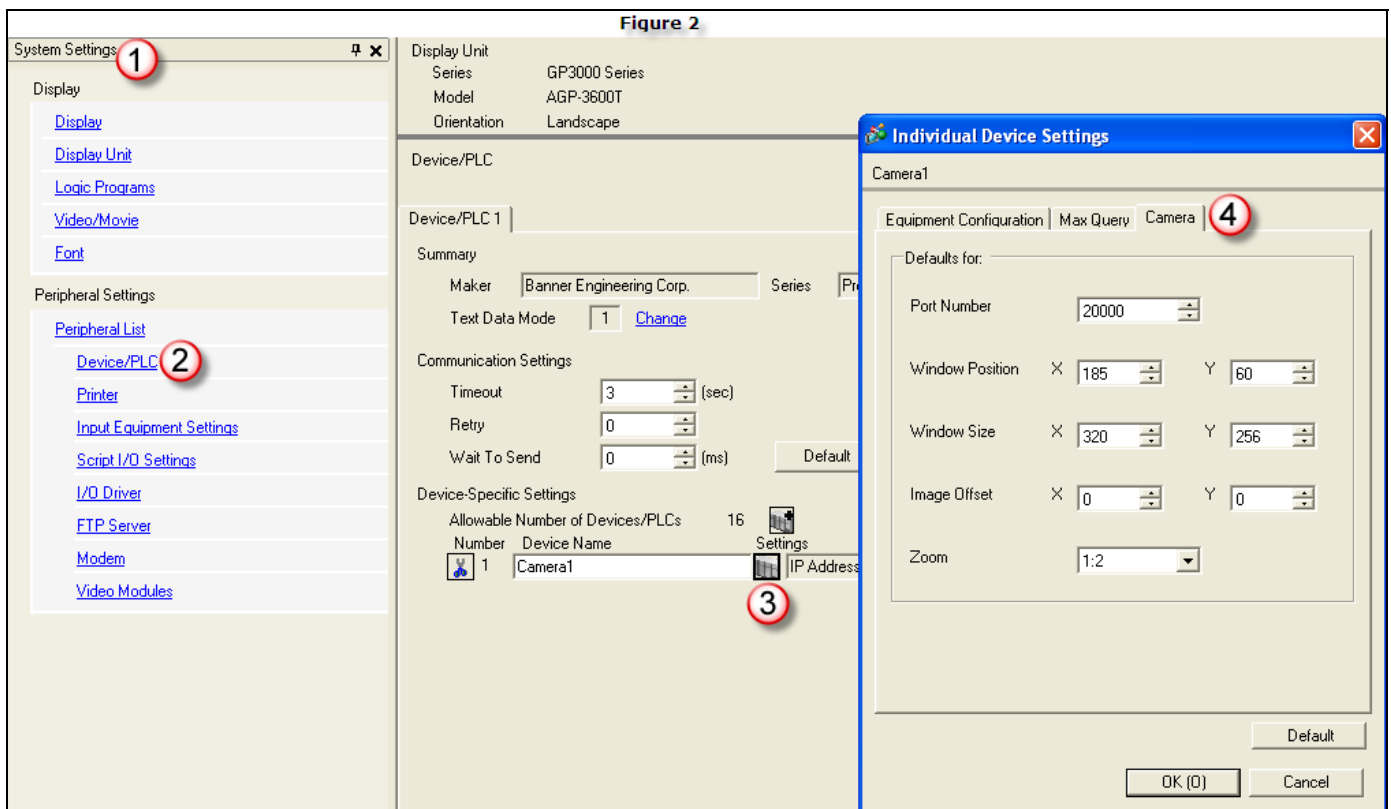
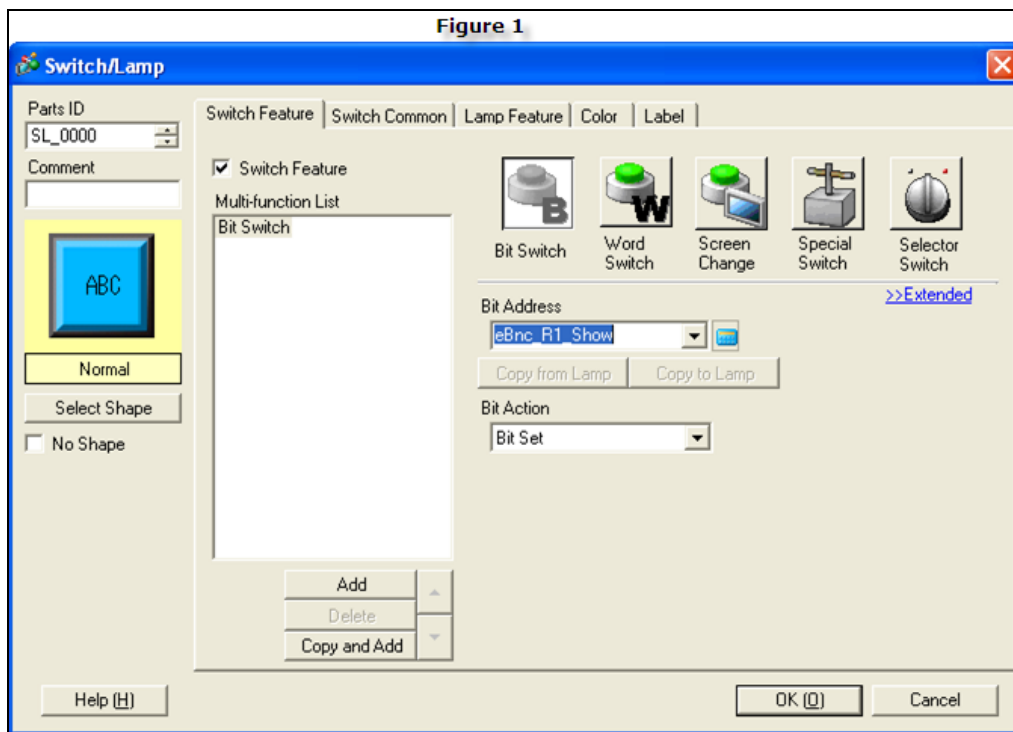
For general instructions on creating a GP-Pro EX project from start to finish, please refer to the GP-Pro EX Reference Manual, Chapter 5.

The following instructions will use examples from the included demonstration project- “GP-Pro EX_2.10.100_Banner_Demo_v1.10.02.prx” and will use Symbols from the included “BNR_PIMG_symbols.csv” file.

