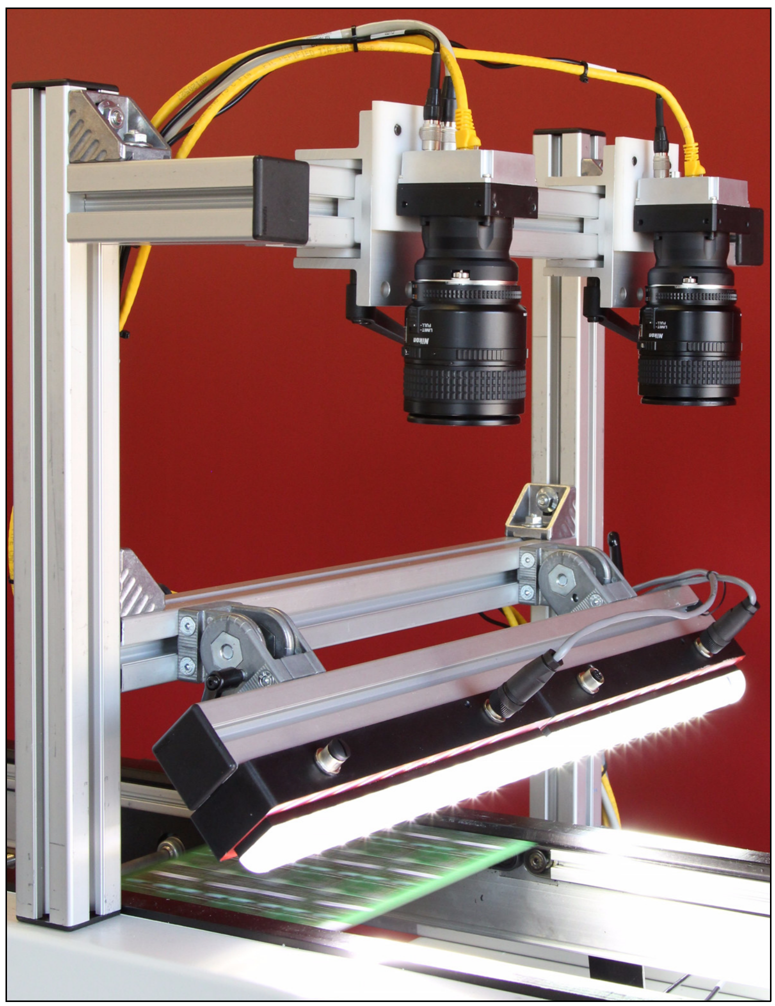
MICROSCAN

PanelScan Integration Guide



P/N 83-9111020-02

Using the PanelScan Multi-Array PCB Traceability System

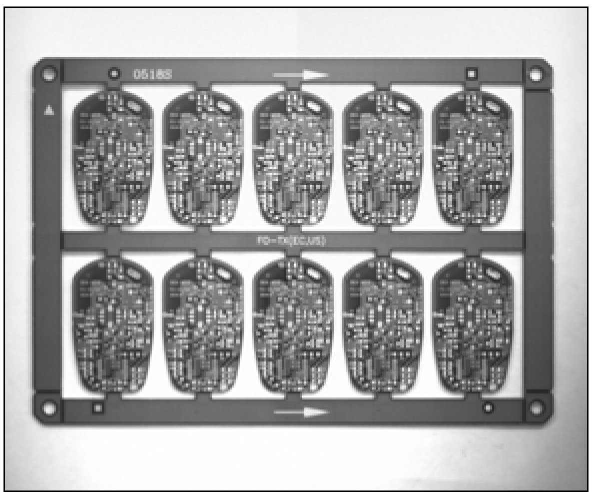
Overview

This document describes the configuration and use of PanelScan, a turnkey solution for large area imaging in electronics manufacturing and assembly applications. The PanelScan solution simplifies the error-prone and time-consuming process of capturing and associating traceability data or inspection data for multi-array printed circuit boards and component trays at the front-end assembly.

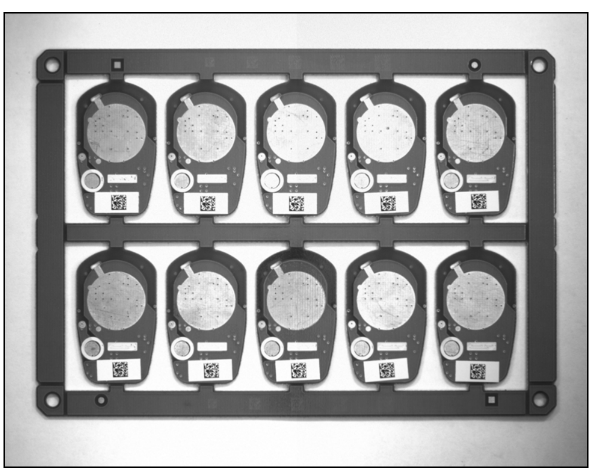
PanelScan is designed to perform array-based decoding within very large line scan images. PanelScan uses one or two Basler Racer 6K wide line scan cameras to view a single row of pixels on a PC board as it moves under the camera on a conveyor. A special line light is used to illuminate the same line on the board being inspected with very bright light.

There are two applications involved. First is the Image Acquire application. This uses the Basler SDK to take images and place them in a Memory Mapped File or MMF. The second application is the PanelScan UI based on Microscan's Visionscape Software. When triggered, it reads these images from the Memory Mapped File and processes them. The output from the system is a string of all decodes placed in a .csv file.

Below are images of the front and back of a typical panelized printed circuit board. This panel has 2 rows and 5 columns of boards.



Front of a Typical Panelized Printed Circuit Board



Back of a Typical Panelized Printed Circuit Board

Specifications

PanelScan comes in two configurations: **Standard** and **Wide**.

- **PanelScan Standard –** PanelScan Standard uses a single 6,144-pixel-wide line scan camera. When the camera is placed at the specified distance from the part as shown in the drawing below, it has a field of view of **250 mm (10”)** and can read symbols up to this board width.
- **PanelScan Wide –** PanelScan Wide uses two 6,144-pixel-wide line scan cameras side-by-side with a 1 inch overlap to cover up to **450 mm (18”)** of board width.
- **X Resolution –** At the specified distance, the camera has a resolution of **0.00163”** per pixel, or **1.63 mils**.
- **Y Resolution –** PanelScan does not use an encoder to trigger each row of pixels in the image. Images are captured in a time-based mode where each line is acquired within a certain “exposure” time. The speed of the conveyor must be matched to the X Resolution of the system to make them both even. When the speed is matched to the X Resolution, a circle will show with an even width and height.

  Note that the lack of an encoder makes the system more economical and easy to set up, but it also means that the boards must be moving at a constant speed under the PanelScan camera and they may not stop until the full board is read.
- **1D Symbol Reading Capability –** With this resolution, the system is capable of reading 1D symbols down to 3.3 mils with 2 pixels across a thin bar.

  Note that the system is able to read at this resolution for two reasons: the first is that it uses a high quality lens with a very good MTF ratio, and the second is that it uses a Rect Warp to magnify symbols by 200% before decoding, which helps the algorithm to decode.
- **Data Matrix Reading Capability –** With this resolution, the system is capable of reading Data Matrix symbols down to 5 mils with 3 pixels per cell.

  Note that the system is able to read at this resolution for two reasons: the first is that it uses a high quality lens with a very good MTF ratio, and the second is that it uses a Rect Warp to magnify symbols by 200% before decoding, which helps the algorithm to decode.

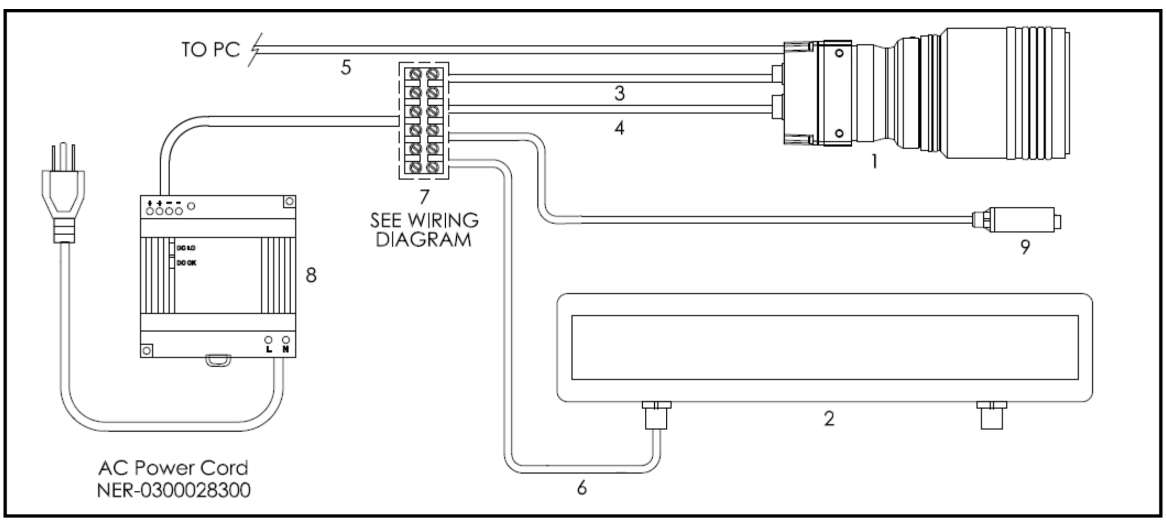
Required Hardware

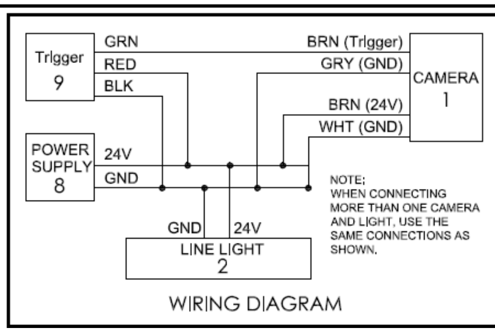
The PanelScan kit consists of a 6K Basler Racer camera connected to an Intel NIC card on a PC. PanelScan also includes a line scan light based on Microscan's HI-BRITE 300. PanelScan requires a custom trigger provided as part of the kit, and also requires a 24V power source split out to the camera, light, and trigger. The full PanelScan kit is shown in the table below. The PC and mounting must be provided by the user.

