IntelliGuide™ Vision

User Manual

Part Number 628571 Revision A

Brooks Automation

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Revision History

Revision	ECO	Date	Action	Author
A	EC154053	4/18/20204	Released manual at Rev. A to follow standard Brooks technical publication styles. Document Created. Compatibility verified with GDS 5.0.3.1.	M. Ashenfelder

Table of Contents

1. Safety

Safety Setup

Brooks uses caution, warning, and danger labels to convey critical information required for the safe and proper operation of the hardware and software. Read and comply with all labels to prevent personal injury and damage to the equipment.

DANGER

Read the Safety Chapter

Failure to review the *Safety* chapter and follow the safety warnings can result in serious injury or death.

- All personnel involved with the operation or maintenance of this product must read and understand the information in this safety chapter.
- Follow all applicable safety codes of the facility as well as national and international safety codes.
- Know the facility safety procedures, safety equipment, and contact information.
- Read and understand each procedure before performing it.

Authorized Personnel Only

This product is intended for use by trained and experienced personnel. Operators must comply with applicable organizational operating procedures, industry standards, and all local, regional, national, and international laws and regulations.

Explanation of Hazards and Alerts

This manual and this product use industry standard hazard alerts to notify the user of personal or equipment safety hazards. Hazard alerts contain safety text, icons, signal words, and colors.

Safety Text

Hazard alert text follows a standard, fixed-order, three-part format.

- Identify the hazard
- State the consequences if the hazard is not avoided
- State how to avoid the hazard.

Safety Icons

- Hazard alerts contain safety icons that graphically identify the hazard.
- The safety icons in this manual conform to ISO 3864 and ANSI Z535 standards.

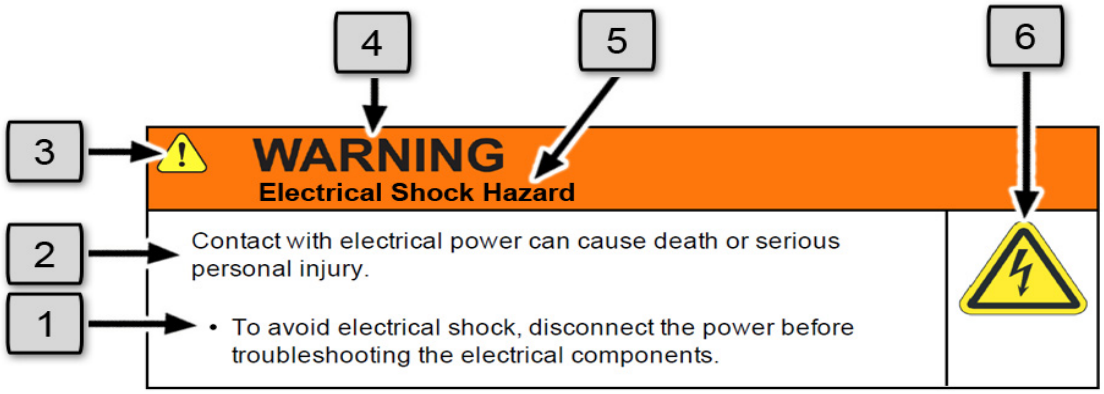
Signal Words and Color

Signal words inform of the level of hazard.

	Danger indicates a hazardous situation which, if not avoided, **will result in serious injury or death**. The Danger signal word is white on a red background with an exclamation point inside a yellow triangle with black border.
	Warning indicates a hazardous situation which, if not avoided, **could result in serious injury or death**. The Warning signal word is black on an orange background with an exclamation point inside a yellow triangle with black border.
	Caution indicates a hazardous situation or unsafe practice which, if not avoided, **may result in minor or moderate personal injury**. The Caution signal word is black on a yellow background with an exclamation point inside a yellow triangle with black border.
	Notice indicates a situation or unsafe practice which, if not avoided, **may result in equipment damage**. The Notice signal word is white on blue background with no icon.

Alert Example

The following is an example of a Warning hazard alert.



Number	Description
1.	How to Avoid the Hazard
2.	Source of Hazard and Severity
3.	General Alert Icon
4.	Signal Word
5.	Type of Hazard
6.	Hazard Symbol(s)

General Safety Considerations

WARNING

Software

Software is not safety rated. Unplanned motion can occur as long as power is supplied to the motors. Maximum torque could be momentarily applied that may cause equipment damage or personal injury.