1.) Show Banner Image Using Driver Default Settings - (Base Screen B2)

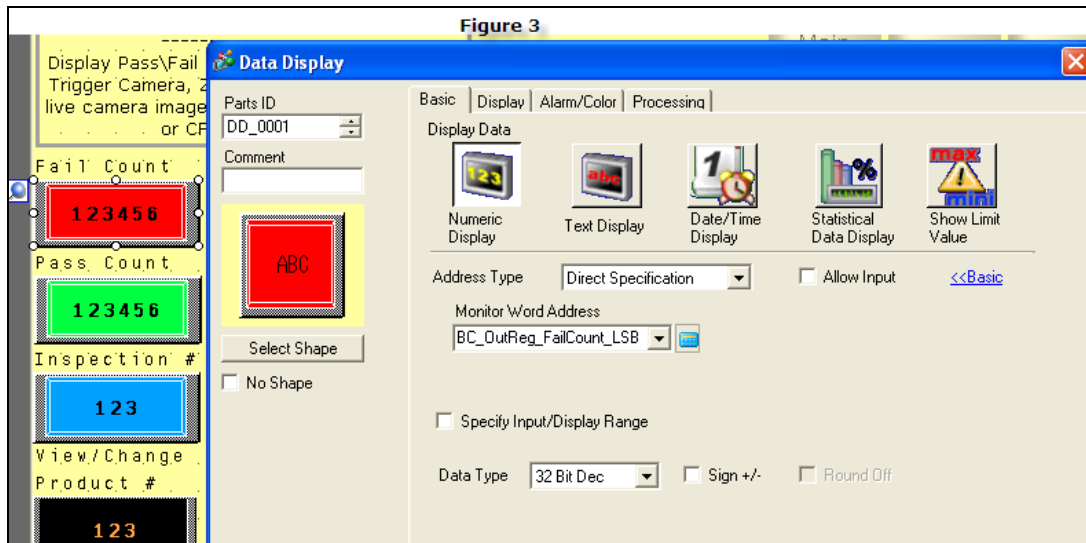
This screen has two Bit Switches configured to enable or disable the Banner Sensor Image. The “Show Image” button performs a Bit Set using Symbol “eBnc_R1_Show” which is mapped to the Modbus TCP address “060001” within the Banner Sensor. The other Bit Switch “Disable Image” performs a Bit Reset on the same Symbol to disable the image. Using a Bit Invert does not work with this Modbus TCP address. (Figure 1)

Note: On this screen, the image that is displayed uses the default settings from the System Settings, Device/PLC, Camera1 Device Specific Settings, Camera tab (Figure 2).



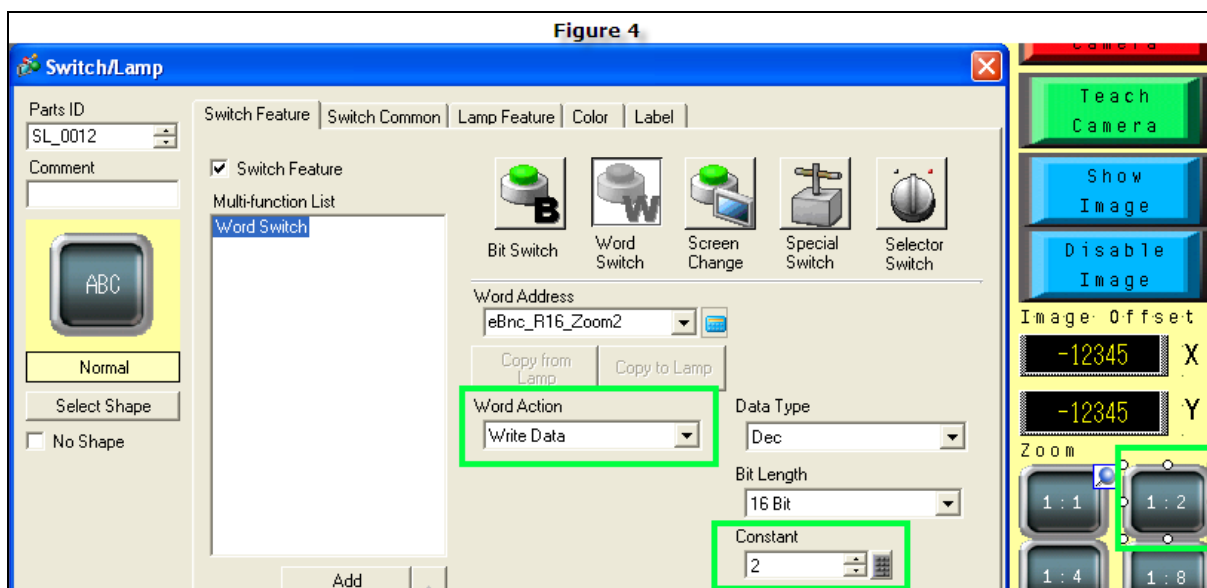
2.) Display Pass\Fail Data – (Base Screen B2)

This screen has two Data Display Parts that show the Pass\Fail Data from the Banner Sensor. In Figure 3 below, the Fail Data is shown in a Data Display Part that is configured as a Numeric Display using Symbol “BC_OutReg_FailCount_LSB” which is mapped to Modbus TCP address “300009” in the Symbol Library. This is a Read Only register within the Banner Sensor.



3.) Zoom Ratio – (Base Screen B2)

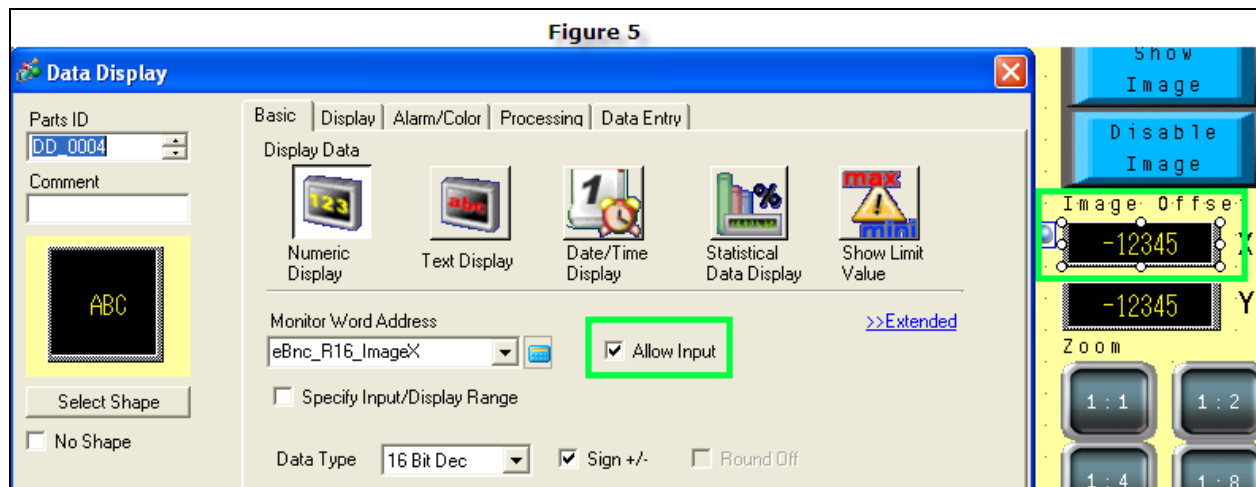
This screen has four Zoom Ratio buttons that enable a user to zoom in on an image up to a 1:8 ratio. (The maximum zoom ratio for the Banner Engineering Corp. Driver v1.10.02 is 1:32). The Zoom 1:2 Ratio Button shown in Figure 4 below is simply a Word Switch that writes a 16 Bit DEC value (in this case “2”) to the Symbol “eBnc_R16_Zoom2” which is mapped to Modbus TCP address “460008” in the Symbol Library.



