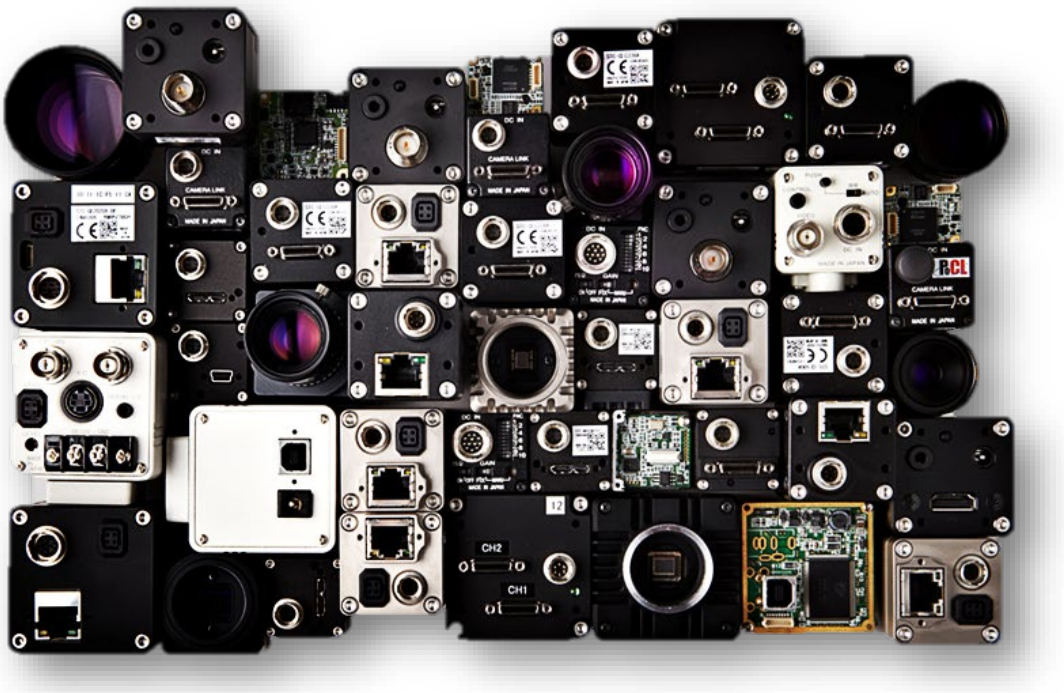
Sentech M Series GigE AutoVISION Setup Guide

Proof of Concept

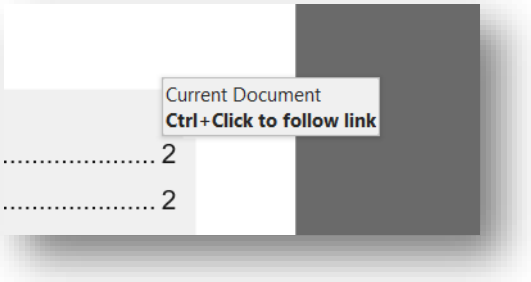
Version 1.0 January, 2021



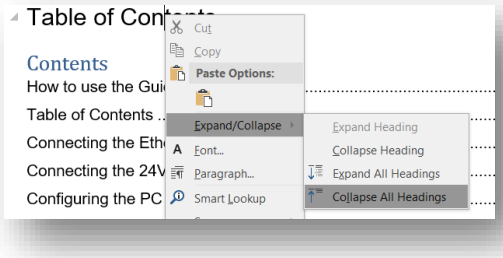
Omron Automation Americas
100 Consilium Place, Suite 802, Toronto, Ontario, M1H 3E3
2895 Greenspoint Parkway, Suite 200, Hoffman Estates, IL 60169

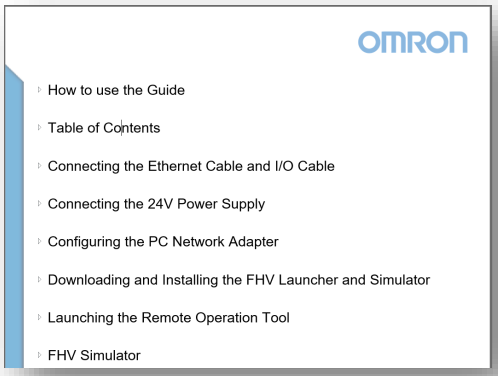
How to use the Guide

1. The Table of Contents is hyperlinked for ease of use. Hold the control button and click the page number or title of the desired section to be read.



2. Each section of this guide can be expanded or collapsed. Right click on the title of a section and select collapse all headings. The contents of the guide can then be individually expanded or collapsed as needed. Additionally, by hovering the mouse over the left hand side of a section title, a triangular icon will appear that can be clicked to expand or collapse that particular section.





3. Double click on the icon to open embedded documents.

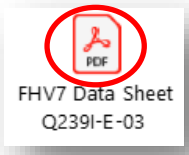


Table of Contents

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Guide Objective

This guide covers all of the steps required to connect an Omron Sentech M Series GigE camera to AutoVISION on a PC.

Omron OCR AutoVISION/Visionscape software, which is typically used to program OCR Smart Cameras, can also be used with industrial GigE and USB 3.0 cameras to create and deploy extremely fast and powerful PC based machine vision solutions. In the case of Smart Cameras, image acquisition, image processing and IO are all done on the camera. In the case of PC vision, GigE or USB 3.0 cameras are used as the image input devices, and the PC is used for image processing and IO.

The user has two choices of programming and deployment software:

- AutoVISION, the simplest UI, allows the user to create a single camera PC based vision system.
- Visionscape FrontRunner, the full machine vision professional software allows the user to connect up to eight cameras to the PC Based Vision system.

Note: It is important for deployment to treat the PC as the vision system, rather than as an IT controlled device. The PC should not be loaded down with firewall/ virus protection etc. that will impede its performance.

GigE Vision Camera Compatibility

The following is the current list of supported Omron Sentech M Series GigE Vision cameras models. All cameras are C-Mount. All cameras are PoE (Power over Ethernet). GigE Vision cameras support data transfer rates up to 125 MB/s. They support cable lengths of up to 100 meters.

Model No.	Monochrome/ Color	Resolution	Frame Rate	Pixels (H x V)	Sensor Size	Cell Size (H x V, µm)	Sensor	Shutter Type
STC-MBS43POE	Monochrome	0.4M	282fps	728 x 544	1/2.9"	6.9 x 6.9	IMX287	Global
STC-MCS43POE	Color							
STC-MBS52POE	Monochrome	0.5M	166.5fps	816 x 624	1/1.7”	9 x9	IMX433	Global
STC-MCS52POE	Color							
STC-MBE132POE	Monochrome	1.3M	61fps	1280 x 1024	1/1.8”	5.3 x 5.3	EV76C560	Global
STC-MCE132POE	Color							
STC-MBS163POE	Monochrome	1.6M	70.7fps	1456 x 1088	1/2.9"	3.45 x 3.45	IMX273	Global
STC-MCS163POE	Color							
STC-MBS202POE	Monochrome	2M	54.6fps	1624 x 1240	1/1.7"	4.5 x 4.5	IMX430	Global
STC-MCS202POE	Color							
STC-MBS231POE	Monochrome	2.3M	41.6fps	1920 x 1200	1/1.2”	5.86 x 5.86	IMX249	Global
STC-MCS231POE	Color							
STC-MBS312POE	Monochrome	3.2M	34.9fps	2048 x 1536	1/1.8"	3.45 x 3.45	IMX265	Global
STC-MCS312POE	Color							
STC-MBS500POE	Monochrome	5 M	21.9fps	2448 x 2048	2/3"	3.45 x 3.45	IMX264	Global
STC-MCS500POE	Color							
STC-MBA503POE	Monochrome	5M	14fps	2592 x 1944	1/2.5”	2.2 x 2.2	MT9P031	Rolling
STC-MCA503POE	Color							
STC-MBS642POE	Monochrome	6.4M	17.4fps	3072 x 2048	1/1.8”	2.4 x 2.4	IMX178	Rolling
STC-MCS642POE	Coor							
STC-MBS881POE	Monochrome	8.9M	12.4fps	4096 x 2160	1”	3.45 x 3.45	IMX267	Global
STC-MCS881POE	Color							
STC-MBS122BPOE	Monochrome	12M	8.9fps	4096 x 3000	1.1”	3.45 x 3.45	IMX255	Global
STC-MCS122BPOE	Color							
STC-MBS1242POE	Monochrome	12M	9.2fps	4000 x 3000	1/1.7"	1.85 x 1.85	MX226	Rolling
STC-MCS1242POE	Color							
STC-MBS2041POE	Monochrome	20M	5.5ps	5472 x 3648	1"	2.4 x 2.4	IMX183	Rolling
STC-MBC2041POE	Color							

PC Based Vision System Licensing

AutoVISION/Visionscape PC Based systems require a runtime license to be able to program them and to run them. There is no development license required. The license is supplied in the form of a USB dongle that plugs into the PC.