- Only operate the robot with its covers installed.
- Guarantee that safety controller features are in place (for example, an emergency stop button and protective stop).
- Regularly test safety components to prove that they function correctly.

WARNING

Robot Mounting

Before applying power, the robot must be mounted on a rigid test stand, secure surface, or system application. Improperly mounted robots can cause excessive vibration and uncontrolled movement that may cause equipment damage or personal injury.

- Always mount the robot on a secure test stand, surface, or system before applying power.

WARNING

Do Not Use Unauthorized Parts

Using parts with different inertial properties with the same robot application can cause the robot's performance to decrease and potentially cause unplanned robot motion that could result in serious personal injury.

- Do not use unauthorized parts.
- Confirm that the correct robot application is being used.

WARNING

Magnetic Field Hazard

This product contains magnetic motors that can be hazardous to implanted medical devices, such as pacemakers, and cause personal harm, severe injury, or death.

- Maintain a safe working distance of 30 cm from the motor when with an energized robot if you use a cardiac rhythm management device.

CAUTION

Unauthorized Service

Personal injury or damage to equipment may result if this product is operated or serviced by untrained or unauthorized personnel.

- Only qualified personnel who have received certified training and have the proper job qualifications are allowed to transport, assemble, operate, or maintain the product.

CAUTION

Damaged Components

The use of this product when components or cables appear to be damaged may cause equipment malfunction or personal injury.

- Do not use this product if components or cables appear to be damaged.
- Place the product in a location where it will not get damaged.
- Route cables and tubing so that they do not become damaged and do not present a personal safety hazard.

CAUTION

Inappropriate Use

Use of this product in a manner or for purposes other than for what it is intended may cause equipment damage or personal injury.

- Only use the product for its intended application.
- Do not modify this product beyond its original design.
- Always operate this product with the covers in place.

CAUTION

Seismic Restraint

The use of this product in an earthquake-prone environment may cause equipment damage or personal injury.

- The user is responsible for determining whether the product is used in an earthquake prone environment and installing the appropriate seismic restraints in accordance with local regulations.

Mechanical Hazards

CAUTION

Pinch Point

Moving parts of the product may cause squeezing or compression of fingers or hands resulting in personal injury.

- Do not operate the product without the protective covers in place.

WARNING

Automatic Movement

Whenever power is applied to the product, there is the potential for automatic or unplanned movement of the product or its components, which could result in personal injury.

- Follow safe practices for working with energized products per the facility requirements.
- Do not rely on the system software or process technology to prevent unexpected product motion.
- Do not operate the product without its protective covers in place.
- While the collaborative robotics system is designed to be safe around personnel, gravity and other factors may present hazards and should be considered.

CAUTION

Vibration Hazard

As with any servo-based device, the robot can enter a vibratory state resulting in mechanical and audible hazards. Vibration indicates a serious problem. Immediately remove power.

- Before energizing, ensure the robot is bolted to a rigid metal chamber or stand.

Electrical Hazards

Refer to the specifications of the *Guidance Controller Quick Start Guide* for the electrical power.

DANGER

Electrical Shock Hazard

Contact with electrical power can cause personal harm and serious injury.

- To avoid electrical shock, disconnect the power before troubleshooting the electrical components.
- Check the unit's specifications for the actual system power requirements and use appropriate precautions.
- Never operate this product without its protection covers on.

WARNING

Electrical Burn

Improper electrical connection or connection to an improper electrical supply can result in electrical burns resulting in equipment damage, serious injury, or death.

- Always provide the robot with the proper power supply connectors and ground that are compliant with appropriate electrical codes.

WARNING

Electrical Fire Hazard

All energized electrical equipment poses the risk of fire, which may result in severe injury or death. Fires in wiring, fuse boxes, energized electrical equipment, computers, and other electrical sources require a Class C extinguisher.

- Use a fire extinguisher designed for electrical fires (Class C in the US and Class E in Asia).
- It is the facility's responsibility to determine if any other fire extinguishers are needed for the system that the robot is in.

NOTICE

Improper handling of the power source or connecting devices may cause component damage or equipment fire.