4.) Display or Change Image Offset (X, Y) – (Base Screen B2)

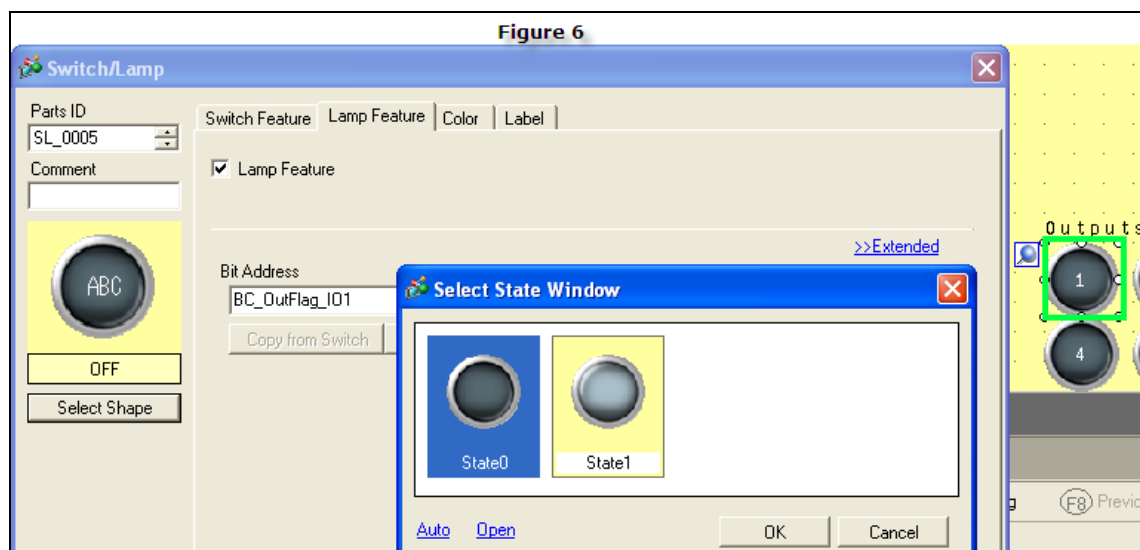
This screen has two Data Display Parts configured as Numeric Displays with a Pop Up Keypad. They allow an operator to move the zoomed in image focus by changing the value of Symbol “eBnc_R16_ImageX” when touched. The numeric value that is displayed or changed is simply the number of pixels on the X or Y axis that the image focus will be moved within the original (1:1) image.

Image Offset is explained in the previous section “Banner Engineering Corp. Driver v1.10.02 Configuration”, Item #8.



5.) Banner Sensor Outputs – (Base Screen B2)

This screen has 6 Lamps that display the state of Outputs within the sensor. Simply place a Lamp Part on the screen, use Symbol “BC_OutFlag_OI1”, and select the Lamp shape. This Symbol is mapped to Read Only Modbus TCP address “10008” in the Symbol Library.

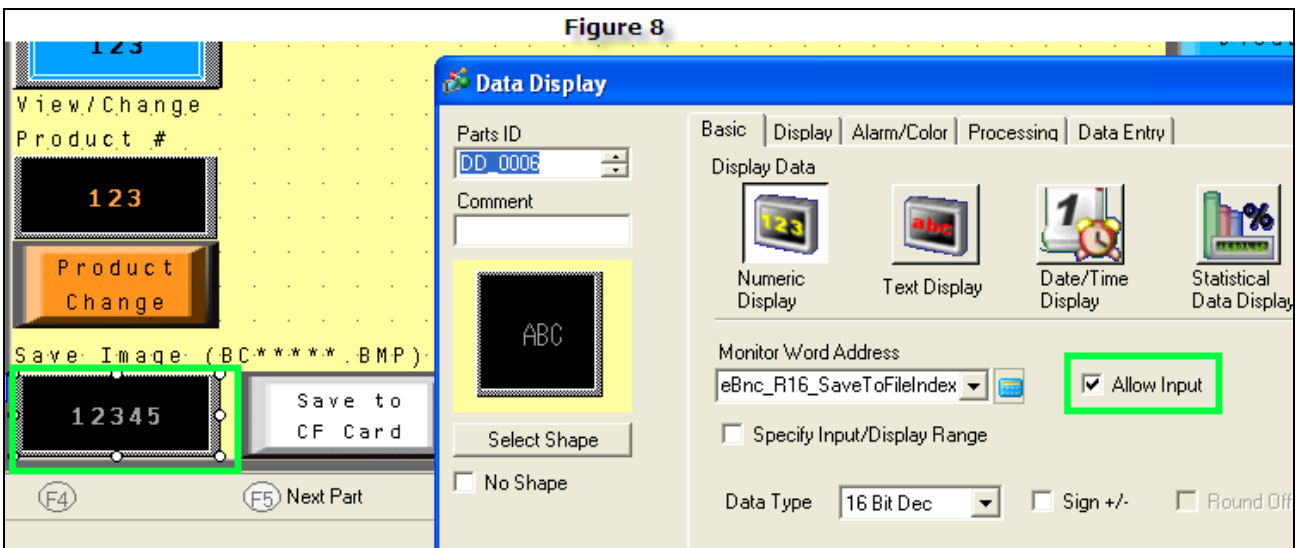
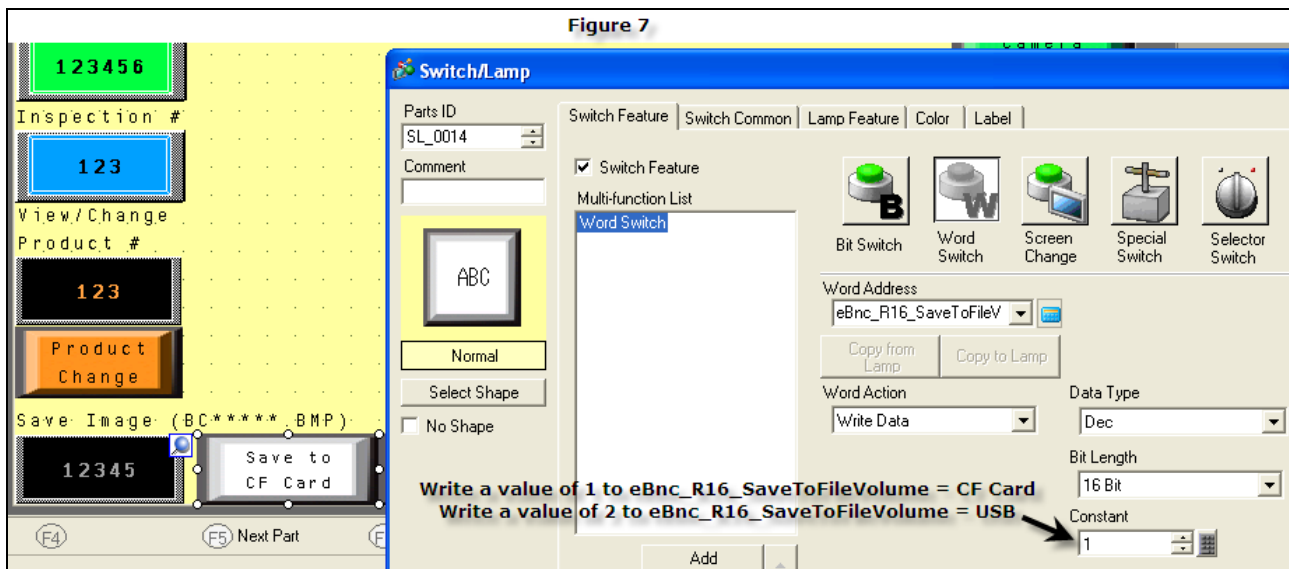


6.) Save Banner Sensor Image as BMP to USB or CF Card Memory – (Base Screen B2)

This screen has a set of 3 Buttons that allow an operator to save a sensor image to USB or CF Card Memory on the AGP. This is helpful when an operator wants to review the image later to inspect a failed part.