There are two types of license dongles. One is for use with Omron cameras, and the second more expensive one is for use with non-Omron 3rd Party cameras.

The part numbers for the license dongles are shown in the table below.

Part Number	Description – GigE Licenses
GMV-VGL0-1DD1	Visionscape GigE License with IntelliFind®, DIVs and 8 Omron Cameras, 32/64 bit
GMV-VGL8-1DD1	Visionscape GigE License with IntelliFind®, DIVs and 8 Third Party Cameras, 32/64 bit

- **GMV-VGL0-1DD1** - This license is specifically for Omron M Series GigE or USB 3.0 cameras, as well as legacy Microscan GigE cameras.
- **GMV-VGL8-1DD1** - This license is for specific sets of other vendor's (3rd Party) cameras. These include the Basler ACE series, and the Baumer VCXG series.

For the purpose of this guide, the dongle needed is GMV-VGL0-1DD1.

Getting Started with GigE Cameras

Choosing the correct PC and NIC card for GigE PC Vision

PC Hardware and NIC cards

GigE cameras require high quality PCs, NIC cards and CAT cables to operate at their full potential. It is recommended to choose from among the several Windows 10 Industrial PCs (IPCs) on the market that are specifically designed for GigE vision. IPCs typically offer 2, 4 or 8 dedicated GigE camera PoE ports. They are designed to assure fast, efficient transfer of camera image to PC memory with minimal processor support, and thus can be used with the fastest and highest resolution GigE cameras at max frame rates.

Commercial Laptops or Desktops on the other hand are **not** designed or recommended for high speed PC Vision. The user is likely to experience Image or Packet Drops when using a standard PC, and will be forced to slow down the camera data rates to compensate.

NIC Cards

IPCs typically have a number of high speed built in PoE Ethernet ports designed for GigE Vision. When using a more traditional PC, it is necessary to choose a high quality, high speed PCIe-4 GigE Vision proven NIC Card, typically based on the Intel Chip set and Gigabit IEEE 802.3 at POE+.

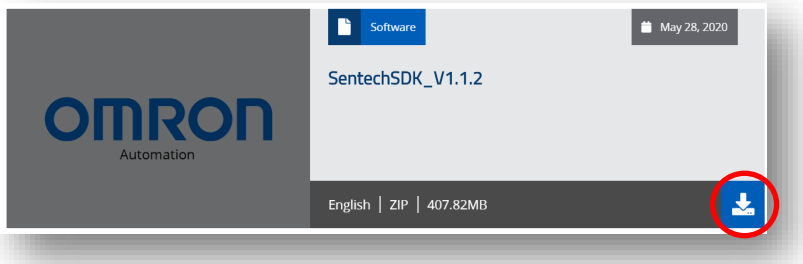
The NIC card should allow for an individual port for each camera, and should allow setting of Jumbo Packets, Receive Buffers, and Interrupt Moderation.

Some of the industry standards for GigE Vision are the Intel Pro1000, the Intel I350-T4, or the Neousys PCIe-PoE354at PCIe POE NIC card.

Download and Install the Sentech SDK

The Sentech software development kit is a group of tools used to configure Sentech cameras.

1. Visit https://automation.omron.com/en/us/
2. In the search bar, type “Sentech”
3. Click to download and then install the SDK.



Connect the Camera

In order to connect an M Series GigE camera to a PC, a PoE switch/injector and RJ45 Ethernet (Cat 6 or higher) cable(s) are required. **A C-mount lens is also needed in order to capture images.**

Direct Wiring Options

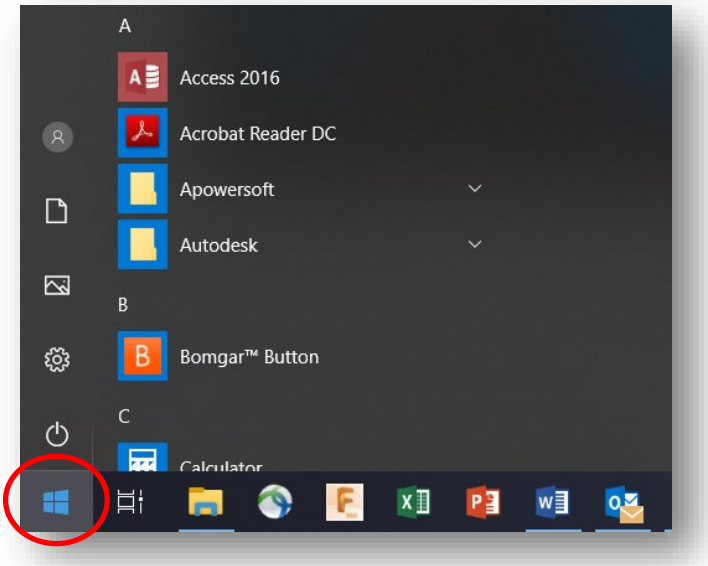
Appearance	Type	Length	Model
	Power Over Ethernet (PoE) Single Port Injector	N/A	V330-AP1
	Standard Ethernet Cables, In-Cabinet Use; Standard RJ45 Connectors on Both Ends; Green	1 Meter	XS6W-5PUR8SS100CM-G
		3 Meters	XS6W-5PUR8SS300CM-G
		5 Meters	XS6W-5PUR8SS500CM-G
		10 Meters	XS6W-5PUR8SS1000CM-G
		15 Meters	XS6W-5PUR8SS1500CM-G
	Standard Ethernet Cables, Out-of-Cabinet Use; Rugged RJ45 Connectors on Both Ends; Light Blue	1 Meter	XS5W-T421-CMD-K
		3 Meters	XS5W-T421-EMD-K
		5 Meters	XS5W-T421-GMD-K
		10 Meters	XS5W-T421-JMD-K
		15 Meters	XS5W-T421-KMD-K

1. If using a PoE Injector, connect an Ethernet cable from the PC NIC to the port labeled “IN” on the injector and connect an Ethernet cable from the “OUT” on the injector to the camera. If using a PoE switch, connect the Ethernet cable to the camera and to a PoE port on the switch.

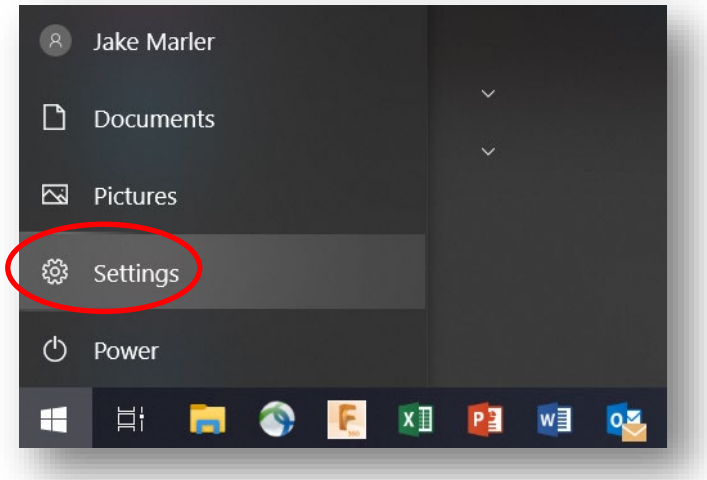
Configure the PC NIC Card for GigE Vision

Multiple NIC settings must be set correctly to maximize system performance. These include using one NIC Port per camera, as well setting each NIC to use Jumbo Packets, Maximum Receive Buffers, and Interrupt Moderation. Each of these settings will be described below.