	Part Number	Description
	SLN-0001000	**PanelScan Multi-Array PCB Traceability System**
1	98-9000006-01	Camera, GigE, CMOS, Line Scan, 6K
	98-9000013-01	Lens, 60 mm, F1:2.8, AF Micro Nikkor
	98-9000012-01	Lens Adapter, Line Scan Camera, F-Mount
2	NER-011661710G	Assembly, LL-300, White
3	98-9000018-01	Cable, Line Scan Camera, Power
4	98-9000017-01	Cable, Line Scan Camera, I/O, 3M
5	98-000134-01	CAT 6 Ethernet Cable, Jack Screw to RJ45, High Flex, 5M
6	61-000186-01	Cable, 5-Pin M12 Socket, Flying Lead, 3M, Shielded
7	12-9000016-01	Connector, Terminal Block, 2 Row, 6 Pole
8	97-000006-01	Power Supply, DSP100, 24VDC 4.2A, DIN Mount
9	99-9000007-01	Trigger, Assembly, 5VDC Converted, Flying Lead, 1M
10	NER-030028300	AC Power Cord, U.S., 1.8M (6.0 ft.), Flying Leads (not shown)
11	98-9000019-01	Adapter, DIN Rail (not shown)
12	37-9000016-01	Media, Product, USB Drive, PanelScan (not shown)
13	GMV-VGL8-1DD1	GigE License, 32-Bit/64-Bit with IntelliFind, Supports up to 8 Cameras (not shown)

Hardware Configuration and Wiring

Trigger and power wiring must be completed as shown below. A single 24VDC power source can be used to power all elements of the system. A terminal block is provided with the system to aid in the wiring of all components.





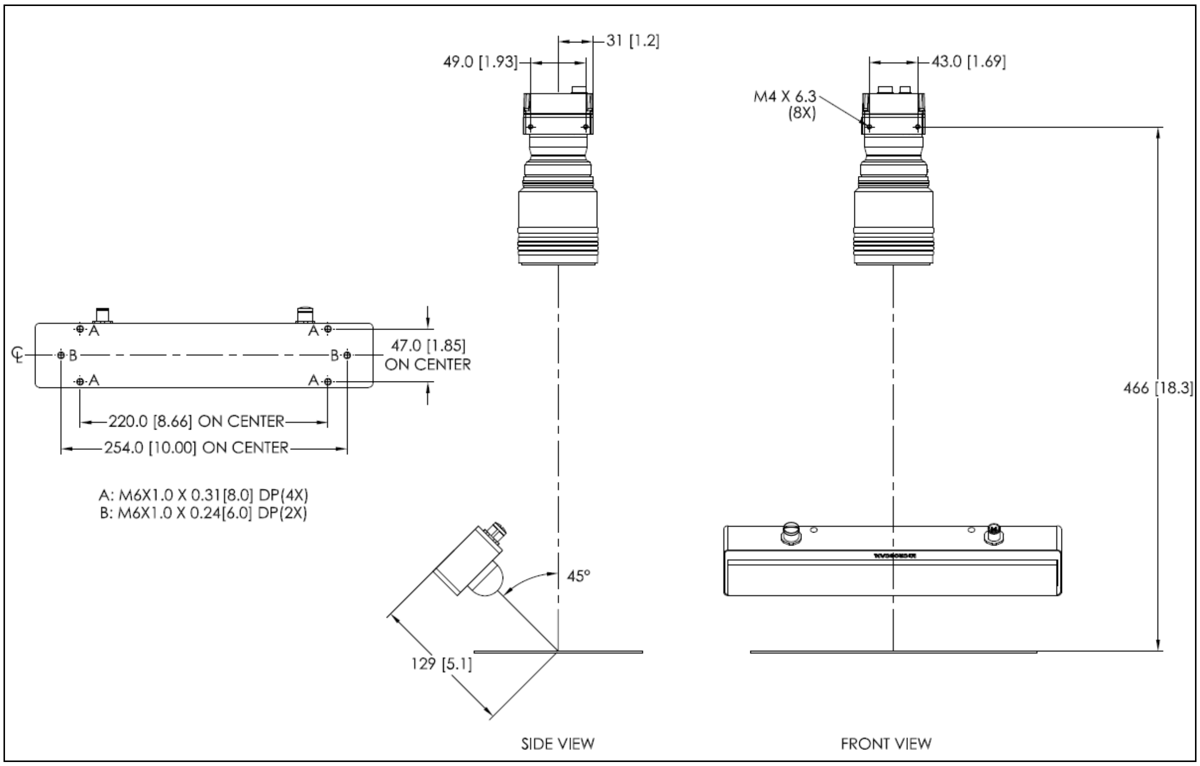
Camera and Light Mounting

The camera and light must be mounted as shown below for PanelScan Standard. The wide system uses two lights side by side and the cameras are separated by **200 mm (8”)**.

Refer to the drawings provided to make a mount for the cameras and for the lights. The drawings show the recommended standoffs from the board and the angle for both the light and the camera. The camera is pointed straight down. The light is mounted at **45 degrees angling in** so that the light line intersects the line scan camera’s viewing line at the board surface.

This type of mounting can generally be made from various kinds of structural tubing. Be sure to allow for side-to-side movement of the camera across the board so that it can be centered. Be sure to allow for angle adjustment of the light so that the center line of the light can be aligned to the center viewing line of the camera.

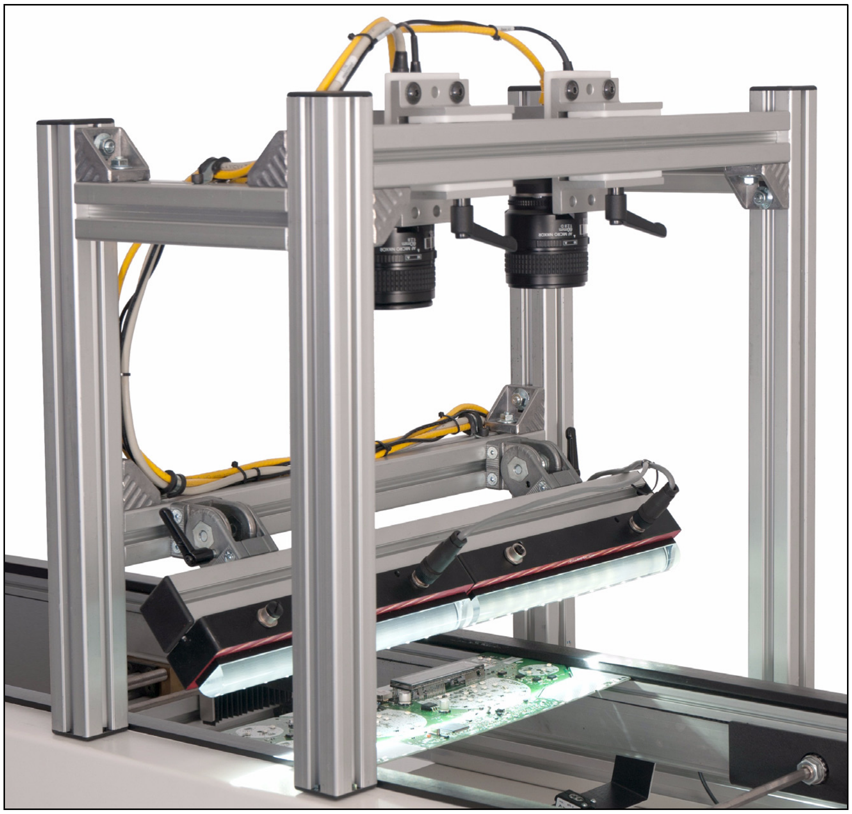
- Assemble the camera by attaching the lens F-Mount adapter using the screws provided.
- Screw on the 65 mm Nikon Nikkor lens provided.
- Mount the camera on the slide as described above.
- Mount the lights on the light mount as described above.