A Word Switch that writes a “1” to Symbol “eBnc_R16_SaveToFileVolume” will save the image to CF Card. A Word Switch that writes a “2” to Symbol “eBnc_R16_SaveToFileVolume” will save the image to a USB Stick. (Figure 7)

Optional: Use a Data Display Part configured as a Numeric Display with Input Enabled to save the image with a specific file name suffix. For example: Touch the Numeric Display and enter “100” in Pop Up Keypad then touch the “Save to CF Card” button. The image will be saved to the CF Card as “BC00100.BMP”. (Figure 8)

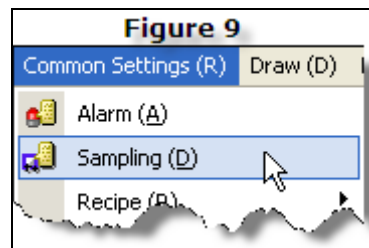


7.) Create Historical Trend Graph of Pass\Fail Data – (Base Screen B6)

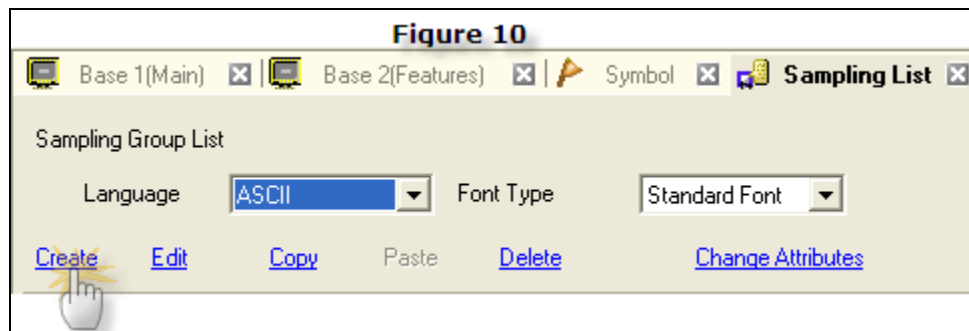
Use GP-Pro EX Sampling Data in order to display a Historical Trend Graph of Pass\Fail data within the Banner Sensor.

For more details on Sampling Data and Historical Trend Graph, please refer to GP-Pro EX Reference Manual, Chapter 23.

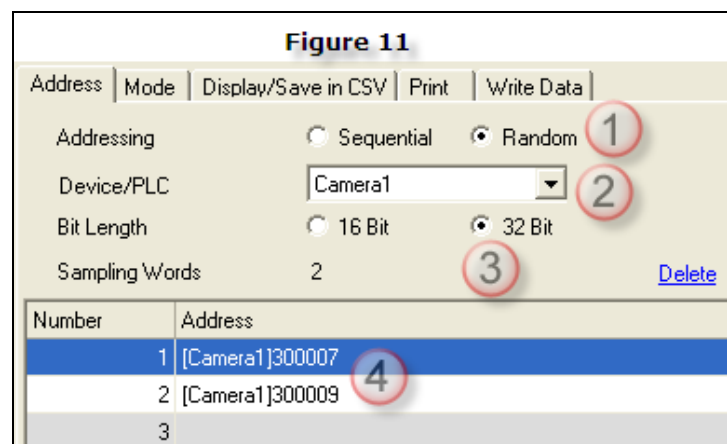
- a.) First: Register Sampling Data by clicking on the GP-Pro EX Editor Menu Common Settings, Sampling.



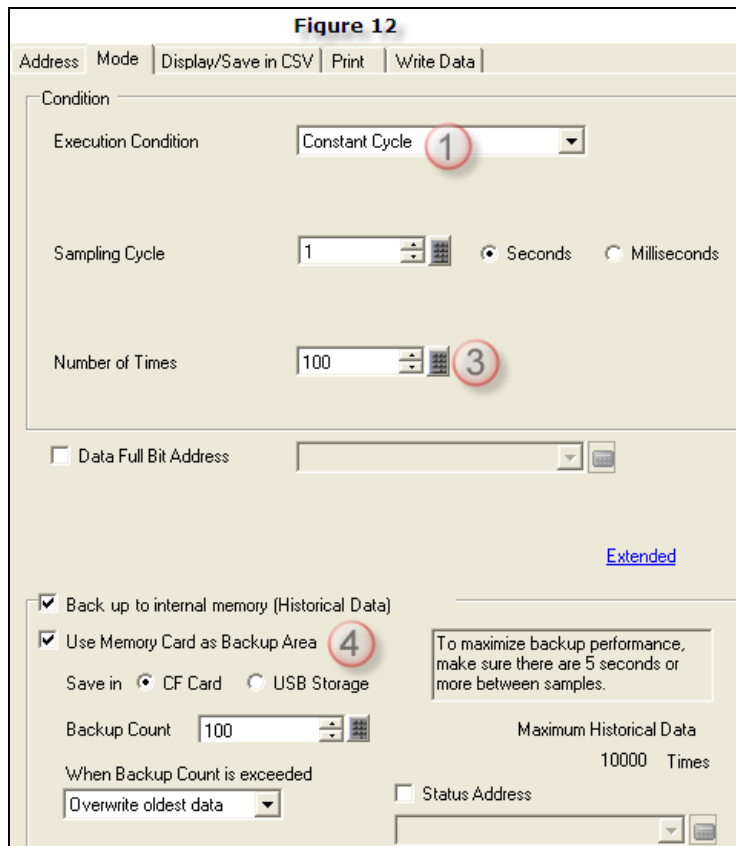
- b.) Create a New Sampling List



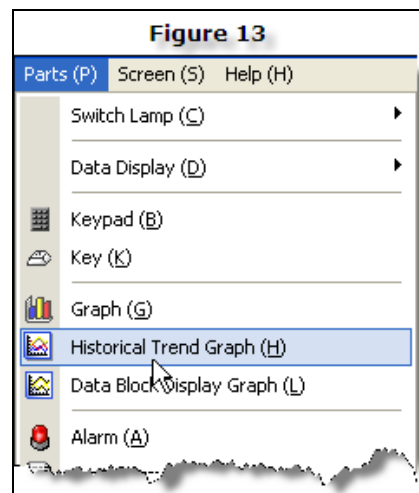
- c.) Configure the Sampling List to use Random Addresses. Select the sensor in your project from the drop down list. Select 32 Bit. Enter Modbus TCP Addresses "300007" (Pass) and "300009" (Fail).