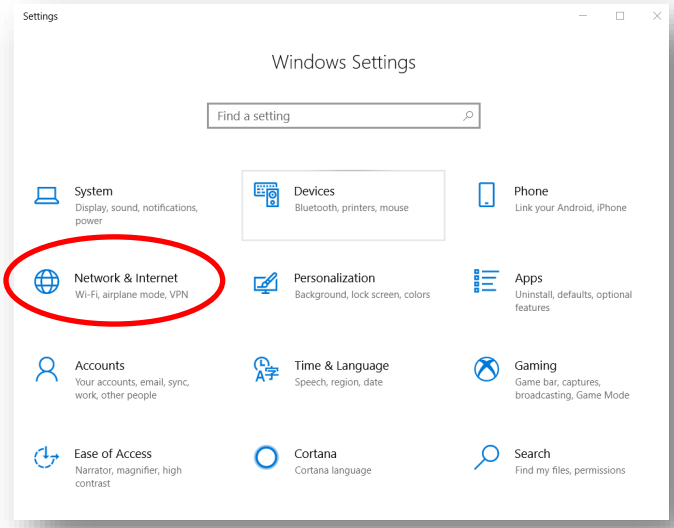
1. Click Start.



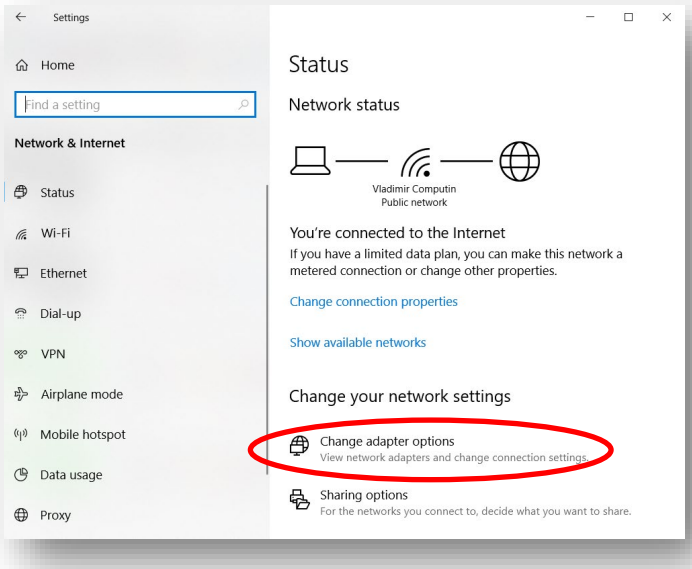
2. Click Settings.



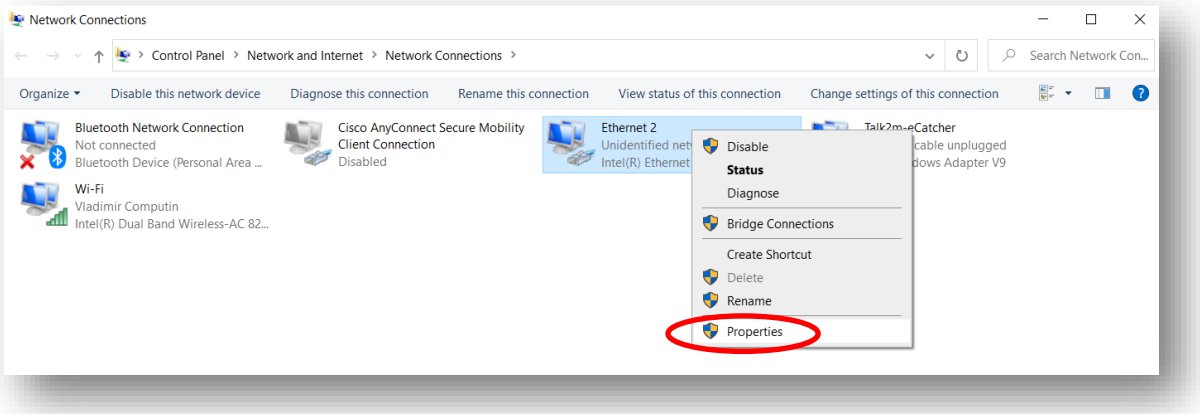
3. Click Network and Internet



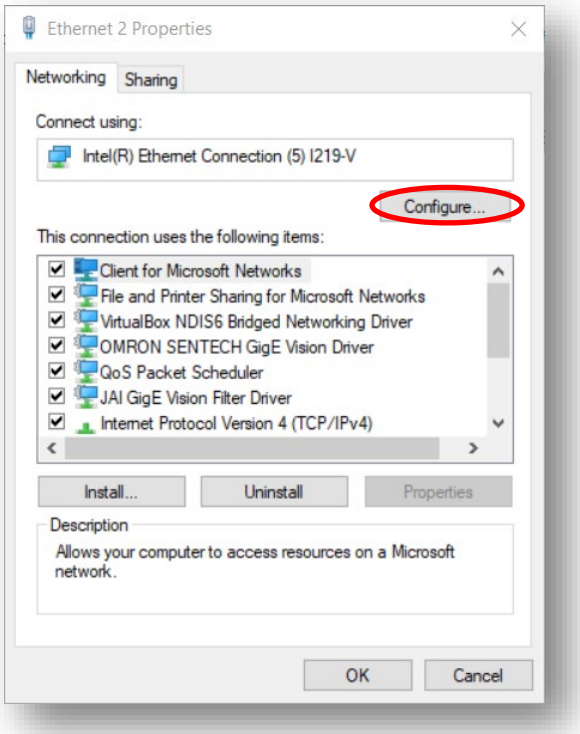
4. Click Change adapter options.



5. Right click on the PC's Ethernet adapter and select Properties.



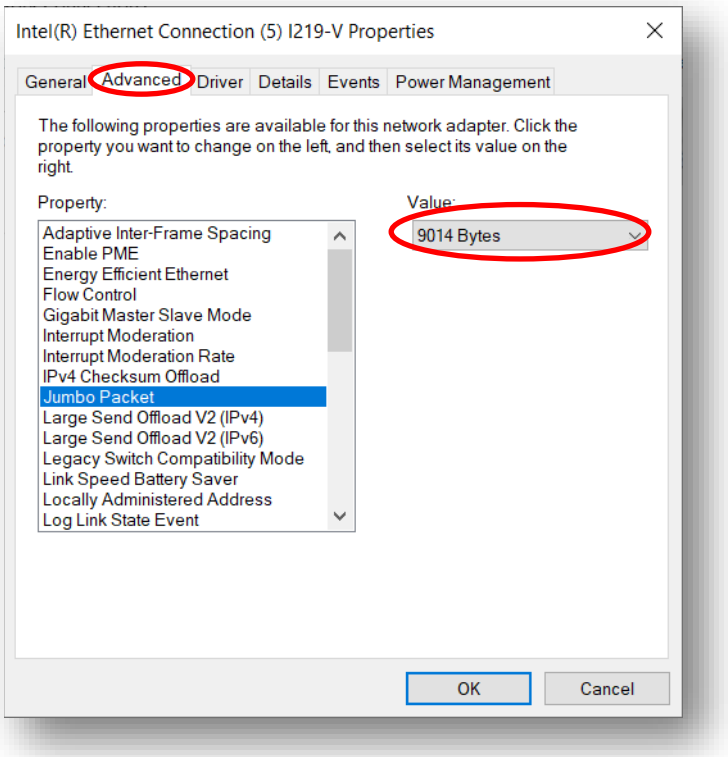
6. Click Configure.