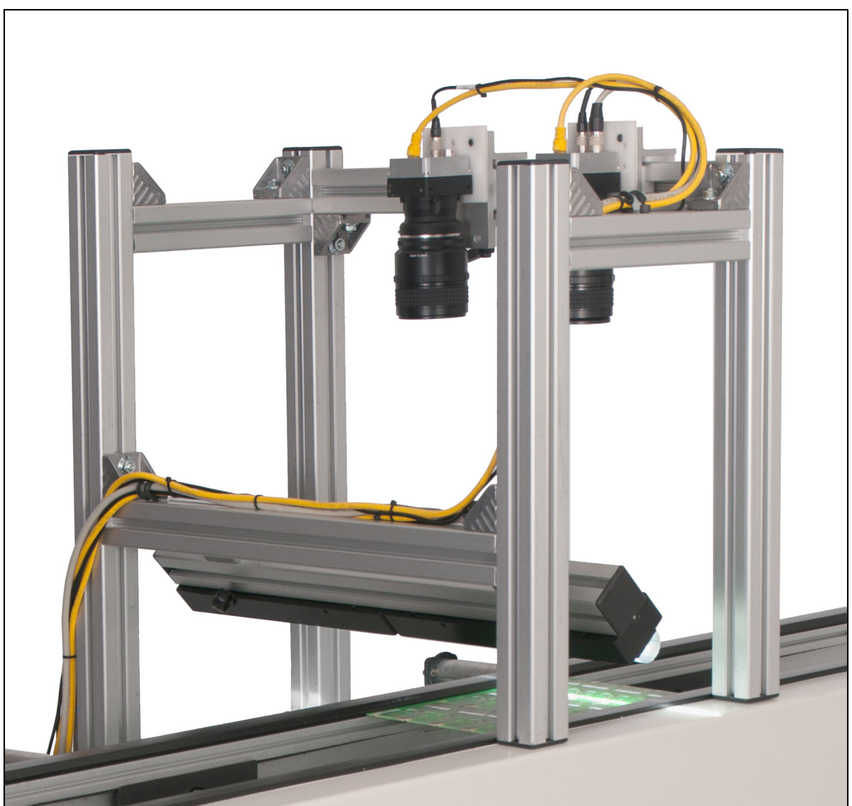


PanelScan Standard Configuration

Two views of typical “over the belt” mounting setups constructed with aluminum extrusions are show below.

The cameras should be mounted on slides so they can be adjusted across the belt, and the lights should be mounted on adjustable angle mounts so the light line can be aimed exactly at the row of pixels that the camera views.





Trigger Mounting

A trigger is provided that will trigger one or two cameras together when the board passes under them.

The trigger must be mounted so that it sees the leading edge of the board just before it passes under the camera. The trigger should be mounted approximately **100 mm** from the board.

The trigger can be mounted pointing up or down, but should be set so that it only triggers on the board edge.

The trigger must be angled slightly away from the line scan light, which can cause it to activate.

Place the trigger near the edge of the board to ensure that the trigger does not see any holes in the board.

PC Requirements

The user must supply the PC for PanelScan operation. The following are the basic PC specifications required by the system.

- Modern Multicore PC
- Windows 7 64-bit
- 6-8 MB of RAM
- Intel chipset-based NIC card

Required Software

PanelScan requires that the four software elements shown below be installed before operation. All the required software is supplied on the USB drive that is included with the PanelScan kit.

Pictures are taken using the Basler SDK:

- ***Pylon 4 Camera Software Suite for Windows 64-Bit Version 4.0.1***

Device Independent Visionscape is required for sharing images through a Memory Mapped File:

- ***Visionscape 6.0.5.1***

A separate .exe to grab images from the Basler camera is required:

- ***Basler Acquire 1.0***

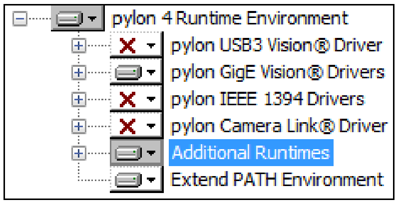
Finally, the PanelScan user interface must be installed:

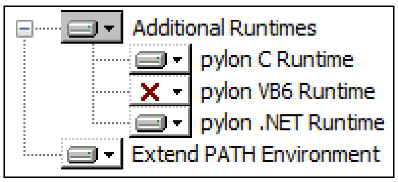
- ***PanelScan Standard 1.0***

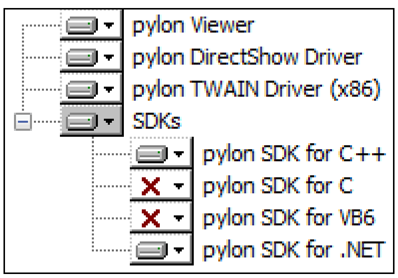
Basler Software Installation

The **Basler Pylon 4 Camera Software Suite for Windows 64-Bit Version 4.0.1** must be installed first. Double-click the **Basler pylon x64 4.0.1.3425.exe** file located in the **BaslerPylonInstall** folder on the USB drive to start the installation process.

The exact elements to install must be set before installation. The following images show the pieces that must be installed. To select or de-select features, click on that item or on the **+** sign to open groups of items. You must install the **Runtime Environment**, **Additional Runtimes**, the **Viewer** and **SDKs**.







PC and Camera IP Configuration

To be able to use the cameras, the PC and the camera must be set up on the same network. These are the suggested network settings for both:

Computer IP Address – For the PanelScan Standard product, the NIC card must be set to static IP **192.168.254.2 (255.255.255.0)**.

Camera IP Address – For the PanelScan Standard product, the 6K line scan camera must be set to static IP **192.168.254.3 (255.255.255.0)**.

The IP Address of the computer is set from the control panel.

The IP Address of the camera can be set from **Start > Basler > pylon4 Software Camera Suite > pylon IP Configurator (x64)**.

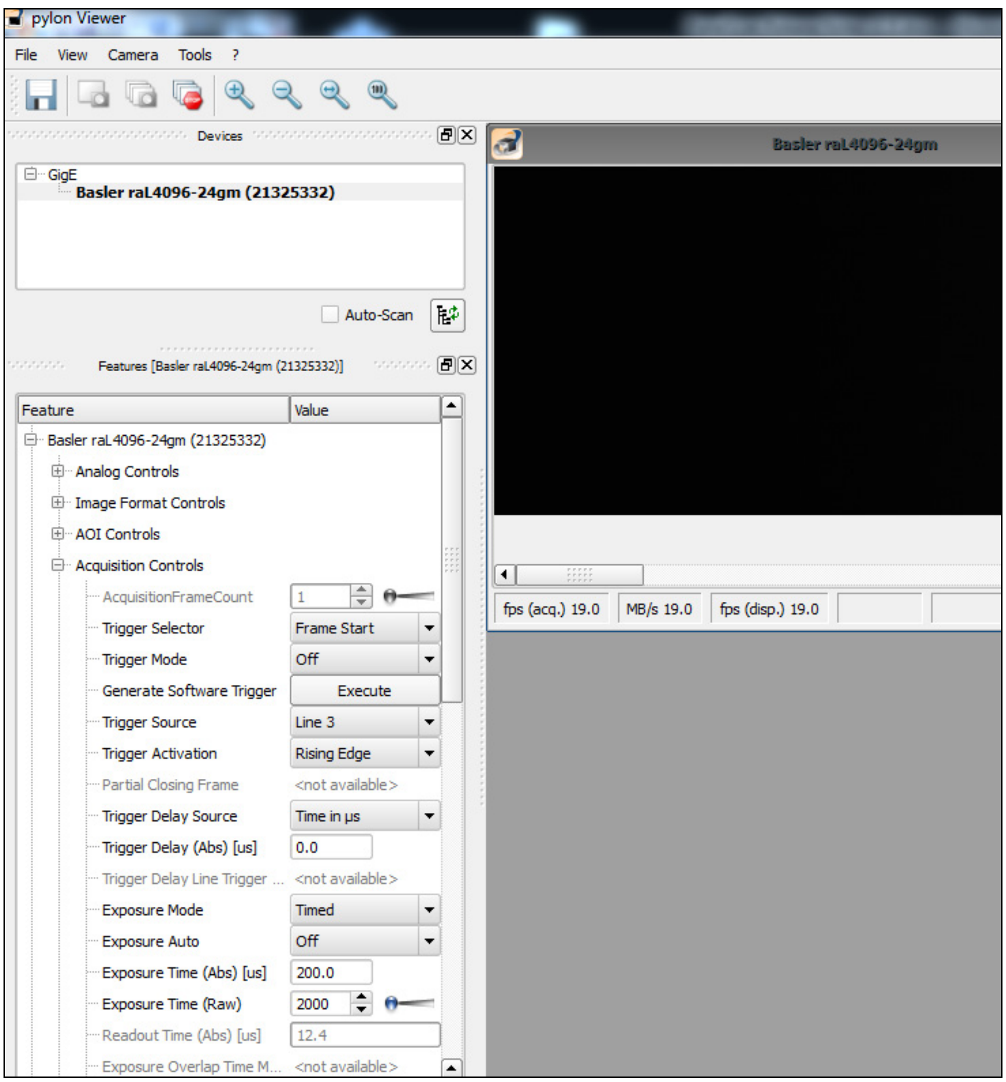
Camera Testing

Once the Basler Software is installed and the IP addresses are set, the camera can be tested. Go to **Start > Basler > pylon4 Software Camera Suite > pylon Viewer (x64)**.

The camera should automatically be detected by the software and show up in the camera list.

- Click on the camera.
- Click on the camera in the **Feature** section
- Navigate to **Acquisition Controls** and set the **Exposure Time (Abs)** to **170 µs** or set the **Exposure Time (Raw)** to **1700**.
- Set the camera lens's aperture to **8.0**.
- Click the **Continuous Shot** button.
- Zoom to fit so you can see entire 6K across of image buffer.

- Observe the image. Shine a light at the camera to verify that it is capturing images.