- Connect the system to an appropriate electrical supply.
- Turn off the power before servicing the unit.
- Turn off the power before disconnecting the cables.

Ergonomic Hazards

CAUTION

Heavy Lift Hazard

Failure to take the proper precautions before moving the robot could result in back injury and muscle strain.

- Use a lifting device and cart rated for the weight of the drive or arm.
- Only persons certified in operating the lifting device should be moving the product.

CAUTION

Tipover Hazard

This product has a high center of gravity which may cause the product to tip over and cause serious injury.

- Always properly restrain the product when moving it.
- Never operate the robot unless it is rigidly mounted.

CAUTION

Trip Hazard

Cables for power and communication and facilities create trip hazards which may cause serious injury.

- Always route the cables where they are not in the way of traffic.

Emergency Stop Circuit (E-Stop)

The integrator of the robot must provide an emergency stop switch.

WARNING

Emergency Stop Circuit

Using this product without an emergency stop circuit may cause personal injury.

- Customer is responsible for integrating an emergency stop circuit into their system.
- Do not override or bypass the emergency stop circuit.

Recycling and Hazardous Materials

Brooks Automation complies with the EU Directive 2002/96/EU Waste Electrical and Electronic Equipment (WEEE).

The end user must responsibly dispose of the product and its components when disposal is required. The initial cost of the equipment does not include cost for disposal. For further information and assistance in disposal, please email Brooks Automation Technical Support at support_preciseflex@brooksautomation.com.

2. Overview

IntelliGuide Vision Gripper Functions

IntelliGuide Vision Grippers include a fully integrated camera-enabled vision system to help guide the robot. Just connect the interface cables, power up the robot, home it, and teach the robot to work on tasks.

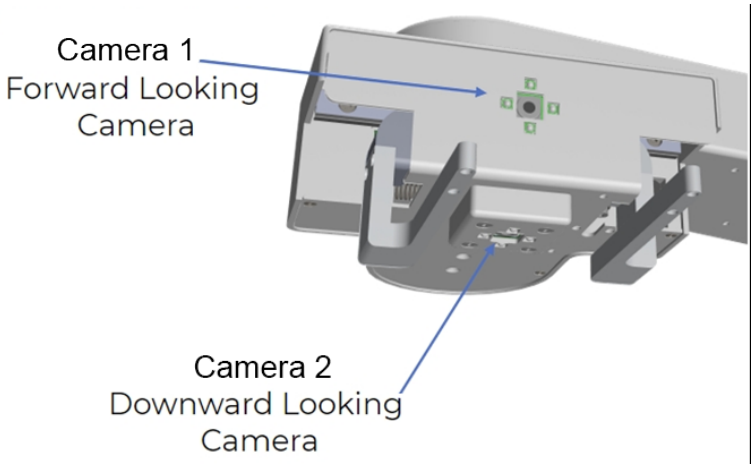
The IntelliGuide Vision Gripper's range of functions include decoding ArUco markers and reading 1D and 2D barcodes and other visual identifiers. The Auto-Teach functionality employs a simplified drag-and-drop programming method, called *sequencing*, which allows you to craft a series of instructions and processes for the robot to execute.

Features

The IntelliGuide Vision Gripper has downward- and forward-facing 5 MP cameras – with 150 mm focal distance – as well as integrated lighting controlled via Pulse Width Modulation (PWM) for brightness.

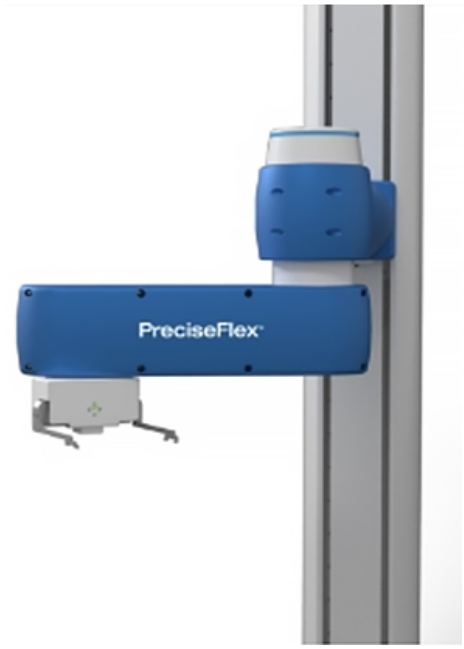
Its functions include:

- Bar code reading, 1D and 2D
- Objection recognition and location
- ArUco marker orientation
- Auto-Teach
- Lighting control

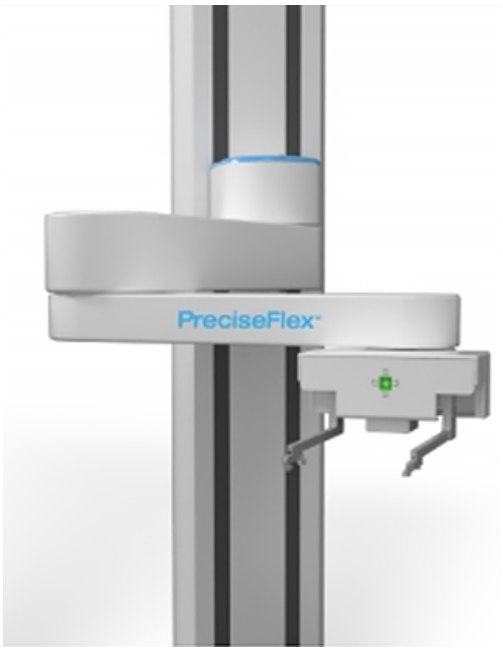


The processing of the images is done on the IntelliGuide Vision Gripper side, and the software that is used to configure and set the vision tools is the Guidance Development Studio (GDS). The vision processing is programmed via GDS over the same Ethernet connection to the base of the robot. By default, the robot IP Address is 192.168.0.1, and the Vision Controller IP Address is 192.168.0.200. Refer to the *Guidance Development Studio* manual for detailed instructions on configuring the vision processing.

Robot Compatibility



PreciseFlex c10 Robot with IntelliGuide v60



PreciseFlex 3400 Robot with IntelliGuide v23

The following table shows which robots the IntelliGuide v23 and v60 are compatible with.

Camera	PreciseFlex 400 *	PreciseFlex 3400 *	PreciseFlex c10
IntelliGuide v23	Compatible	Compatible	Compatible
IntelliGuide v60	Not Compatible	Compatible	Compatible

* Also compatible with these robots on a Collaborative Linear Rail

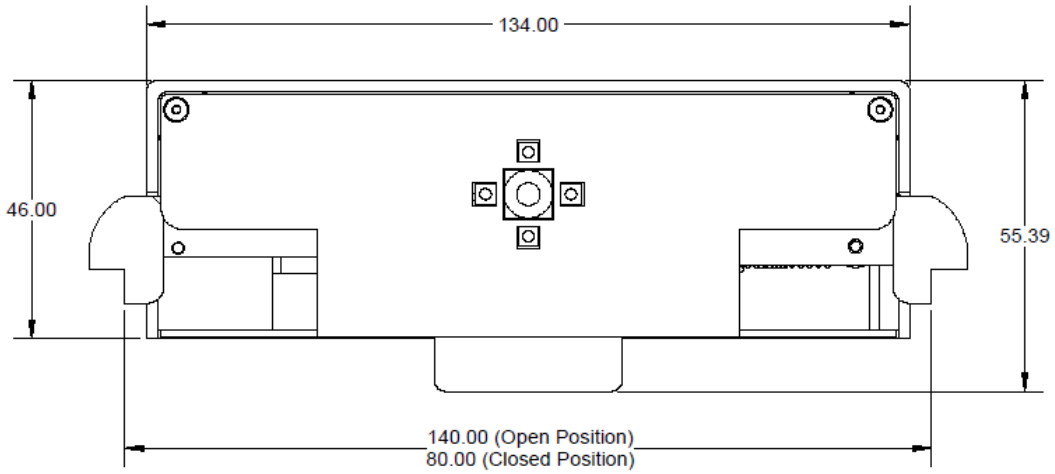
IntelliGuide v23

The IntelliGuide v23 is designed to handle SBS Plates in both portrait and landscape orientations. Thus it has a wider stroke and lower payload. Similar to the 23 N Servo Gripper, it can apply 23 Newtons of force, and it requires homing when the robot is powered off and back on.