7. Click the Advanced tab. Set the Jumbo Packet value to 9014 bytes.

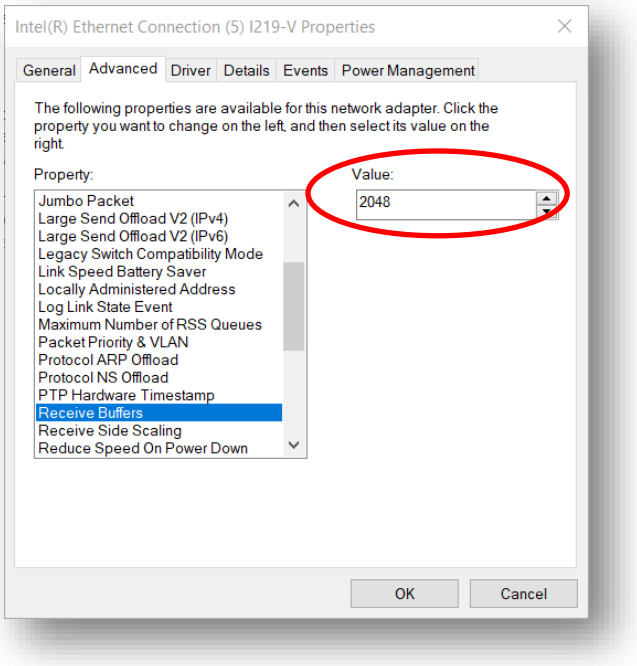
   The GigE camera image is transferred to the PC in a series of UDP Packets. Each time the PC receives an Ethernet packet, a PC interrupt takes place. Each interrupt disturbs the image transfer flow and causes CPU loading and possible packet drops due to several OS internal switchover processes. The smaller the packet size, the more interrupts that will occur. The larger the packet size, the more efficient the image transfer will be.

   For best performance, the NIC should be set up to use Jumbo Packets (sometimes called Jumbo Frames) which are 9014 bytes in size. This will increase the network performance, decrease the PC's CPU load, and minimize packet drops.



8. Scroll down to Receive Buffers and set the value to 2048.

   This sets the number of buffers used by the Ethernet driver when copying data to the protocol memory. The NIC itself does not feature any buffer memory, but the received data packets need to be buffered in order to compensate CPU load changes caused by the operating system. Therefore, buffers are allocated in the PC's RAM. In general, it is recommended to allocate as many receive buffers as possible to reduce the risk of packet resends. This value is often directly in the Advance Parameter list. Other times, this value is under Performance Options. Set this value to the maximum, typically 2048.

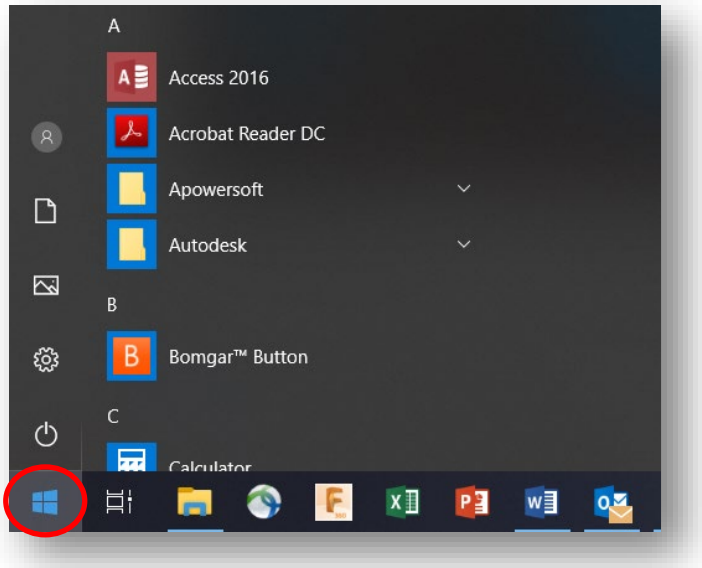


9. Scroll down to Interrupt moderation and make sure it is enabled. Set the Interrupt Moderation Rate to Adaptive.

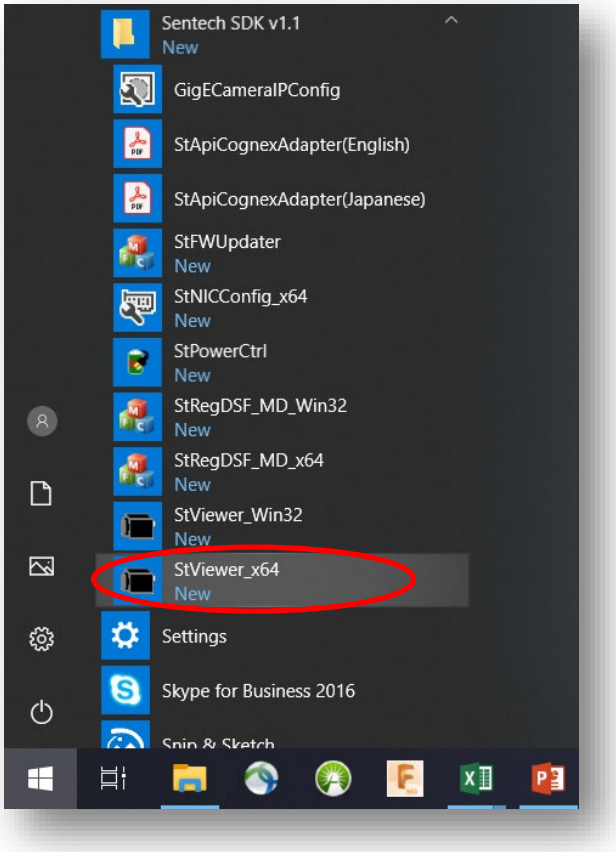
When a packet arrives, the adapter generates an interrupt that allows the driver (CPU) to handle the packet. At greater link speeds, more interrupts are created and CPU usage increases which can result in poorer system performance. When you enable Interrupt Moderation, the interrupt rate is lower resulting in better CPU performance. However, this lower CPU usage can also result in dropped packets. Interrupt Moderation is generally set to Adaptive by default to allow interrupt rates to be set dynamically depending on traffic type and network usage. If your system is experiencing dropped packets, this value should either be set to Minimal to allow the CPU to handle the packets, or to Extreme to minimize CPU usage. The user will have to experiment with this value because it is PC architecture dependent.

Configure the Cameras IP Address and Acquire Images

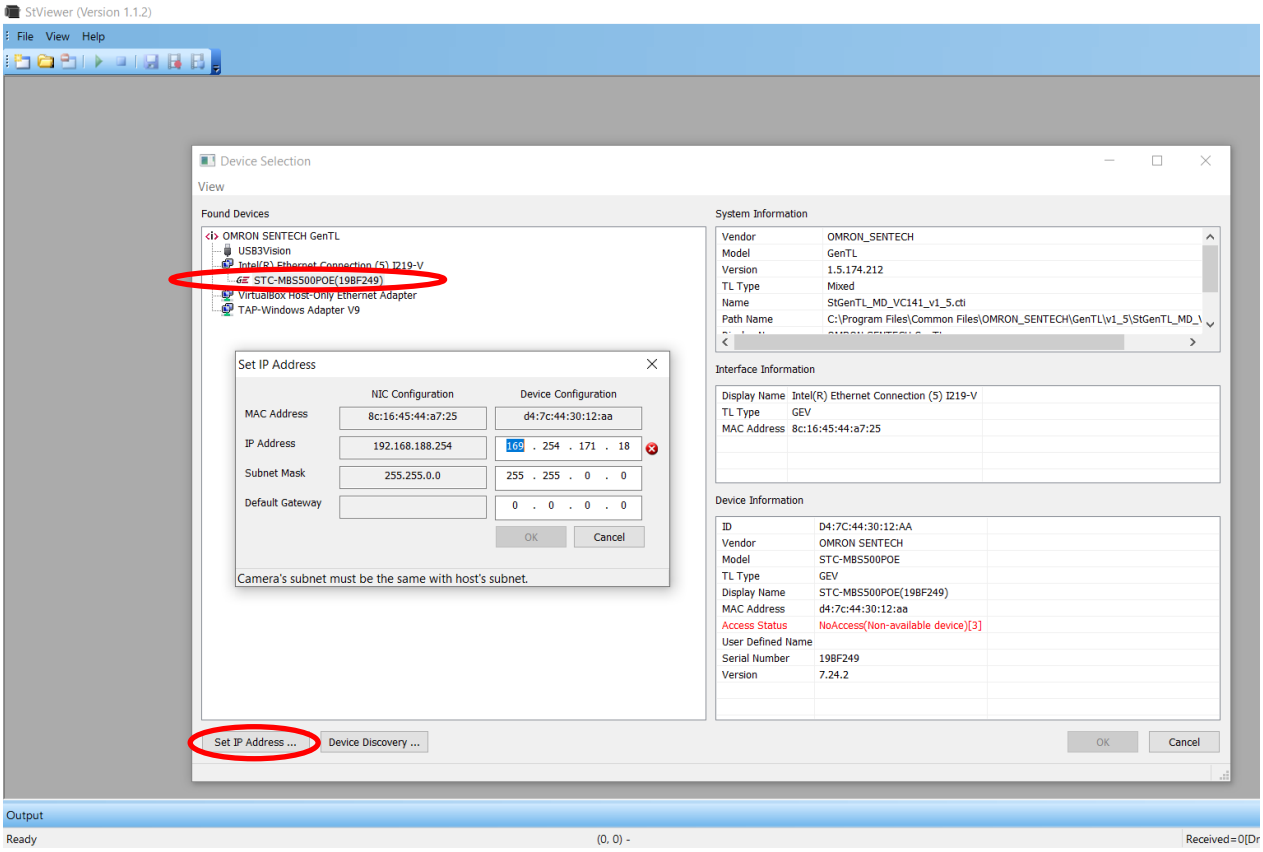
1. Click Start.