- d.) In the Sampling List Mode Tab, set the Execution Condition to Constant Cycle, Sampling Cycle to every second, Number of Times to 100, and use USB or CF Card Memory to store the Historical Data. (Figure 12)

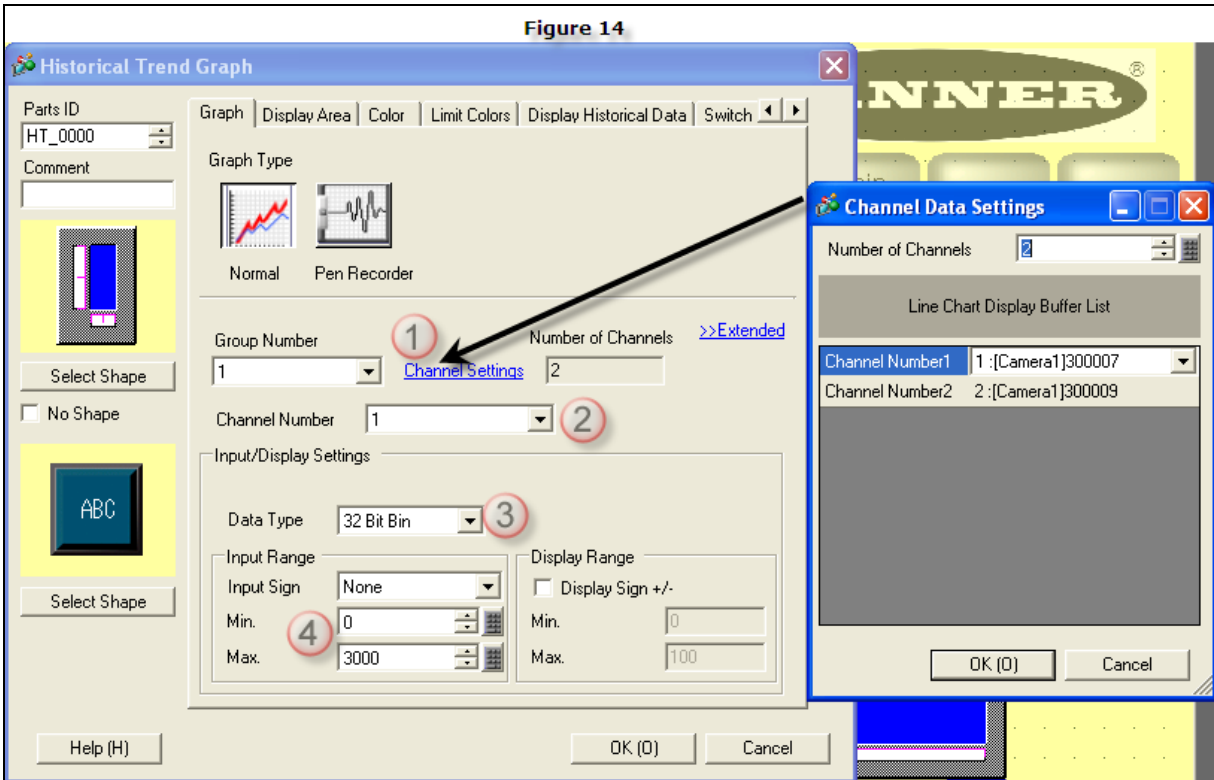


- e.) Second: Place a Historical Trend Graph on the screen by clicking on the GP-Pro EX Editor Part Menu then Historical Trend Graph



- f.) Configure the Historical Trend Graph to use 2 Channels, each Channel should be configured to have a Data Type of 32 Bit BIN, and a scale (0-65535) then click OK. Set up all other Historical Trend Graph tabs to your preferences.

In the following example, the Historical Trend graph is set up to display 0-3000 Passed or Failed images.



Change Banner Camera Image Size or Position using a D-Script or Global D-Script:

The following instructions can be used with the GP-Pro EX_2.10.100_Banner_Demo_v1.10.02-ADVANCED.prx project example.

To change the Banner Vision Sensor Image size and position in the AGP3000 Runtime requires the use of D-Scripts or Global D-Scripts and Internal Memory Addresses. The Banner Sensor Modbus Registers that are used to change these values cannot be written to directly using Switches or Input Display Parts. The new values are written to an Internal Memory Address within the AGP3000 then all the changes are written to the Banner Vision Sensor at one time using a D-Script.

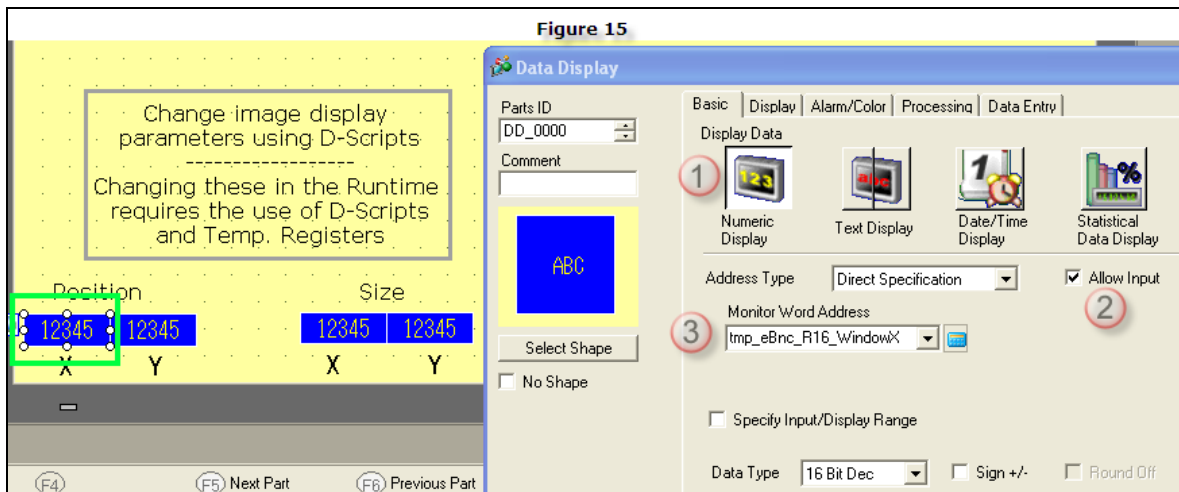
The following table shows the GP-Pro EX Symbols, Banner Vision Sensor Addresses, and the corresponding AGP3000 Internal Memory Address used to store the new values into the Banner Vision Sensor.