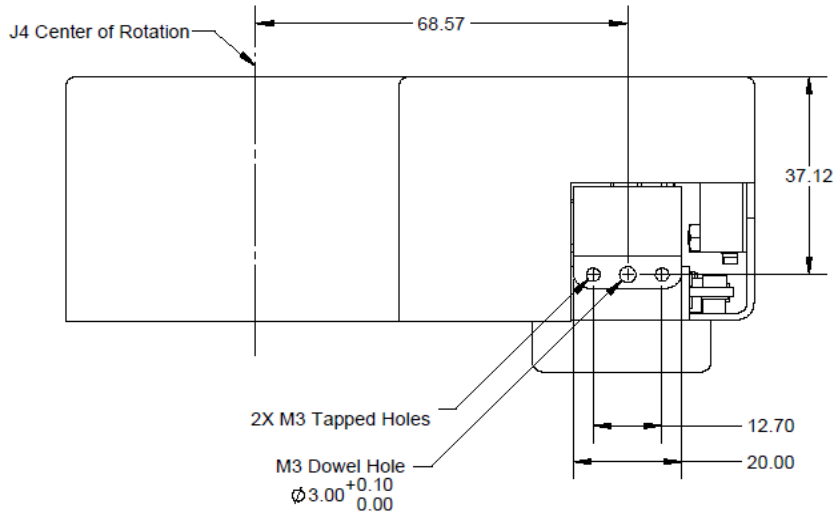
The IntelliGuide v23 features include:

- 23 N gripping force
- 60 mm stroke
- (Picks SBS plates in portrait and landscape modes)
- 1.0 kg payload (may be limited by robot payload

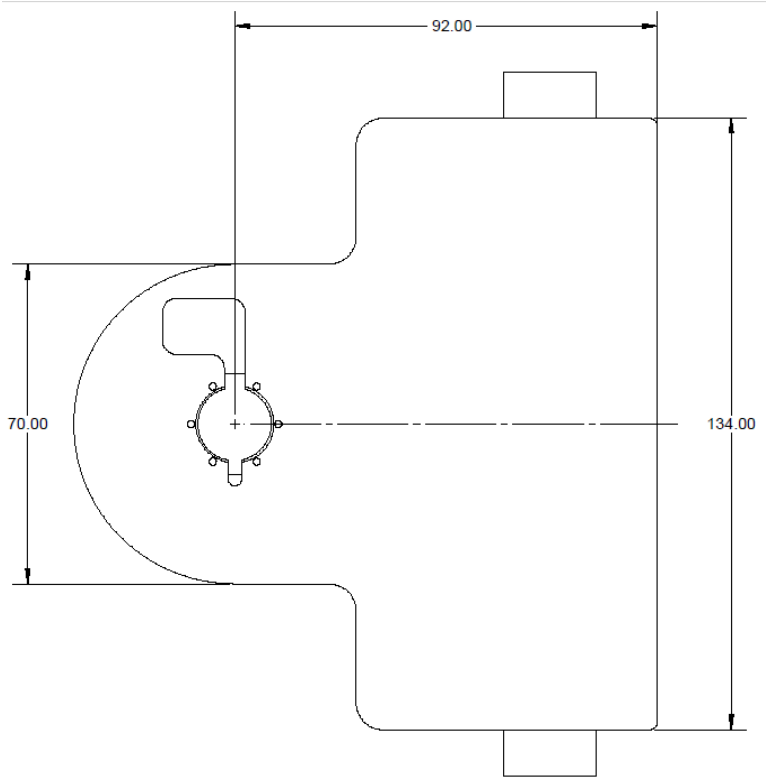
NOTE: All dimensions are in millimeters.



IntelliGuide v23, Front View



IntelliGuide v23, Side View



IntelliGuide v23, Top View

IntelliGuide v60

The IntelliGuide v60 is designed to handle heavier payloads and can only grab SBS Plates in one orientation, either portrait or landscape. Thus it has a shorter stroke and higher payload. It can apply