2. Scroll down to Sentech SDK, expand the folder and select StViewer_x64



3. Click on the camera, click Set IP address, and put the GigE camera on the same network and subnet mask as the PC NIC. (Example, the PC NIC shown below has an IP Address of 192.168.188.254 and a Subnet Mask of 255.255.0.0. In order to configure the camera IP address onto the PC NIC network, the IP address should be set to 192.168.X.X (X being any number ranging from 0-255)



4. Press OK. Double click on the camera name in the device tree view.

5. Click the green play button to test the camera functionality. After validating that the camera is acquiring images successfully close the STViewer software.


StViewer (Version 1.1.2) - [STC-MBS500POE(19BF249)]
File View Window Help
STC-MBS500POE(19BF249)
NodeMap-STC-MBS500POE(19BF249)
Polling
Visibility: Guru
Filter Regular expression
Node Value
Interface
Action Command Execute
Action Device Key 0
Action Group Key 0
Action Group Mask 0xffffffff
Action Scheduled T... False
Gev Action Destinat... 192.168.255.255
Event Selector Action Command
Event Notificatio... Off
Event Action Command Data
Event Action Command Acknowle...
Local Device
Device Information
Device ID D4:7C:44:30:12:AA
Device Serial N... 19BF249
Device User ID
Device Vendor ... OMRON SENTECH
Device Model N... STC-MBS500POE
Device Version 7.24.2
Device Manufac... www.sentech.co.jp
Output
Ready
(0, 2047) - Mono8 : 0
Received=33[Dropped ID=0]
21.95[fps] / 880.50[Mbps]

Download and Install AutoVISION

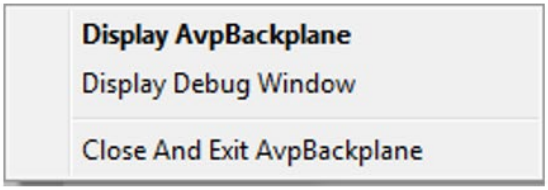
AutoVISION Version 5.2.1 or greater is required.

1. Install the latest version of AutoVISION via the link below.
   https://automation.omron.com/en/us/forms/autovision-software-download-request-form

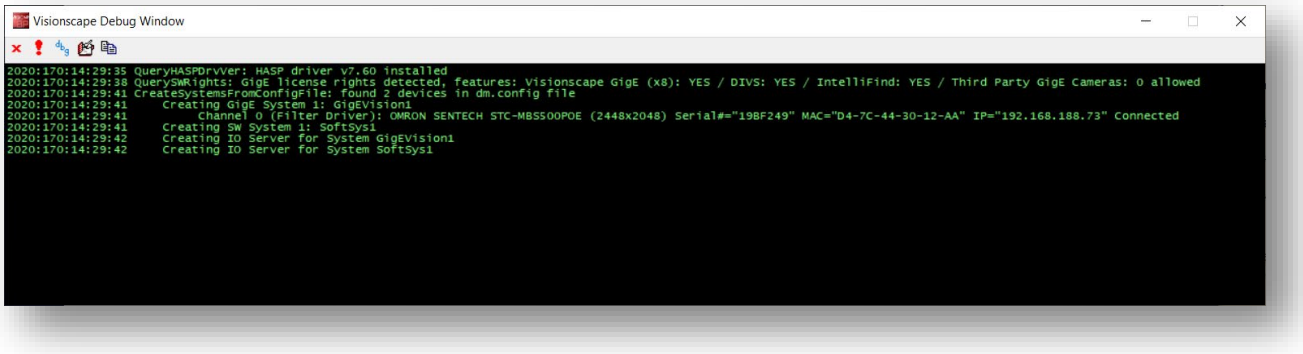
Open AutoVISION and Create a Vision Job

1. Insert the Visionscape dongle into the PC and then Open AutoVISION.

When AutoVISION or Visionscape is started, the AVPBackplane (avpsvr.exe) is automatically launched. The AVP Backplane is responsible for discovering all the cameras and allocating them to the vision system. This AVP Backplane is the Red Icon that can be seen in the system tray (see left hand image). Right clicking on the icon gives the menu shown in the center image. To view what the AVPBackplane is doing, click on “Display Debug Window”, and then click on the Visionscape Backplane icon in the task bar to open it.

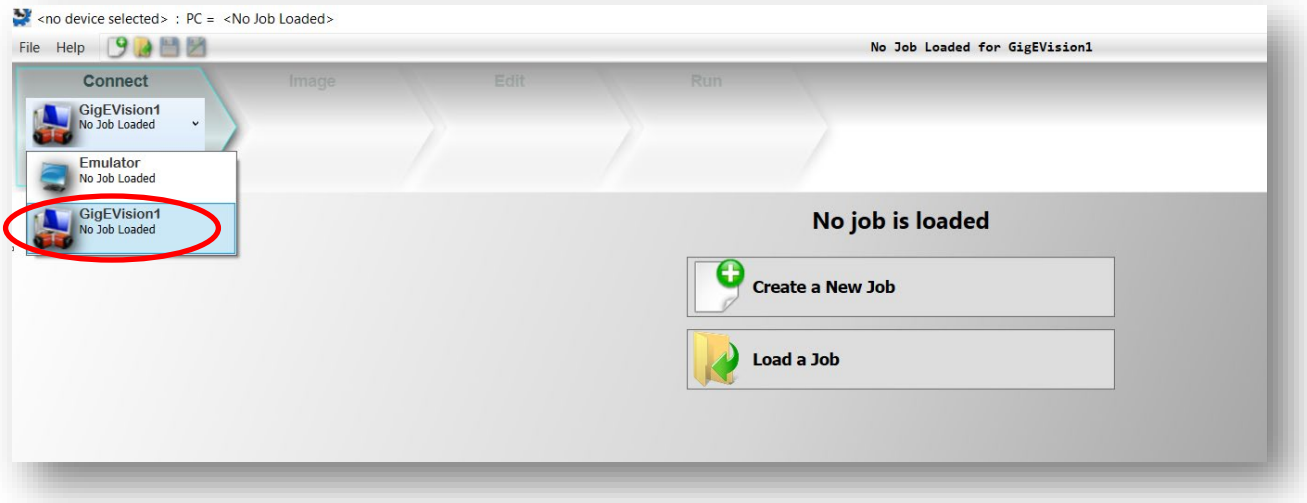


2. Display the debug window. It should show the camera being recognized as shown below.



3. Close the debug window and open the AutoVISION interface.

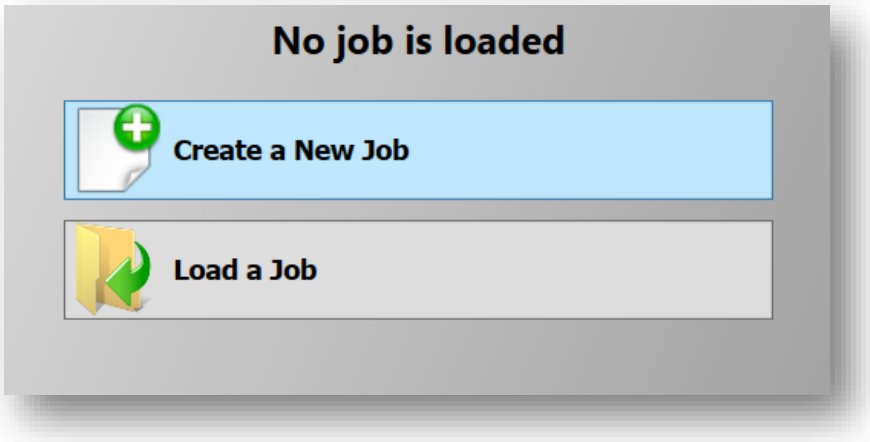
4. Select the GigE camera from the drop down list on the Connect tab.