Symbol Name	Modbus Address	Purpose	Internal Memory Symbol
eBnc_R16_WindowX	460002	Window Position (X)	tmp_eBnc_R16_WindowX
eBnc_R16_WindowY	460003	Window Position (Y)	tmp_eBnc_R16_WindowY
eBnc_R16_WindowDX	460004	Window Size (X)	tmp_eBnc_R16_WindowDX
eBnc_R16_WindowDY	460005	Window Size (Y)	tmp_eBnc_R16_WindowDY

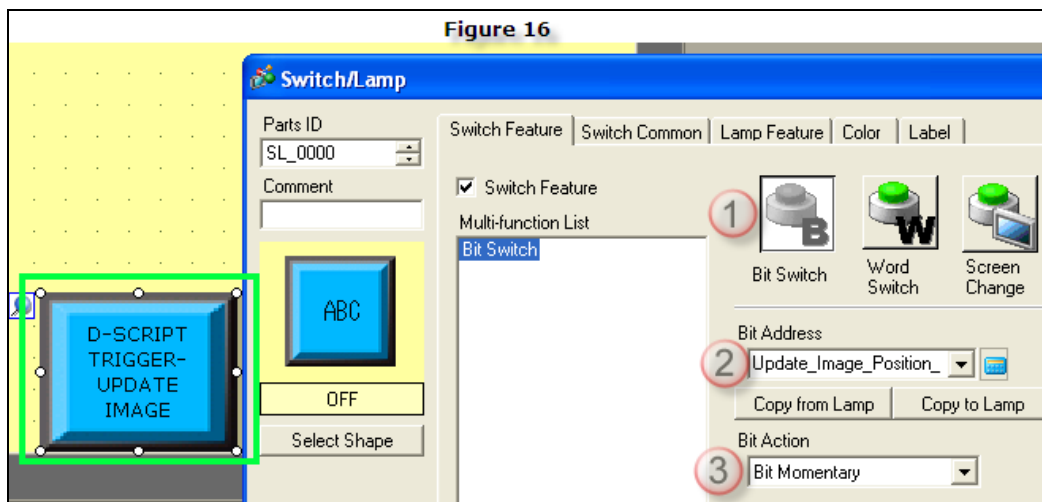
For general instructions on creating a GP-Pro EX D-Script or Global D-Script, please refer to the GP-Pro EX Reference Manual, Chapter 20.

The following instructions will use examples from the included demonstration project- “GP-Pro EX_2.10.100_Banner_Demo_v1.10.02.prx” and will use Symbols from the included “BNR_PIMG_symbols.csv” file.

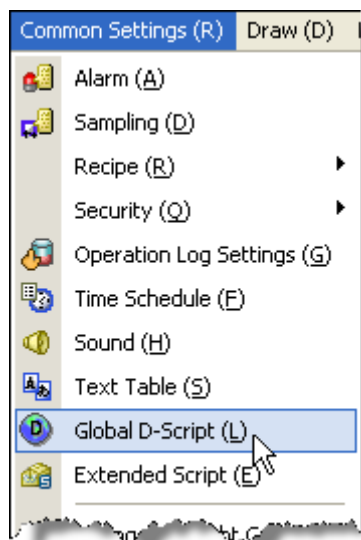
- 1.) Change the Default Display Settings via D-Scripts & Data Display Parts - (Base Screen B3)
 - a.) Create 4 Data Display Parts configured for Numeric Display with Input Enabled. Use a GP-Pro EX Symbol that will store the changes into Internal Memory Addresses. For example: tmp_eBnc_R16_WindowX



- b.) Create a Momentary Bit Switch that will trigger a Global D-Script (shown later). Use the GP-Pro EX Symbol “Update_Image_Position_Trigger”.



- c.) Create a Global D-Script to move the changes from the Internal Addresses to the Banner Sensor Address. Open the Global D-Script Editor by clicking on Common Settings, Global D-Script.

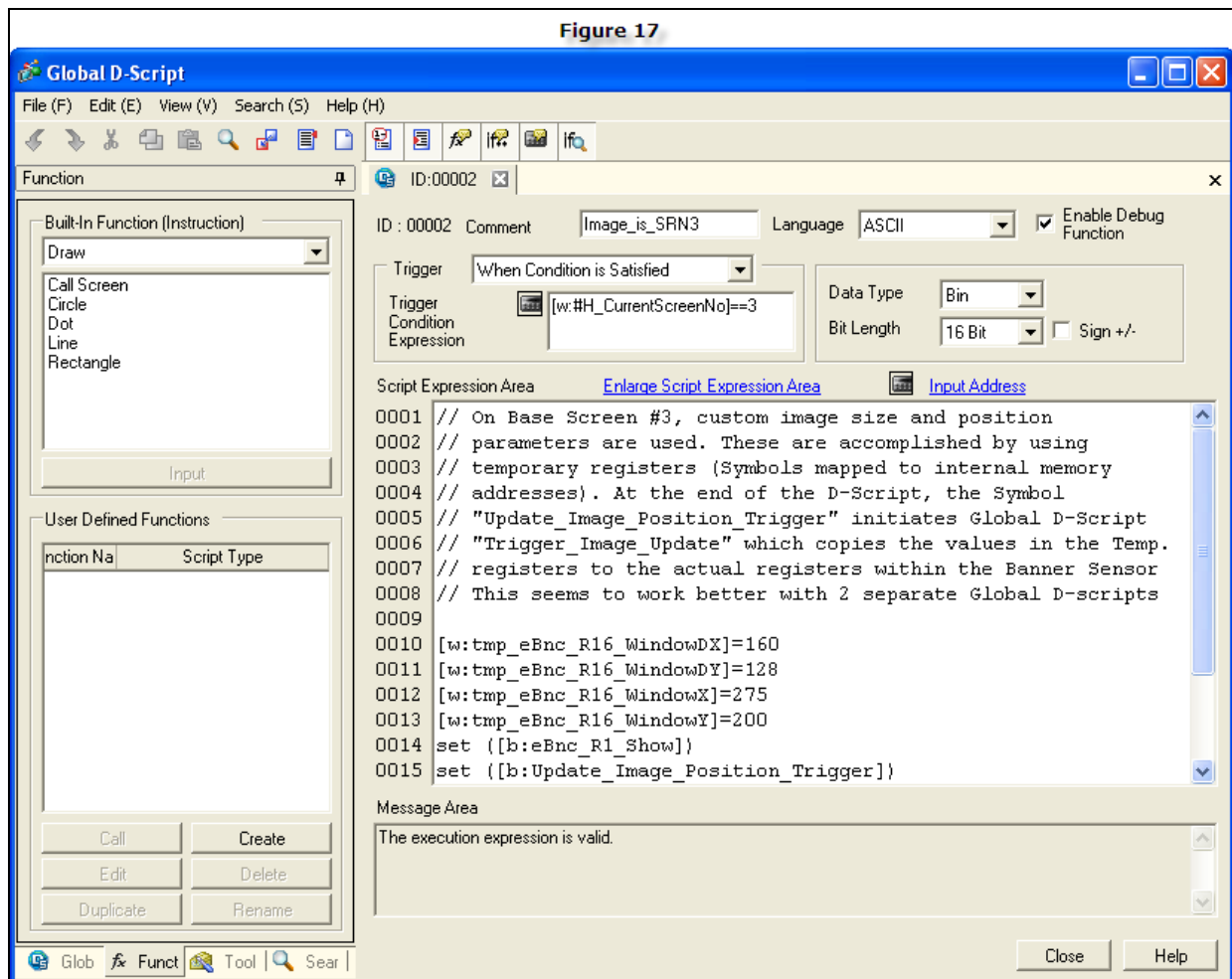


- d.) Copy and Paste the following example text into a new Global D-Script. Set the Trigger to use an expression if the AGP3000 Runtime is navigated to Base Screen 3. Click Close when finished and Save the Global D-Script when prompted.