Visionscape Software Installation

- Double-click **Visionscape6.0.5.1.exe** to install Visionscape 6.0.5.1. It is located in the **Visionscape** folder on the USB drive.

  Important: During Visionscape installation, you will notice that Microscan's AutoVISION software is also being installed. This is by design, and the installation process is working normally. You can find Visionscape FrontRunner after installation by navigating to **Start > All Programs > Microscan Visionscape**.

- Verify that Visionscape has installed properly by checking for **Microscan Visionscape** in the Start menu.
- Copy the following two camera definition files from the **CamDefs** folder on the USB drive to **C:\Microscan\Vscape\Drivers\CamDefs**:
  - **Basler_raL6144-16gm_6144x12800_SoftSys.cam**
  - **Basler_raL6144-16gm_12288x12800_SoftSys.cam**
- Copy the **test.tif** image from the **Images** folder on the USB drive to **C:\Microscan\Vscape\Jobs**.

Visionscape Emulator Test Job with Virtual I/O Trigger

PanelScan uses the Device Independent Visionscape Emulator. PanelScan also uses a separate Basler application for taking pictures, which in turn triggers Visionscape via **Virtual I/O Trigger 1**. Use the following procedure to test the functionality of Visionscape, Softsys1, and Virtual I/O.

- Insert the Visionscape USB key. This is necessary to stay in **Run Mode** for more than 1 minute.
- Start **FrontRunner**.
- Create a job using the **Basler_raL6144-16gm_6144x12800_SoftSys.cam** camera definition file.
- Set the **Buffer Count** for the camera to **3** to avoid using excess memory. All other camera Buffer Counts can be set to **1**.
- Set the job to load images from a file using the **test.tif** image.
- Verify that **GainOffset**, **Rectwarp**, and **Symbology Tools** can be inserted. **Symbology** goes in **Rectwarp**.
- Set these tools up on one of the symbols in **test.tif**. The Symbology Tool should be in Rectwarp. The Rectwarp should be set to magnify to **200%**.
- Verify that the job runs in setup.
- Verify that job runs in **Run Mode** and can be triggered with a **Virtual Trigger**.
- Close the program.
- Close the **AVP Backplane**.

Basler Acquire Software Installation and Testing

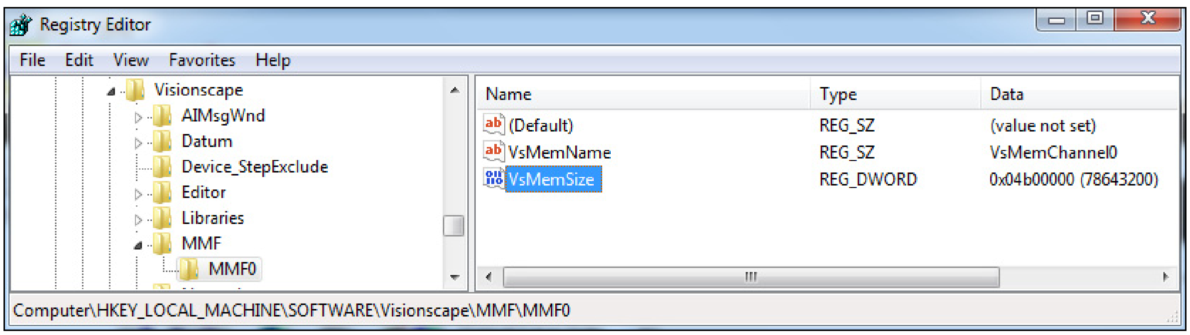
Basler Acquire captures images and puts them in the shared memory file for Visionscape to read. This is a .NET program so it must be put on the system.

- Create a directory called **C:\PanelScan**.
- Create a subdirectory called **C:\PanelScan\BaslerApp**.
- Copy the **Debug** folder from the **BaslerAcquireInstall** directory to the **C:\PanelScan\BaslerApp** subdirectory.
- Enter your newly-created **C:\PanelScan\BaslerApp\Debug** subdirectory and double-click **BaslerAcquire.exe** to install Basler Acquire. The program should start automatically, but the window may be minimized. Maximize the Basler Acquire window to verify that the software has been installed.
- Close the BaslerAcquire program.

Registry Setup for Device Independent Visionscape

PanelScan uses Device Independent Visionscape when a separate program is used to take a picture and put it in a Memory Mapped File for Visionscape to access. This requires that a Memory Mapped File object be placed in the Registry. To set up the MMF, follow this procedure:

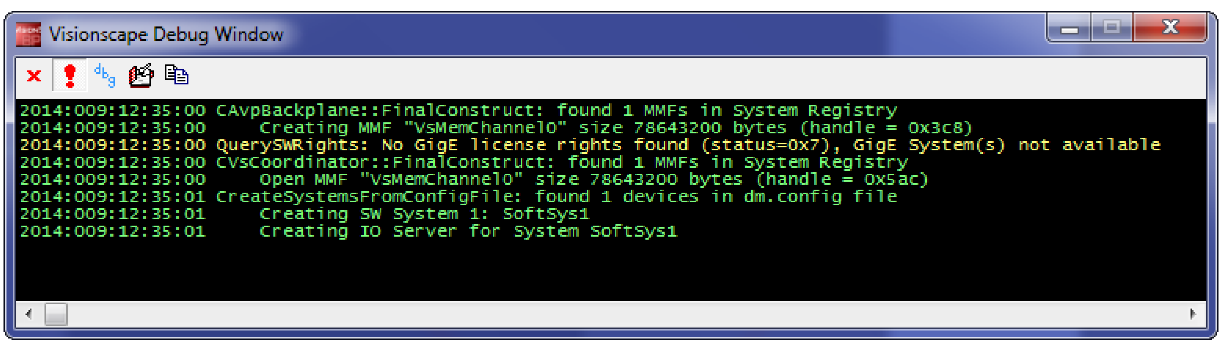
- Set keys in the registry.
- Open the registry by navigating to **Start > Run**.
- Type **Regedit**.
- Navigate to **HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Visionscape**.
- Create a **New Key** called **MMF**.
- Inside of MMF, create a **New Key** called **MMF0**.
- Inside of MMF0, create a **New String Value** called **VsMemName**.
- Modify the value of this string and insert **VsMemChannel0**.
- Inside of MMF0, create a **New DWord** (32-bit value) called **VsMemSize**.
- Modify the value of this DWord to **78,643,200** decimal (**0x04b00000** binary). The registry should resemble the image below.
- Once finished verifying the settings, close the registry.



Operation of the Memory Mapped File (MMF)

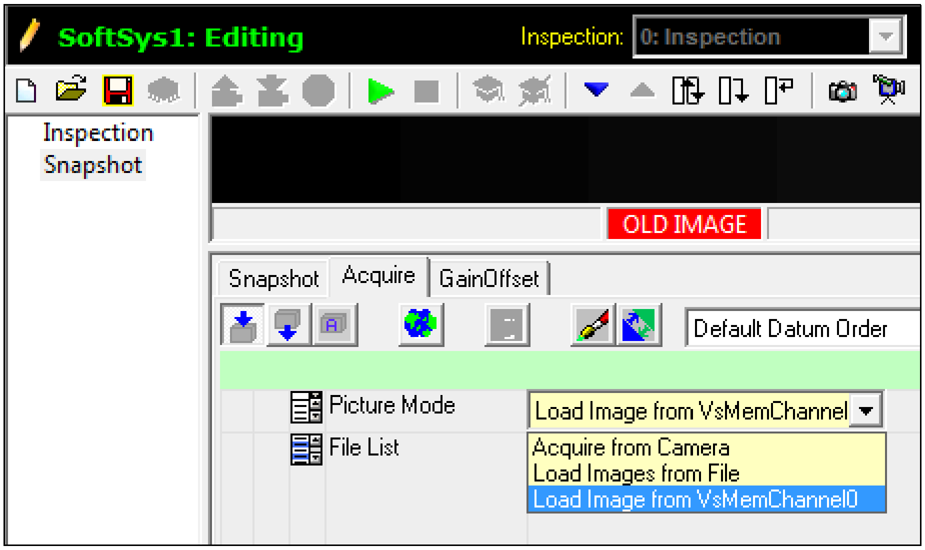
The MMF or Memory Mapped File will now be created by Visionscape whenever the AVP Backplane runs. The AVP Backplane will run when you start FrontRunner or PanelScan.

The creation of the MMF will be displayed in the Visionscape Debug Window. See the 2nd and 5th lines below.