5. Print the Training images and place Training Card 1 into the field of view of the camera.

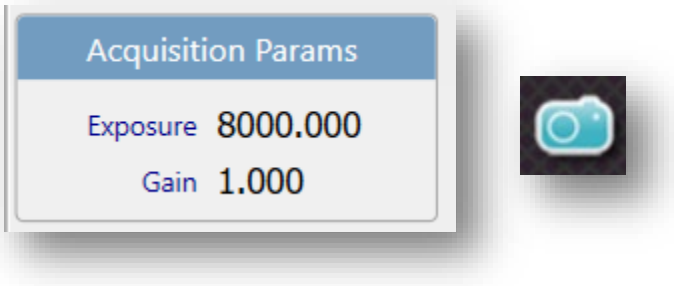
AutoVISION_Training_Images.zip

6. Click Create a New Job.

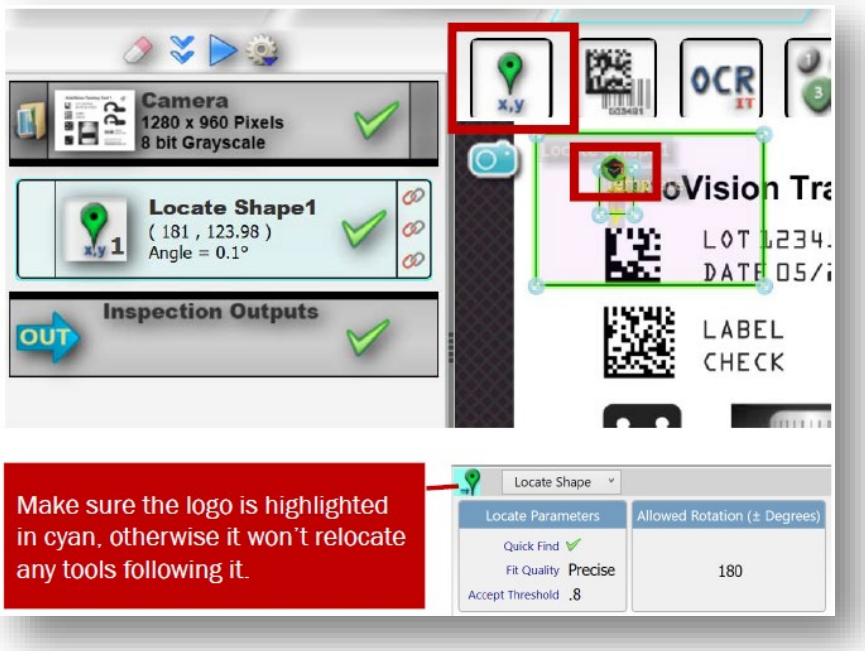


7. Click the Edit tab.

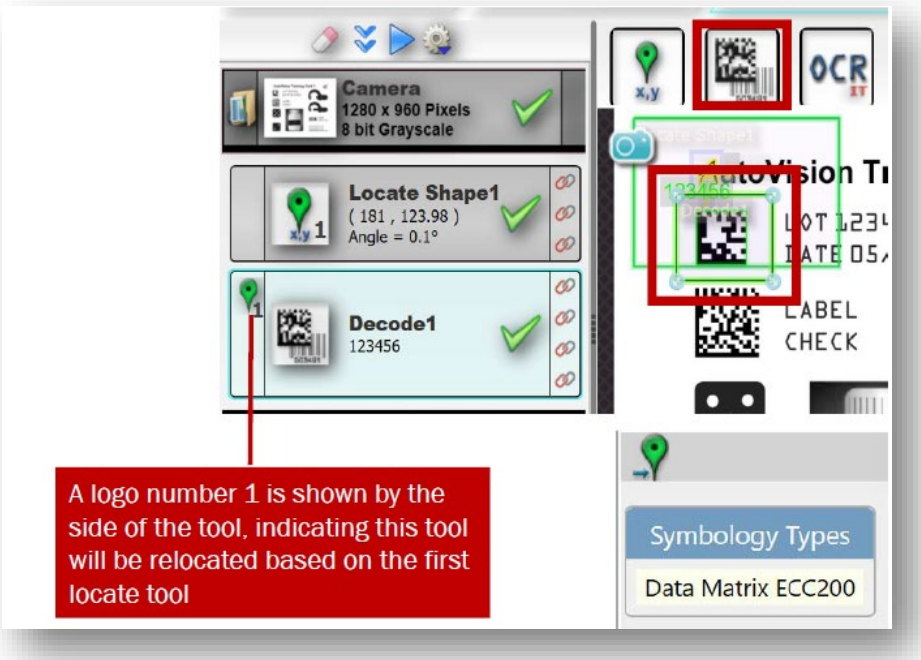
8. Adjust the focus of the lens, the exposure, and the gain until a satisfactory image is acquired. Each time a parameter is adjusted, click the blue camera icon to acquire a new image. The use of a TP-JVA Tripod Mount and Manfrotto 244 Variable Friction Magic Arm (Omron part number BGN-244) with Camera Bracket and 035RL Super Clamp (Omron part BGN-035) is highly recommended.



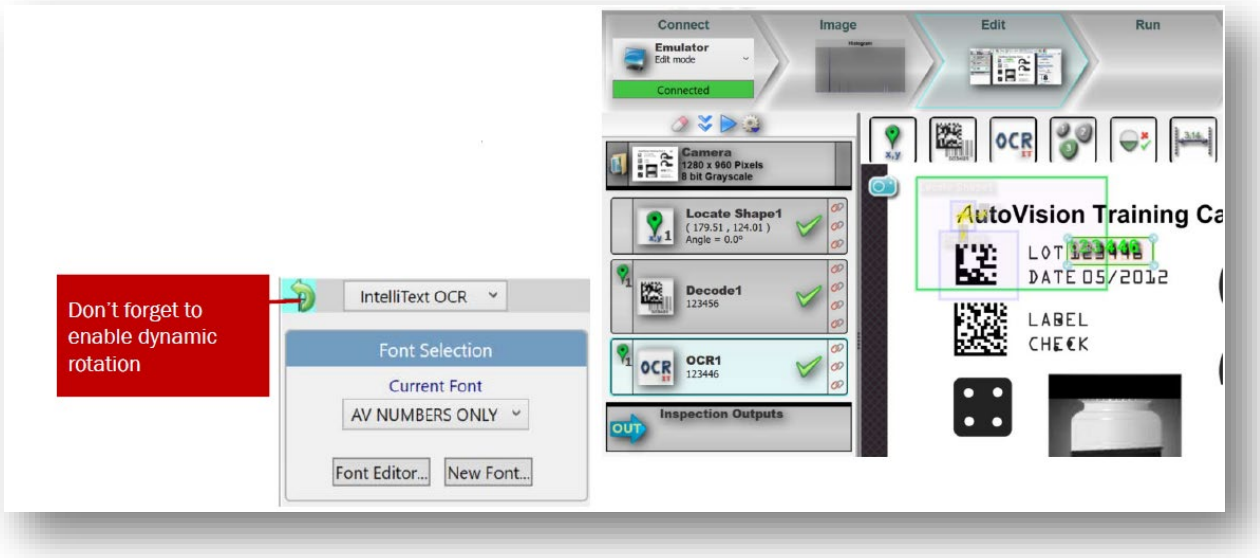
9. **Setup a Locate tool to dynamically move other tools.** Adjust the small window around the letter of ‘A’ of AutoVISION. Adjust the larger window so it covers all possible locations of ‘A’. Train the tool by clicking on the hat icon



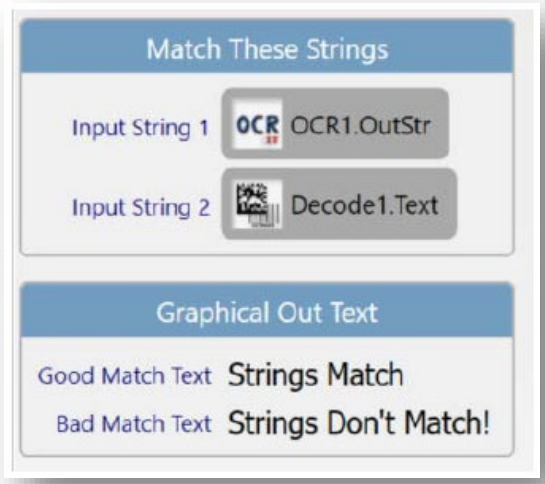
10. **Decode the small data matrix.** Click on the decode tool. Move it to cover the top data matrix, make sure you leave adequate quiet zone for the code. Disable unnecessary symbologies to boost processing speed.