D-Script Text Example for Base Screen 3:

```
// On Base Screen #3, custom image size and position
// parameters are used. These are accomplished by using
// temporary registers (Symbols mapped to internal memory
// addresses). At the end of the D-Script, the Symbol
// "Update_Image_Position_Trigger" initiates Global D-Script
// "Trigger_Image_Update" which copies the values in the Temp.
// registers to the actual registers within the Banner Sensor
// This seems to work better with 2 separate Global D-scripts

[w:tmp_eBnc_R16_WindowDX]=160
[w:tmp_eBnc_R16_WindowDY]=128
[w:tmp_eBnc_R16_WindowX]=275
[w:tmp_eBnc_R16_WindowY]=200
set ([b:eBnc_R1_Show])
set ([b:Update_Image_Position_Trigger])
```



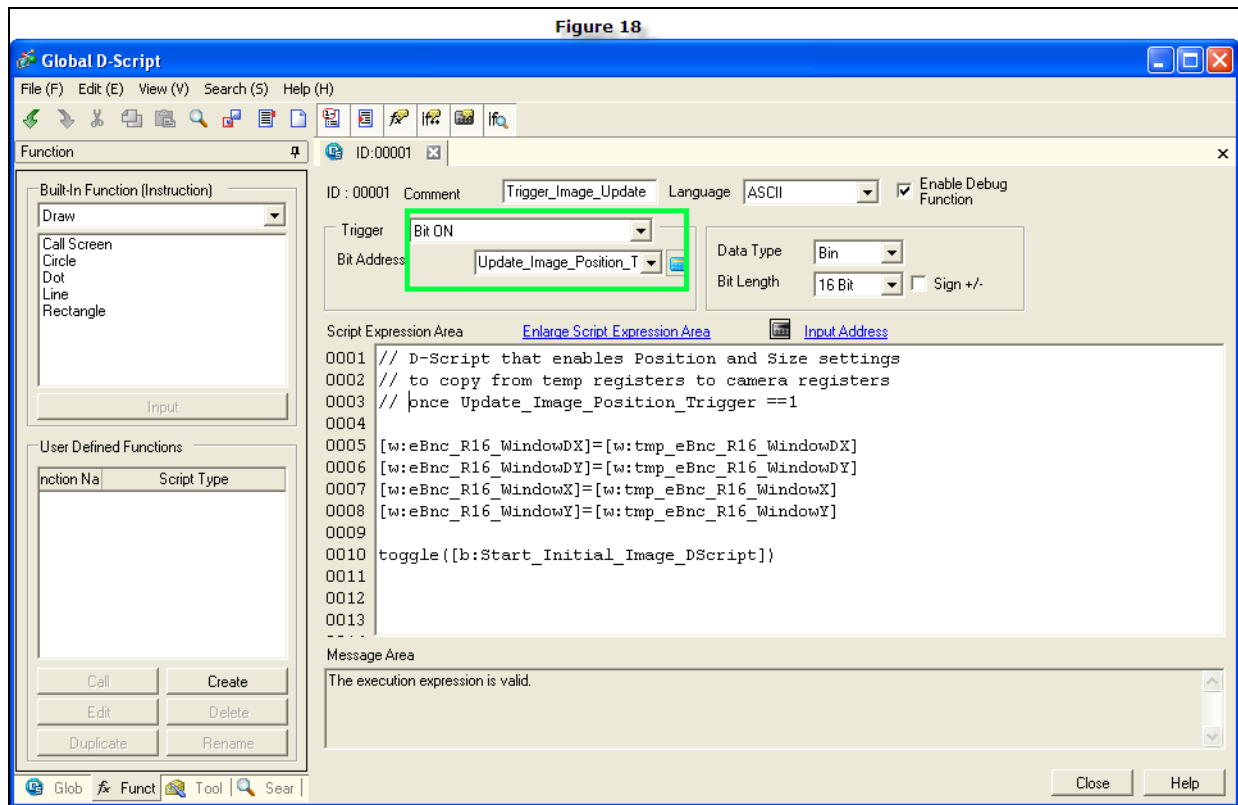
a.) Create another Global D-Script and copy and paste the following text into it.

D-Script Text Example for Updating Banner Sensor:

```
// D-Script that enables Position and Size settings
// to copy from temp registers to camera registers
// once Update_Image_Position_Trigger ==1

[w:eBnc_R16_WindowDX]=[w:tmp_eBnc_R16_WindowDX]
[w:eBnc_R16_WindowDY]=[w:tmp_eBnc_R16_WindowDY]
[w:eBnc_R16_WindowX]=[w:tmp_eBnc_R16_WindowX]
[w:eBnc_R16_WindowY]=[w:tmp_eBnc_R16_WindowY]

toggle([b:Start_Initial_Image_DScript])
```