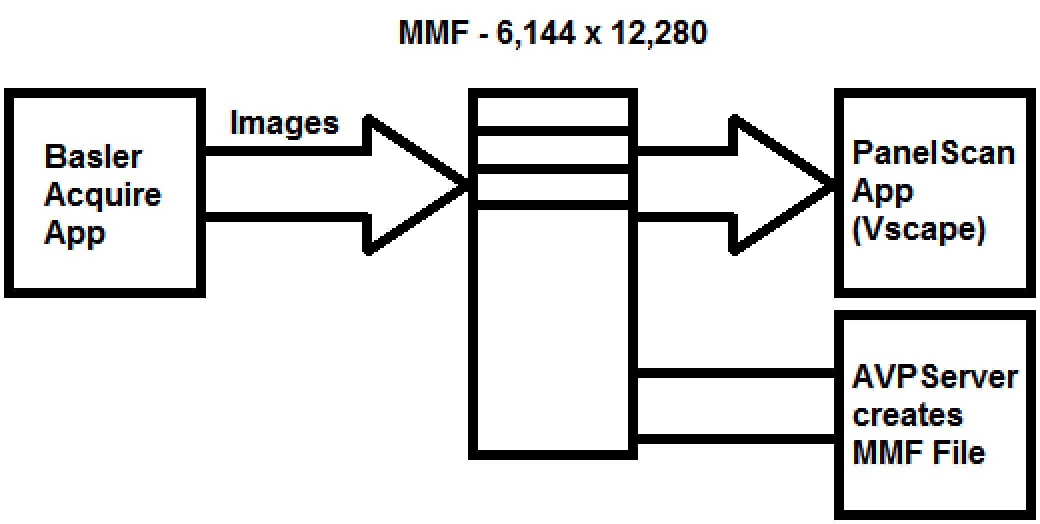
From this point on, whenever a new job is created in Visionscape, there will be a new means for **Acquire** and **Image**. It is called **Load Image from VsMemChannel0** as shown below.

Note that you can create any number of Memory Mapped File channels in the registry so that you can have one per camera.



The diagram below shows how the components work together when the system is running.

- **PanelScan** starts and opens the **AVP Backplane**.
- The AVP Backplane creates the **Memory Mapped File**.
- When PanelScan launches, it also starts the **Basler Acquire** application.
- During PanelScan operation:
  - Basler Acquire takes pictures when the camera receives a hardware trigger.
  - Basler Acquire puts the acquired image into the MMF.
  - Basler Acquire then triggers the PanelScan app with Virtual I/O 1 to communicate that the new picture is ready.
  - PanelScan reads in the image and processes it.
  - PanelScan outputs the read results to file.



PanelScan Software Installation

The final step is to install PanelScan software.

- Double-click the **Setup.exe** file in the **PanelScanInstall** directory on the USB drive to run the PanelScan installer.
- Allow PanelScan to install the **Visual Basic Power Packs** if necessary.

Once the full PanelScan installation is complete, the software will start automatically.

- Close PanelScan by clicking the red **X**.
- Verify that the PanelScan icon is on the desktop.

Focusing the Camera

PanelScan is now ready for setup and operation. The first step is to get a good image by focusing the camera and aligning the camera and light so that they are both perpendicular to the axis of motion of the board. This can be accomplished by performing the following steps.

- Put a wide board on the conveyor beneath the camera. The board should have white bar codes all the way across the board. These are ideal features for focusing the camera.
- Run the **Basler Pylon Viewer (x64)** software from the Start menu.
- Set the aperture of the lens to **8.0**.
- Set the camera **Exposure Time (Abs)** to **170 μs**, or **Exposure Time (Raw)** to **1700**. This can be found in the **Acquisition Controls** section.
- Enable live video by selecting the camera and clicking on the **Continuous Shot** button. This will show a **6,144 x 256** pixel image. Zoom out to see whole image.
- Change the tilt of the light so that the image is as bright as possible. Lock down the light.
- Move the board so that the bar codes can be seen.
- Change the focus of the lens so that the black and white bars of the bar codes are as sharp as possible. Zoom in to get a better view.
- Move the scroll bars so you can see the far right and far left of the image. Be sure that both sides are in focus.
- If both sides of the picture are not in focus, verify that the camera face plane and the board plane are perfectly parallel.
- Adjust again.

Aligning the Light and Camera

The light line, the image line and the board edge must be exactly parallel to each other. The edge of the board should be seen all at the same time, and the light should be perfectly even across the board. You can verify this by performing the following steps.

- Put a piece of white paper over the board aligned with the leading edge.
- Go into live video and zoom all the way out.
- Move the board and paper under the camera until it can just be seen.
- The whole width of the image should show the whole width of the white paper simultaneously. If it does not, adjust the camera moving the paper in and out until this leading edge is seen all at once.
- Now do the same thing for the light.
- Place the paper completely under the camera. Adjust the tilt of the light until the image is at its brightest.
- If one side of the image is less bright than the other, adjust the light until the paper is evenly illuminated across the board.

Fine Focus

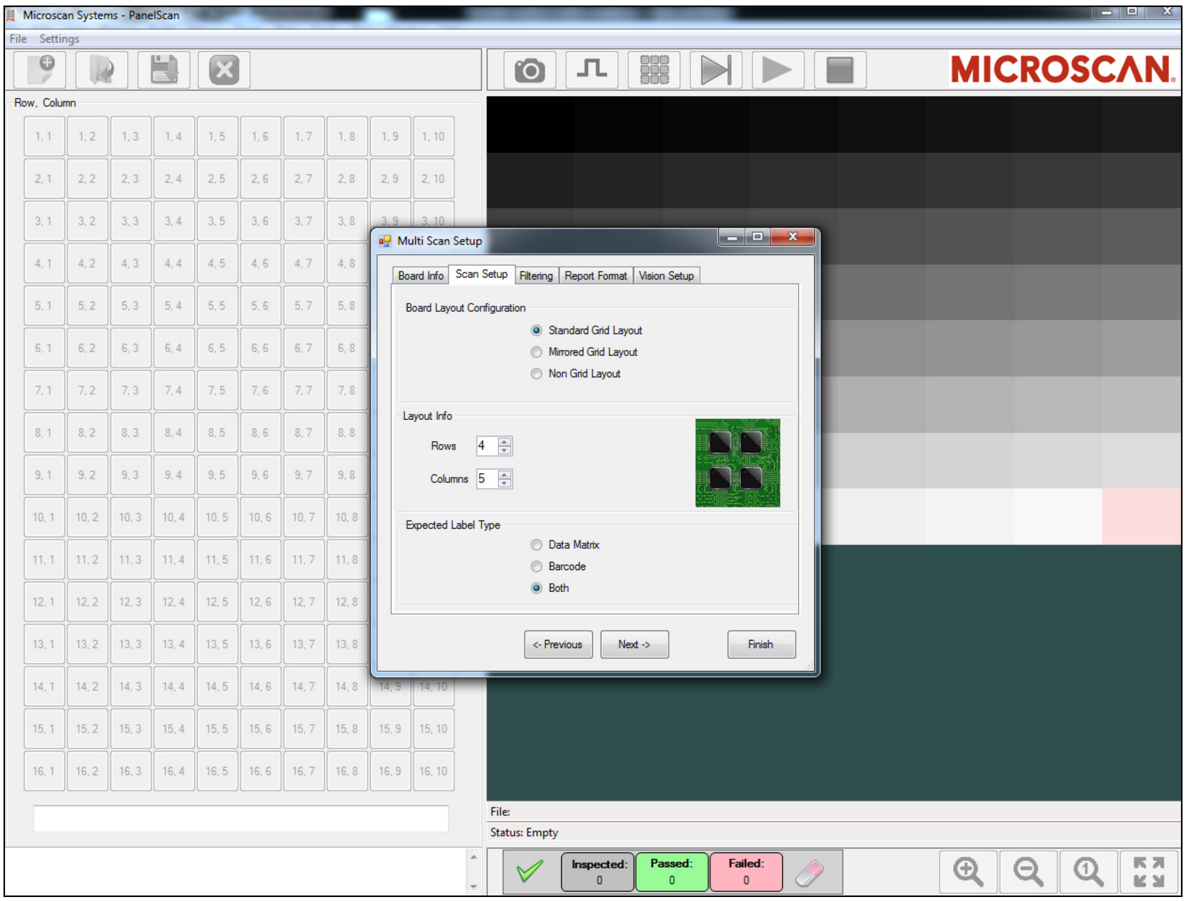
In the following steps you will begin taking moving pictures with PanelScan. You will begin to see full X, Y images of the board. As the board moves under the camera you will be able to perform a fine focus to achieve the best possible images of the bar codes or Data Matrix symbols. The symbols should look like the ones shown at right. Zoom in to see real images. Cells as small as 3 pixels and narrow bars as narrow as 2 pixels should be readily distinguishable.

Getting Started – Create a Basic PanelScan Job

Once system imaging is configured, you can begin setup and run panels of boards. Most panels are laid out with a certain number of rows and columns of boards. PanelScan makes it easy to train the system on these panels. In this basic job, you will be training a panel laid out in a regular grid of **4 rows** and **5 columns** of boards. The symbols are a mix of bar code and Data Matrix.

To train a new panel:

- Start PanelScan.
- Click the **New File** button.
- Step through the dialogs with the **Next** button until you reach the **Scan Setup** tab.
- On this tab, choose **Standard Grid Layout**, **4 Rows**, **5 Columns** and **Both** for **Expected Label Type**.



- Click **Finish**.