11. **Read the lot number.** Place the OCR tool around the lot number. Use IntelliText and font AV NUMBERS only.

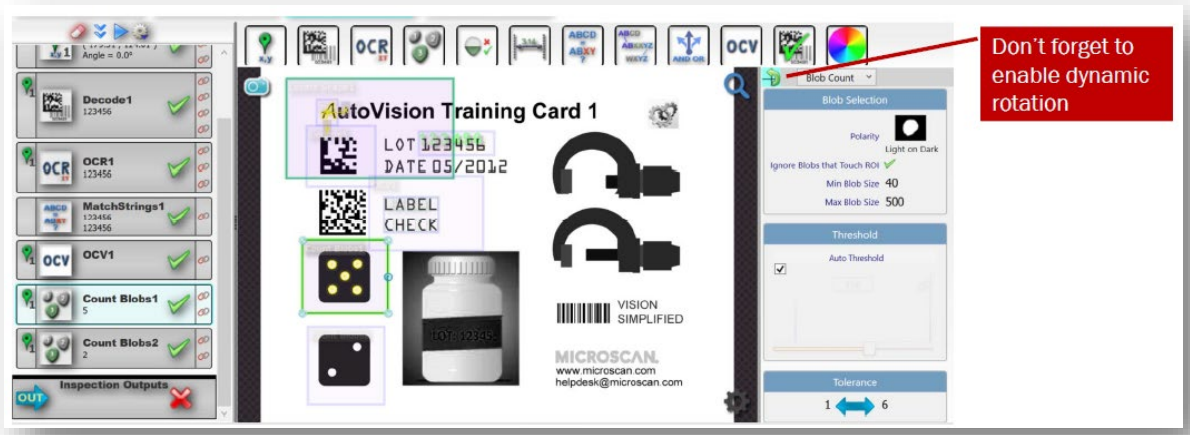


12. **Check whether the OCR string and decode string matches.** Add a match string tool. Set OCR output string to Input String 1, set the decoded string to Input String 2.

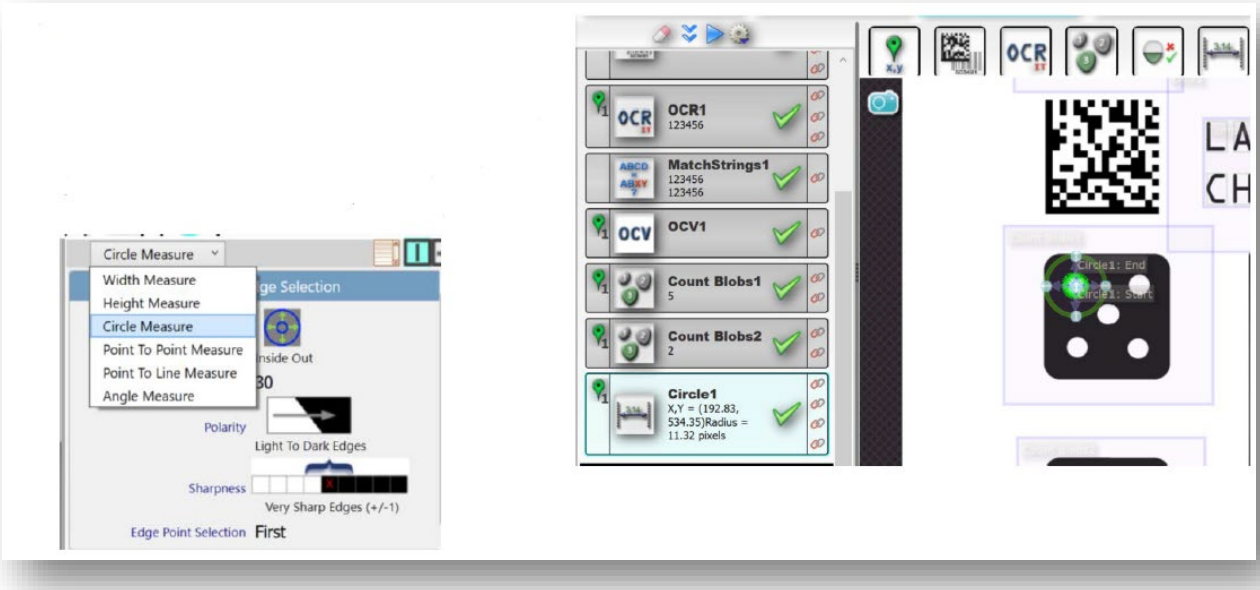


13. **Check the print quality of “LABEL CHECK”.** Place the OCV Tool around the text, fit “LABEL CHECK” to the small box and place the big box on possible locations of the text. Don’t forget to train the tool.

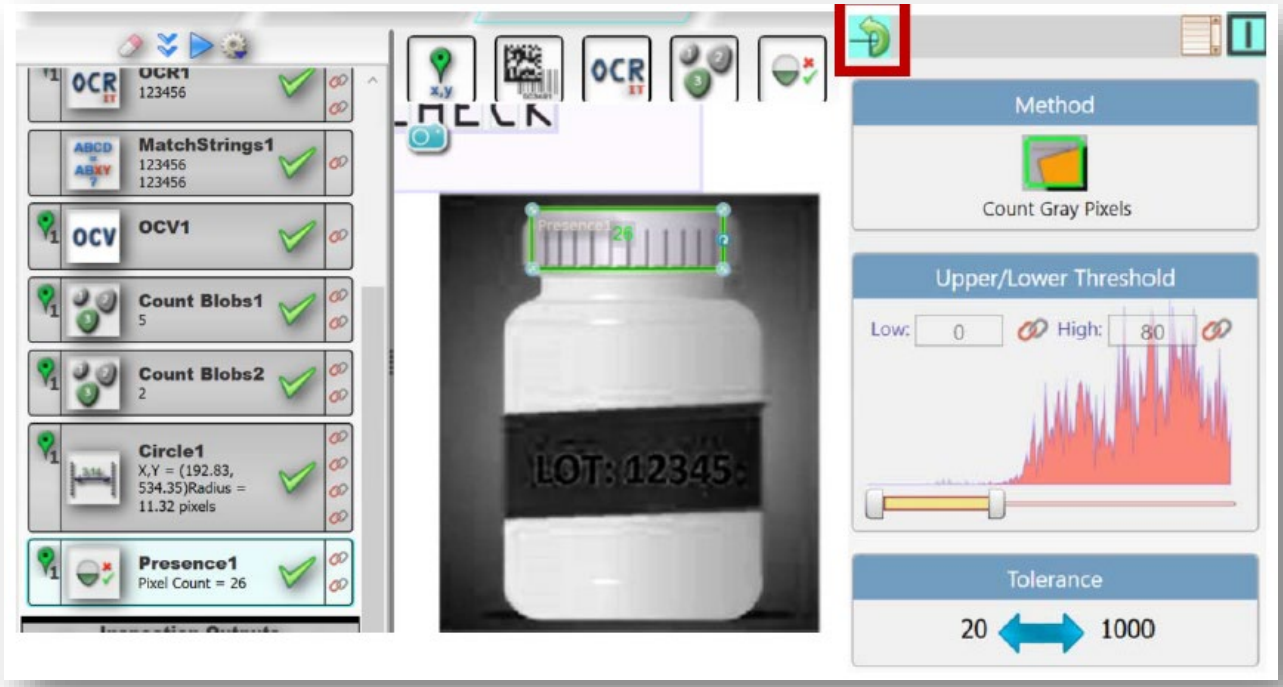
14. **Count the dots on each dice.** Place a count tool around each dice. Set an appropriate polarity, blob size, and tolerance.