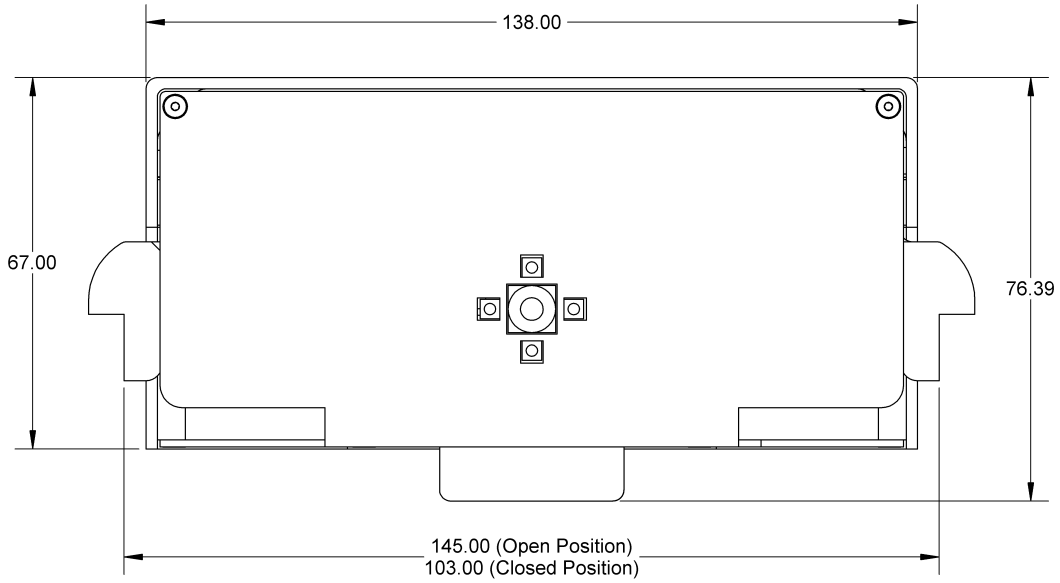
60 Newtons of force. With an absolute encoder, it does not require homing when the robot is powered off and back on.

The 60 N gripper can only pick up plates in one orientation while the 23 N gripper can pick up in two orientations without changing fingers due to its longer stroke.

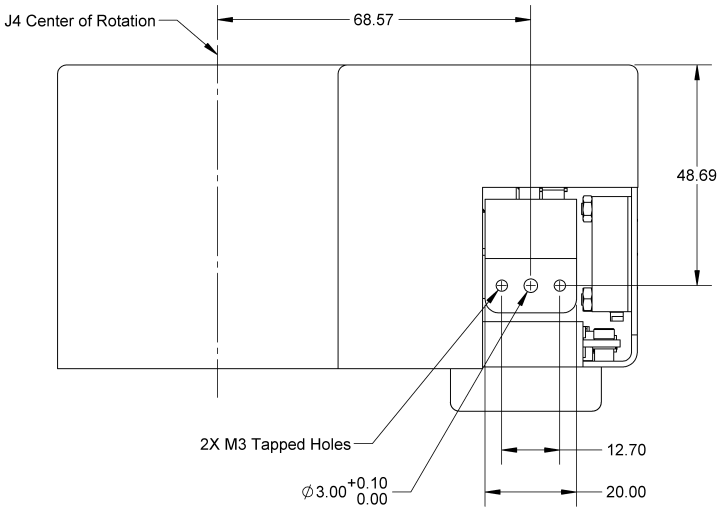
The IntelliGuide v60 features include:

- 60 N gripping force
- 40 mm stroke
- (Picks SBS plates in either portrait or landscape modes)
- 3.0 kg payload (may be limited by robot payload

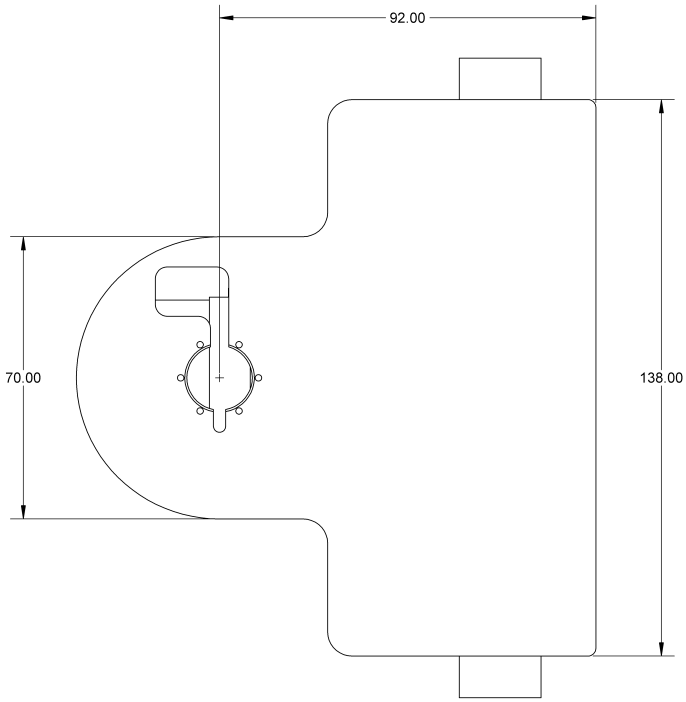
NOTE: All dimensions are in millimeters.