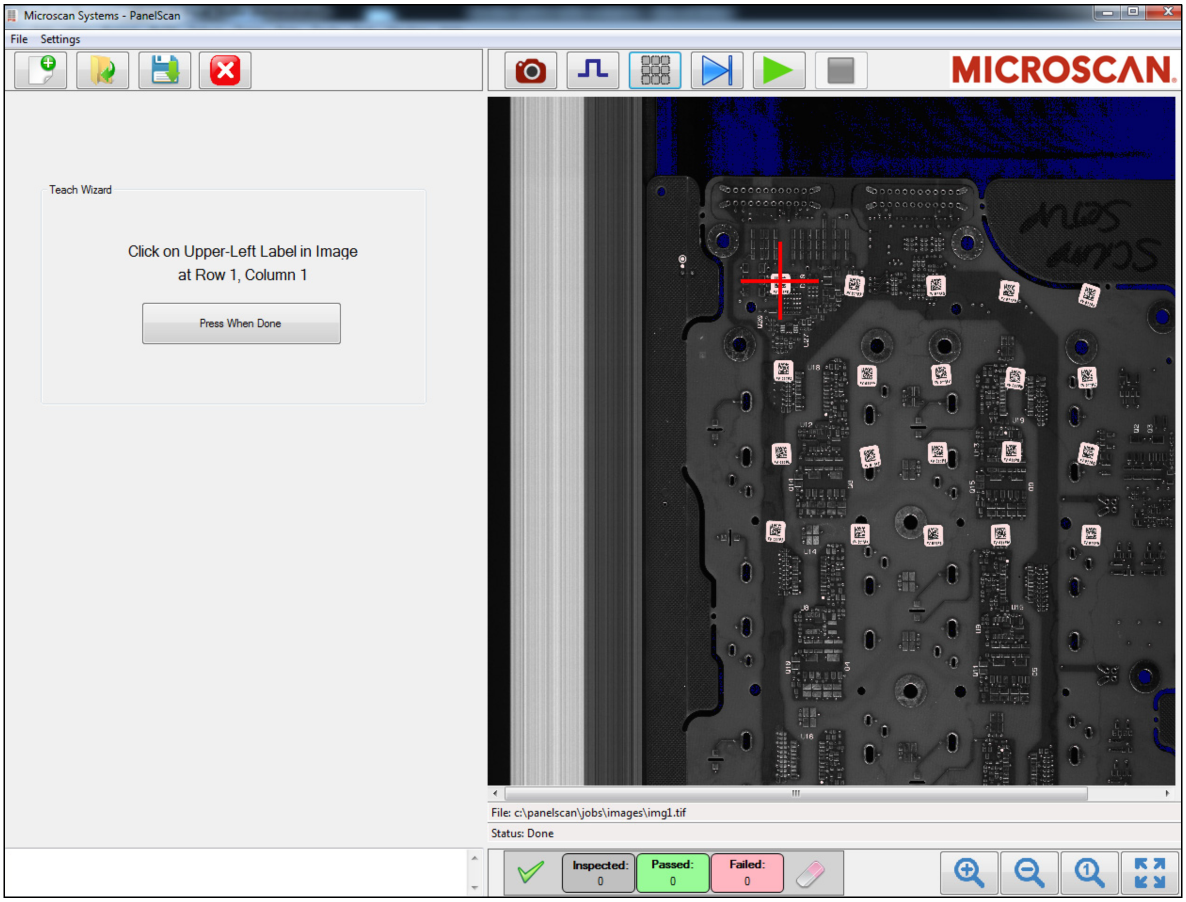
  The system now creates a new vision job containing all the required vision tools.

  The system then helps you place these tools in the right locations.
- Click the **Take Picture** button. You will see that the camera is ready and waiting for a trigger.
- Place a board on the conveyor and run it under the camera. It should trigger the camera and then an image should automatically appear on the screen.
- Teach the system the layout of the boards on the panel by clicking the **Teach Layout** button to the right of the **Trigger** button.

  The screen will automatically zoom in to the upper left corner and will prompt you to train the upper-leftmost symbol in the image at **Row 1, Column 1**.

  You can scroll to this exact label and zoom in by clicking and rolling the mouse wheel, or by using the zoom buttons.
- When you reach the upper-leftmost symbol, left-click in the center of the symbol. A red **+** will appear over the symbol. You can click multiple times to position the cross in the exact center of the symbol.

- Click the **Press When Done** button when the **+** is centered.

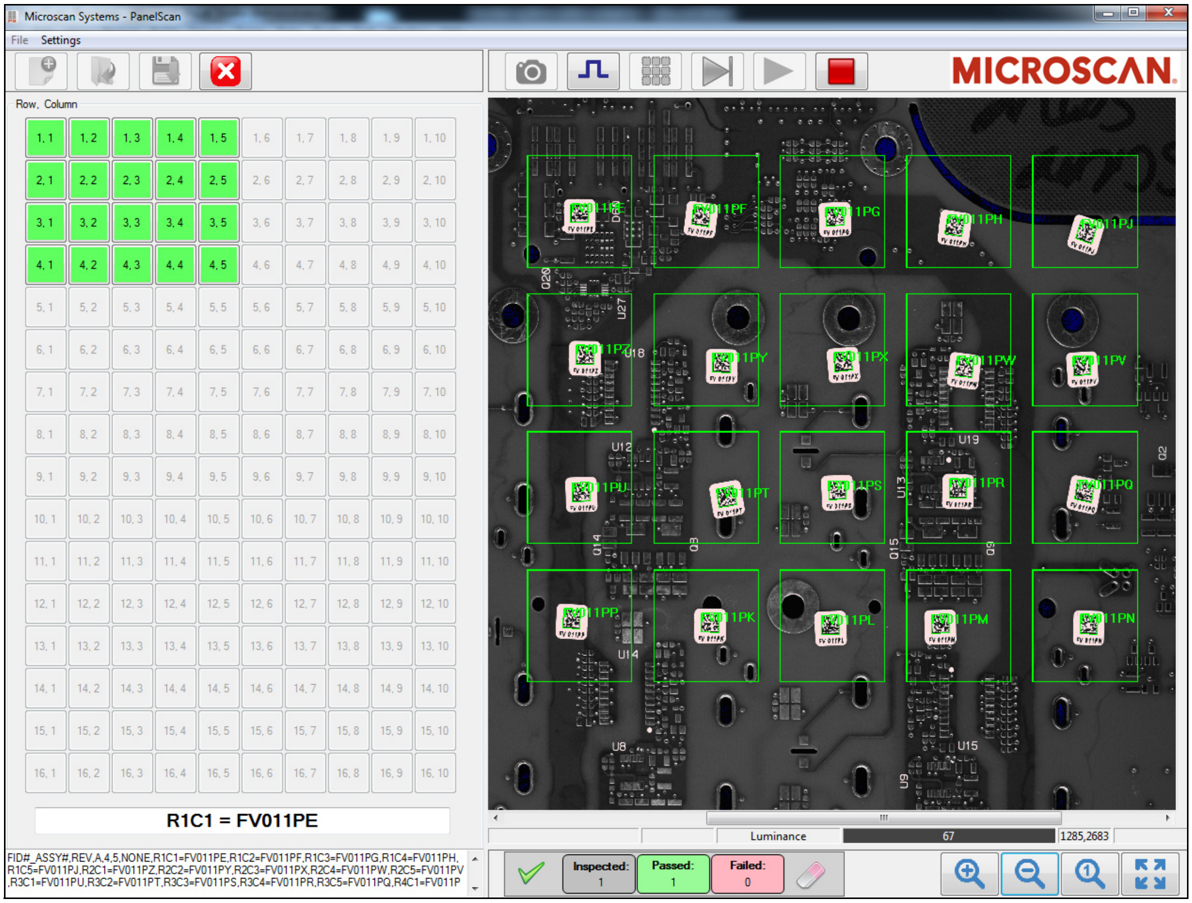


- The system then prompts you to click on the center of the lower-rightmost symbol. Zoom and scroll until it is in view, and then click on it.
- Click the **Press When Done** button.

  If you were training a mirrored grid, you will be prompted to click the first mirrored symbol. If you were training a non-standard grid, you will be prompted to click each symbol in the order in which you want them to be reported until you have trained the entire set.

  When the training process is done, the system will automatically lay out all the inspection regions again, and then it will run a test on the current image. Click the Trigger button to help the system complete the test.
- If you are not satisfied with the box layout, you can re-teach the system. If you are satisfied, enter Run Mode by clicking **Go To Run Mode**.

Once in Run Mode, operation is easy. Simply feed boards into the conveyor. The camera will trigger and capture, process the panel, and write the read data to disk.



The resulting output string is shown in the lower left part of the user interface in the format in which it will be saved.

The grid array is shown on the left in gray, green, or red. **Gray** means "untrained". **Green** means that the symbol was successfully decoded. **Red** means that the symbol was not successfully decoded.

You can click on any of these buttons and the system will zoom in to show that symbol. The decoded data is displayed in large bold letters in the text box below the buttons.

A pass / fail counter is visible at the bottom of the Run screen. This counter can be reset by clicking the **Erase** button.

The vision job can be saved to disk and opened again to run at a later time.

Because the layout of search windows is based on conveyor speed, it may be necessary to repeat the Teach process to ensure that regions of interest are centered on the bar code or Data Matrix areas when you open the job.

Fine Focus

At this point you can run boards back and forth beneath the camera and finely adjust the camera's focus.