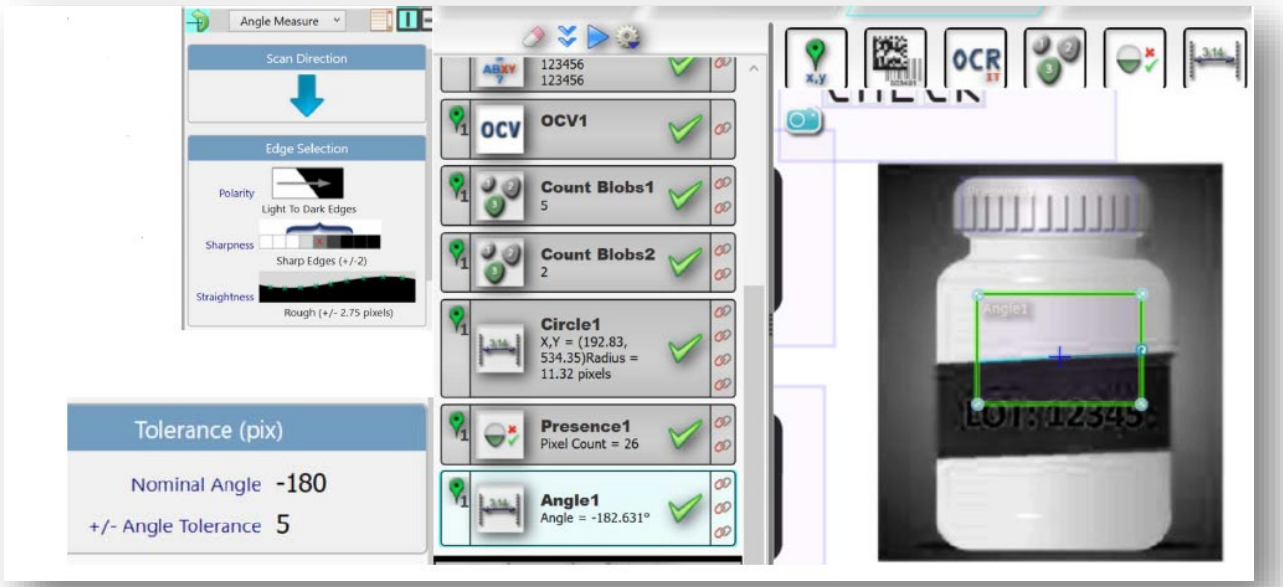
15. **Measure the size of the dots on the upper left corner of the top dice.** Add a measure tool, then select Circle Measure. Fit the inner circle to the inside of the dot, and the outer circle to the outside of the dot.



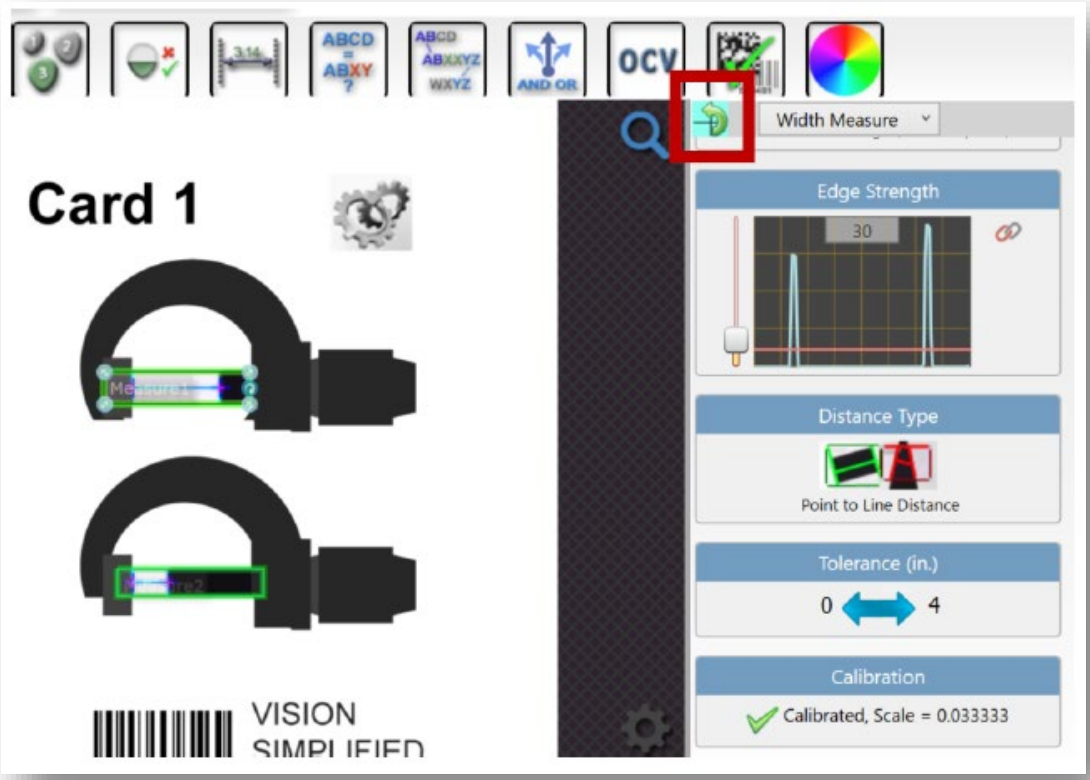
16. **Check the presence of the bottle cap.** Add a Presence/Absence tool and place it on the cap. Select Count Gray Pixels. Set a tolerance (an acceptable range of gray pixels when cap is present). Don't forget to enable dynamic rotation.



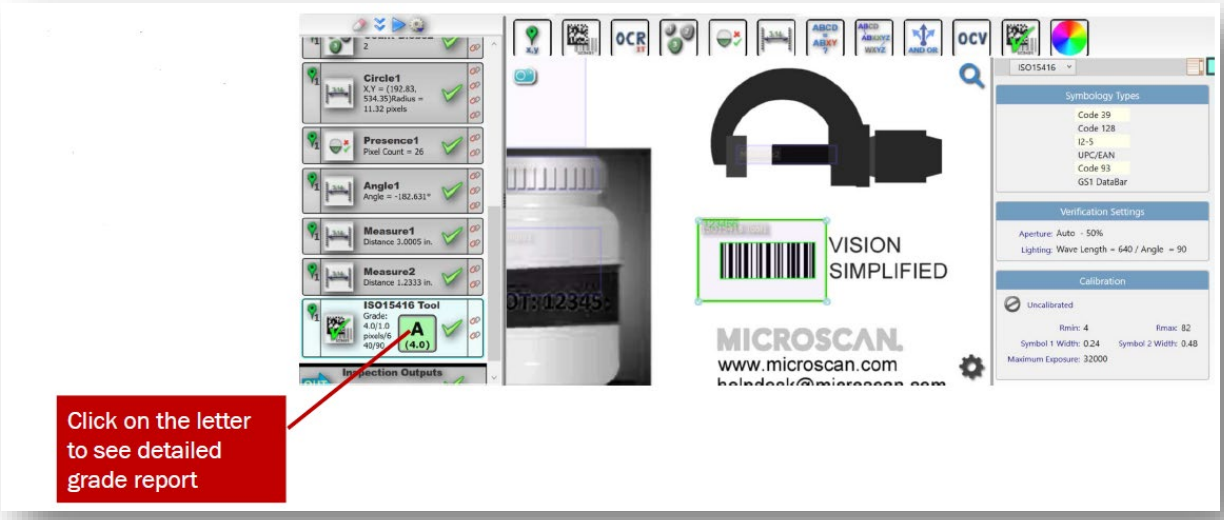
17. **Measure the tilt angle of the bottle label.** Add a measure tool and select Angle Measure. Place the measure window around the top label edge. Select scan direction, polarity, and set a tolerance. (an acceptable range of measured angle)



18. **Measure the two clamps' openings and calibrate it.** Place a measurement tool on each clamp. Select Width Measure. Enable Dynamic Rotation. Set Edge Selection (default is okay in this case). Set the Calibration Scale (30 pixels = 1 in). Set a tolerance in inches. (0"-4")



19. **Verify the quality of the 1D barcode.** Place a verification tool around the barcode. Select ISO15416 for 1D symbology.



Appendix

For more detailed information on using Omron Sentech Cameras with AutoVISION and Visionscape, please refer to the Supplemental Users Guide.

Using Omron Sentech CMOS STC C