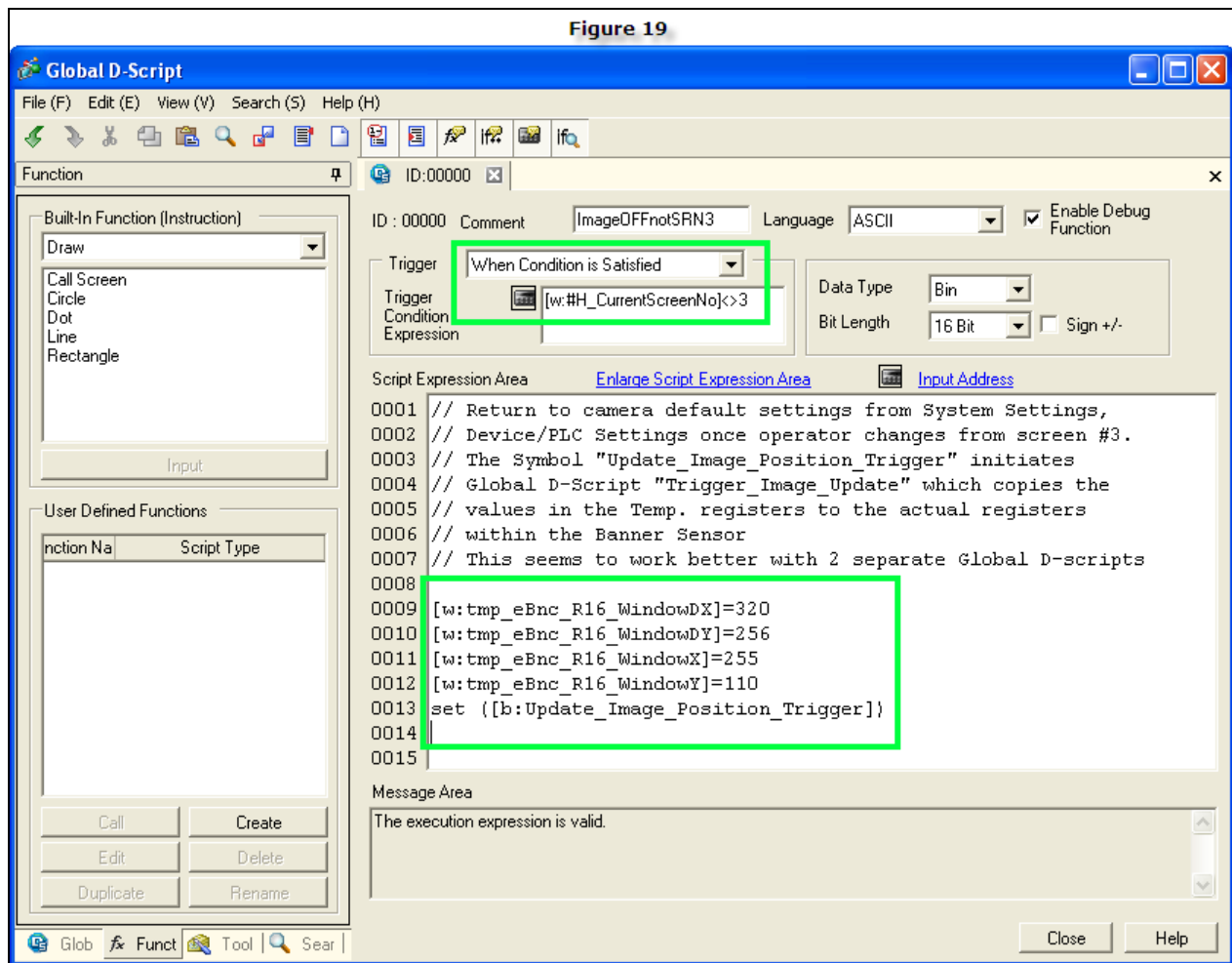
Note: If an operator changes the Banner Sensor Image Size or Position in one screen of the AGP3000 Runtime, the changes will be reflected in all screens. The following example shows how to set the AGP3000 Runtime back the Banner Engineering Corp. Driver Default Settings if the operator navigates away from Base Screen 3.

a.) Create a new Global D-Script that uses an expression to check if the AGP3000 is on Base Screen 3. If it is not, then write the default image position and size settings back into the Banner Sensor. Use the following D-Script Text:

D-Script Text Example for restoring default parameters:

```
// Return to camera default settings from System Settings,
// Device/PLC Settings once operator changes from screen #3.
// The Symbol "Update_Image_Position_Trigger" initiates
// Global D-Script "Trigger_Image_Update" which copies the
// values in the Temp. Registers to the actual registers
// within the Banner Sensor
// This seems to work better with 2 separate Global D-scripts
```

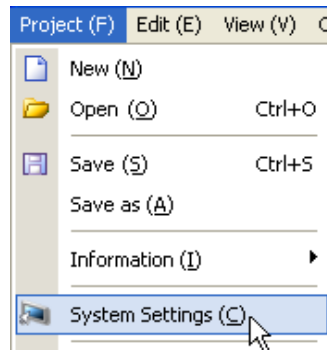
```
[w:tmp_eBnc_R16_WindowDX]=400
[w:tmp_eBnc_R16_WindowDY]=240
[w:tmp_eBnc_R16_WindowX]=175
[w:tmp_eBnc_R16_WindowY]=225
set ([b:Update_Image_Position_Trigger])
```



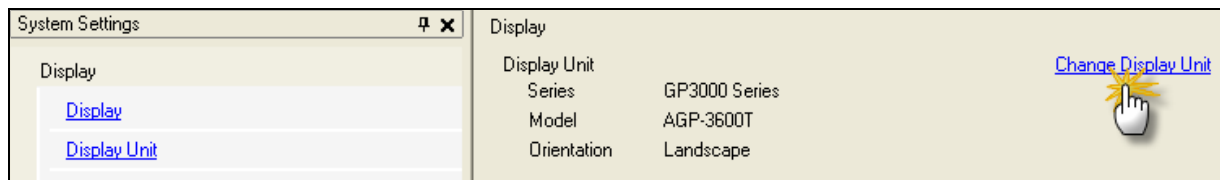
How to convert enclosed demonstration project to a different model\screen size:

In order to use the enclosed demonstration project, which was configured for an AGP3600T, to a different model and screen size, follow these steps.

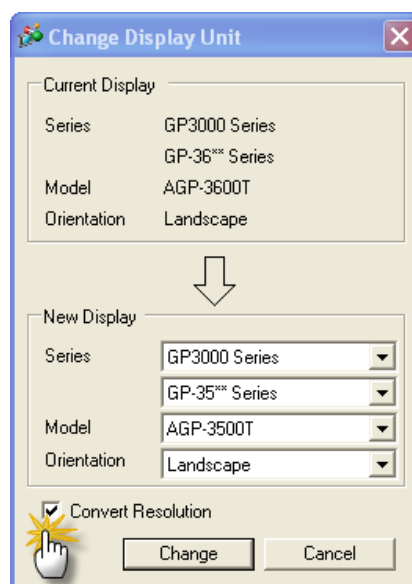
- 1.) Open the enclosed GP-Pro EX project, click on the Project menu then System Settings.



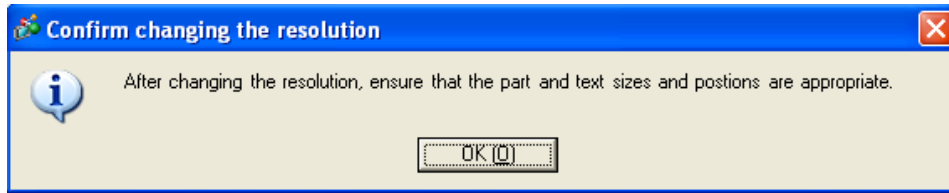
- 2.) Click on Display in the System Settings menu then Change Display Unit.



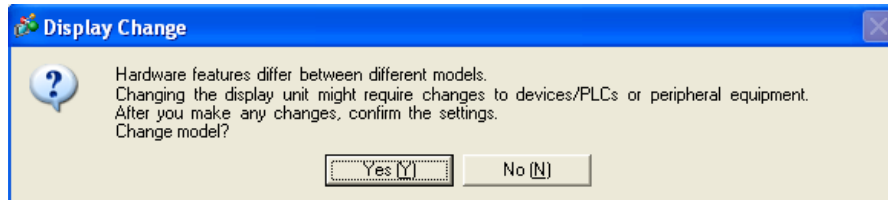
- 3.) Select the series line and model of the new AGP. Make sure to click the Convert Resolution check box in order to automatically resize all screen objects in the application.



4.) Click OK to the reminder to check the screen objects before downloading to an AGP.



5.) Click YES to acknowledge that AGP models have hardware capabilities.



6.) Inspect the demonstration project screens and objects to verify that they were converted and scaled properly.

For more information on Pro-face and our full line of HMI, Operator Interface and Industrial PC products please visit our web site at www.profaceamerica.com.