PanelScan Details

Board Info Dialog

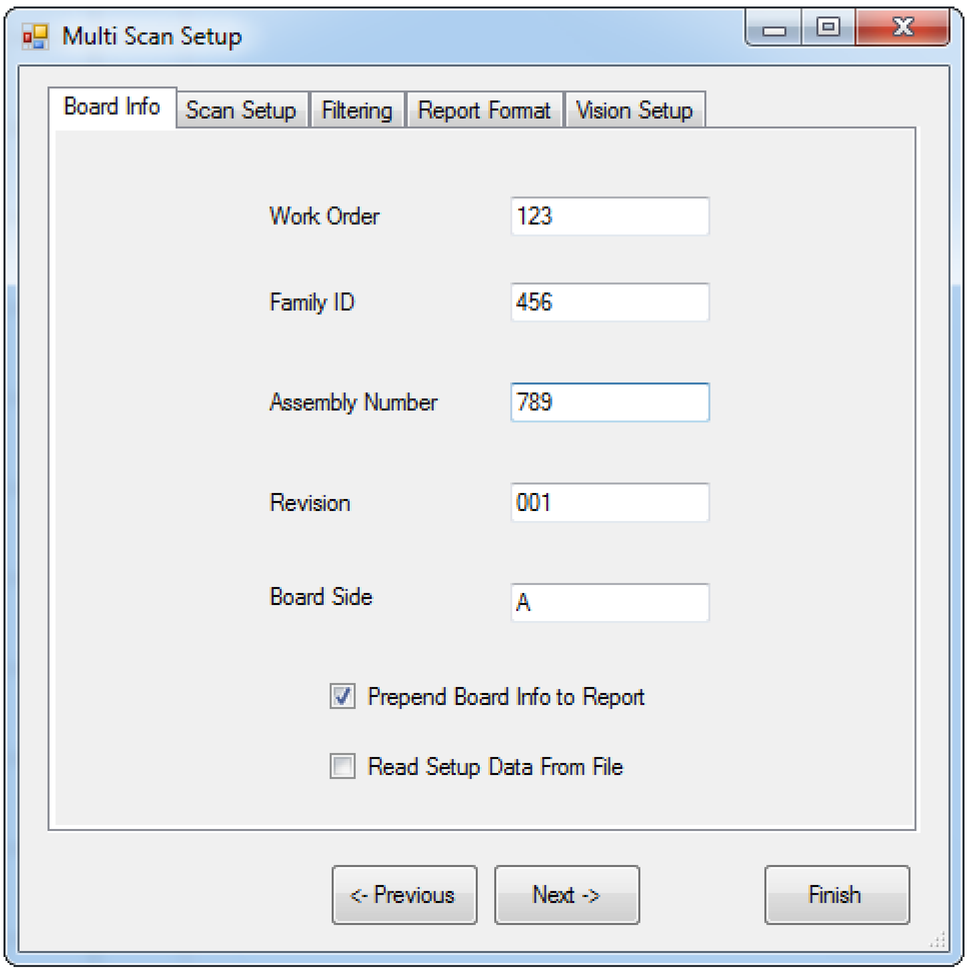
When setting up a new job, there are five tabs in the **Multi Scan Setup** dialog where you can enter data.

The first tab is **Board Info**. This is a configurable dialog and is meant to allow input of information about the **Current Panel** and **Work Order** for processing that panel.

There is an associated **setup.ini** in the **C:\PanelScan\Jobs** folder that contains the five strings used as the labels for these fields. A user can set these labels up to match whatever information the application needs to have associated with the panels it is processing. The default fields are shown below.

During panel training time, you can fill in the entries to match the board run. This data is then used in two different ways: first, the data fields **1-4** are used to create the file name for logging data from that run of panels.

Second, there is a check box which, when checked, will prepend the data from fields **2-5** to each panel result in the log file. In addition to these fields, the number of rows and columns of boards on the panel is placed in each string result, as shown in the example at the bottom of the page.



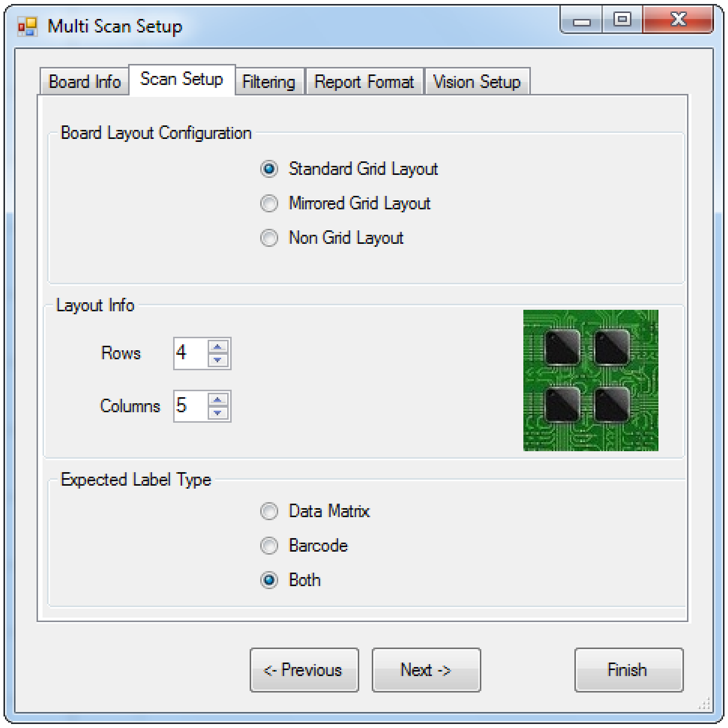
Log file example: Given the above settings, the file **123~456_789_001.txt** is automatically created in the **C:\PanelScan\Logs** folder. Below is an output result for a panel from that log file:

```
456_789,001,A,4,5,NONE,R1C1=FV011PE,R1C2=FV011PF,R1C3=FV011PG,R1C4=FV011PH,R
1C5=FV011PJ,R2C1=FV011PZ,R2C2=NoRead,R2C3=FV011PX,R2C4=FV011PW,R2C5=FV011PV,
R3C1=FV011PU,R3C2=FV011PT,R3C3=FV011PS,R3C4=FV011PR,R3C5=FV011PQ,R4C1=FV011P
P,R4C2=FV011PK,R4C3=FV011PL,R4C4=NoRead,R4C5=FV011PN
```

Scan Setup

Scan Setup is the second tab. It allows you to enter the type of grid on the panel, the number of rows and columns, and which types of symbols are on the panel.

These entries are described below.

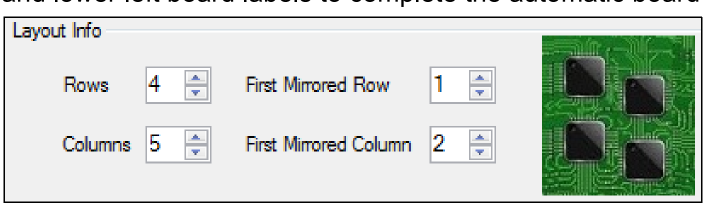


Standard Grid Layout – This is used when there is a regular X, Y pattern of boards as in the previous example. Here you insert the number of rows and number of columns of boards on the panel.

Rows – This can be set for as many as **10**.

Columns – This can be set for as many as **16**.

Mirrored Grid Layout – To achieve a tighter fit of boards on a panel, every other board may be flipped180 degrees, or mirrored. If this is the case, you must enter the number of rows and columns of boards, but you must also enter which row and column has the first mirrored board. For instance, in the example below there are **4 rows** and **5 columns**, and the board at **Row 1**, **Column 2** is the first mirrored board. In this setup you will be prompted to click this first mirrored board label as well as the upper right and lower left board labels to complete the automatic board layout.



Rows – This can be set for as many as **10**.

Columns – This can be set for as many as **16**.

First Mirrored Row – This is either **1** or **2**.

First Mirrored Column – This is either **1** or **2**.

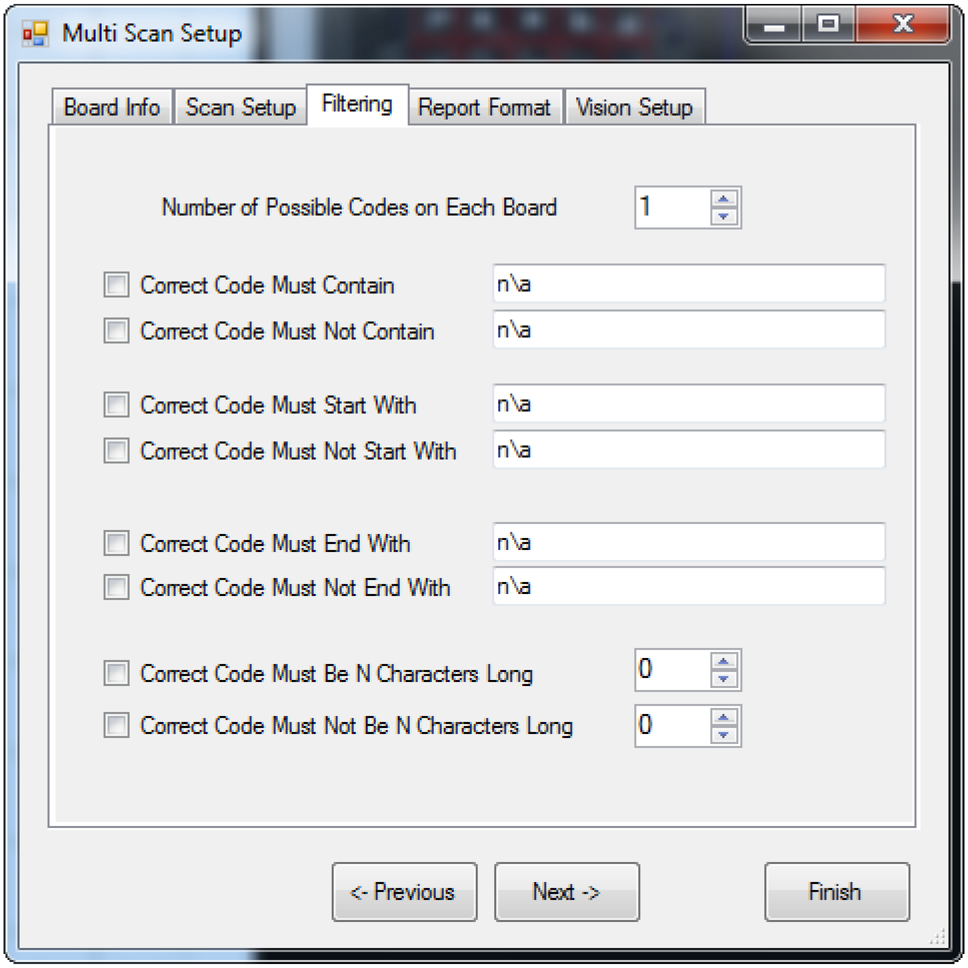
Non-Grid Layout – This is useful for when boards are not in a row, column configuration. This option allows you to point to each board individually during the teach process. In this field, simply enter the number of boards on the panel.

Number of Boards on Panel – This is the number of boards on a non-grid panel from **1** to **160**.

Expected Label Type – Selecting only Data Matrix or bar code can help speed up the system and make it more robust. Select **Both** when both types of symbols are present.

Filtering

Sometimes there are multiple symbols on the board in the read area, but only one symbol is used for tracking. The **Filtering** dialog allows you to configure the system to report only the one correct symbol in the output string.



Number of Possible Codes on Each Board – This tells the system that there could be multiple symbols on each board. This should be set to the maximum number of symbols so the system is sure to read all of them.

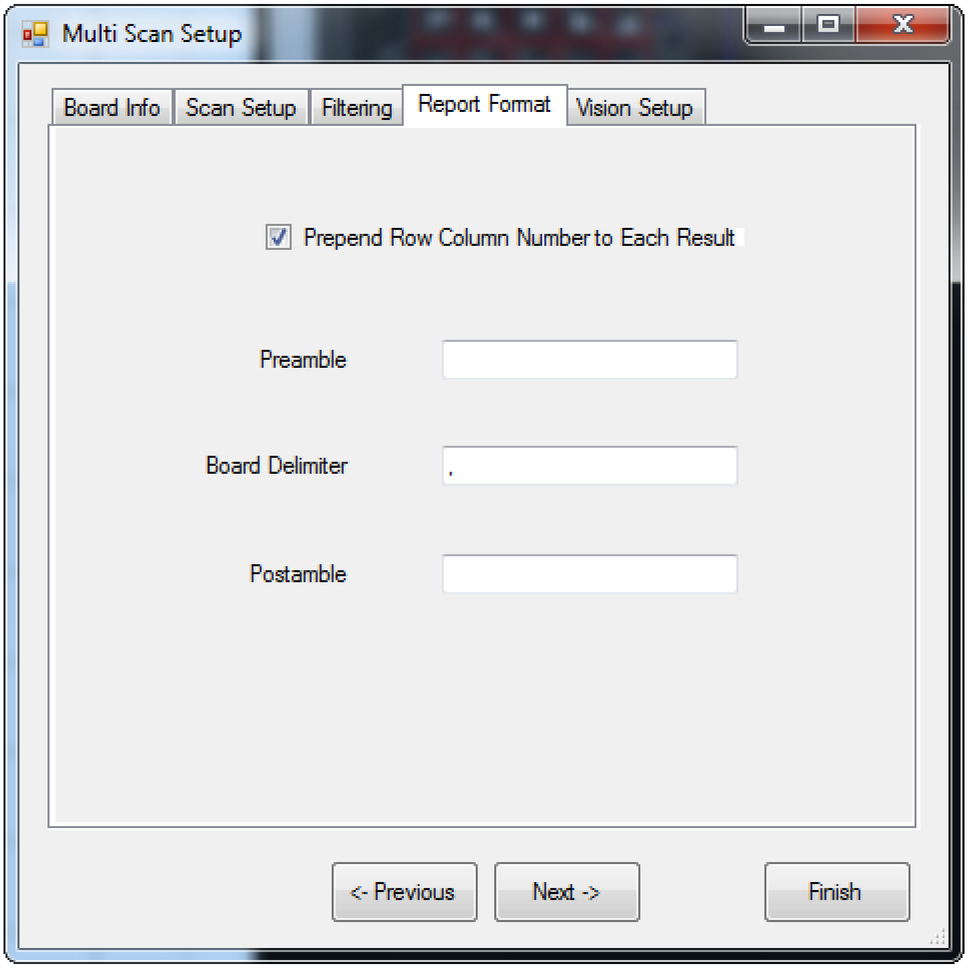
Filters – The eight check boxes represent the filters. You can apply multiple filters simultaneously. The filter must be checked and then configured as needed.

Filter example: If you know the correct symbol data will always start with **FIS** and will always be **10 characters long**, you can check the boxes **Correct Code Must Start With** and **Correct Code Must Be N Characters Long**, and then configure them accordingly.

Report Format

When PanelScan runs, it reads all the bar codes or Data Matrix symbols on a board and concatenates their data into a single string. This string is saved in a log file in the **C:\PanelScan\Logs** directory. The name of this file is generated from the data in the **Board Info** tab.

The **Report Format** dialog allows you to set up the format for each panel's data string.



As mentioned earlier, the **Board Info** dialog contains strings that are prepended to the output string for each panel. This dialog allows you to configure the output format further.

Prepend Row Column Number to Each Result – By default, the Row and Column number is prepended to each board result on the panel. For example, **R1C1=FV011PE,R1C2=NoRead**. This can be disabled so that the Row and Column indicators are not present in the report string.

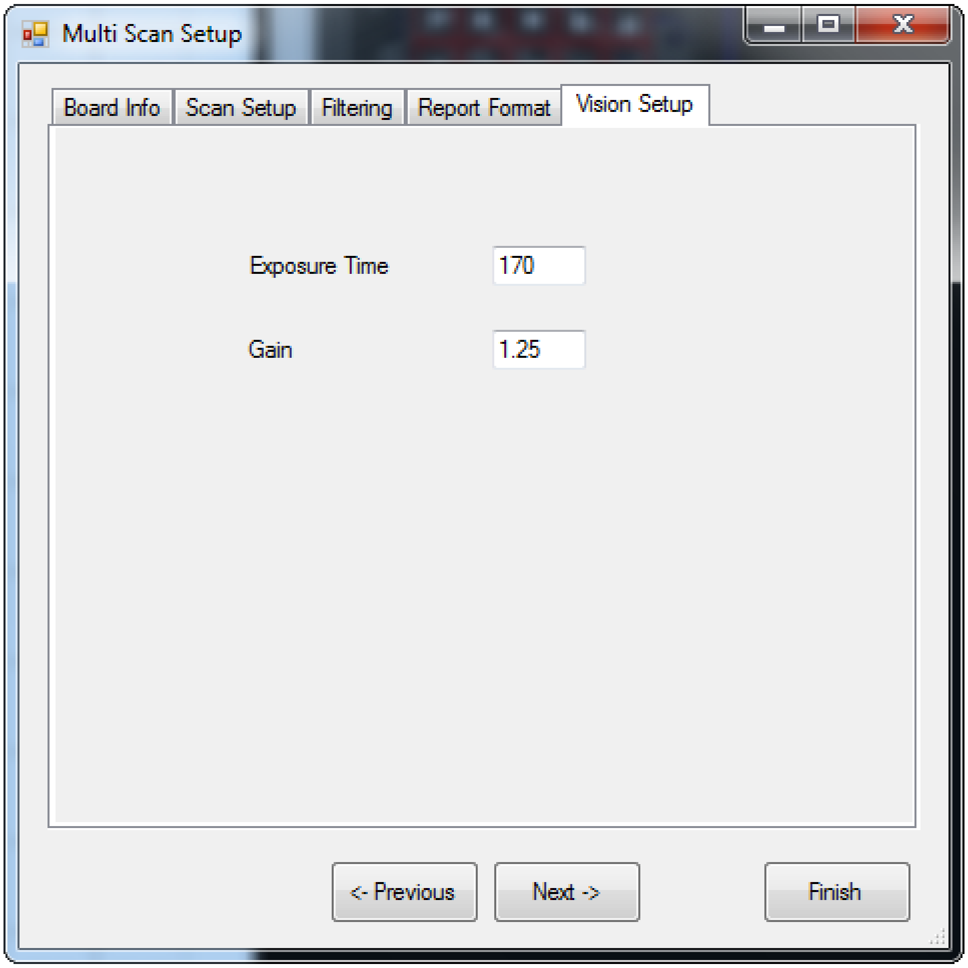
Preamble – When enabled, the Preamble string is prepended to each data string. This is blank by default.

Board Delimiter – This is the board separator character. It is set to a comma by default.

Postamble – When enabled, the Postamble string is appended to each data string. This is blank by default.

Vision Setup

This tab contains settings for the camera's exposure time and gain.



Exposure Time – By default, the camera is configured to expose each line of the image for **170 µs**. This matches the speed of most conveyors and results in an image that has the same aspect ratio in X and Y. If the conveyor must run at a certain speed, this value must be changed to set the image to the proper aspect ratio. Significantly increasing or decreasing this value will significantly increase or decrease the brightness of the image. If the image becomes unusable, Gain can be used to compensate.

Gain – This value is set to **1.25** by default. The range of Gain values are **0** to **2.5**. Increasing Gain will make the image brighter. Decreasing Gain will make the image darker.