IntelliGuide v60, Front View.



IntelliGuide v60, Side View.

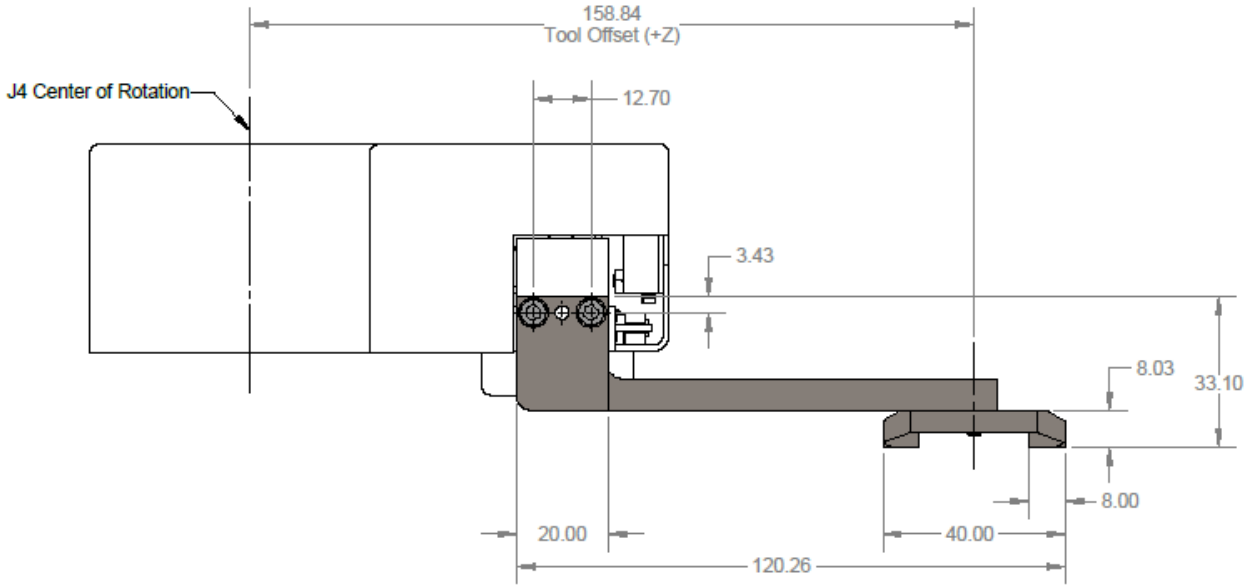


IntelliGuide v60, Top View.

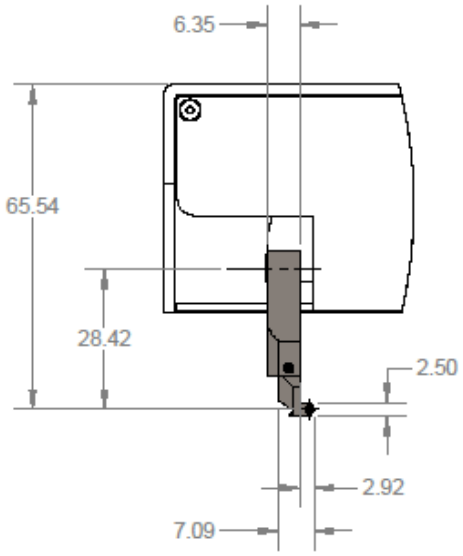
Accessories

23 N Gripper Fingers

NOTE: All dimensions are in millimeters.



23 N Gripper Fingers for Microtiter Plates, Side



23 N Gripper Fingers for Microtiter Plates, Front

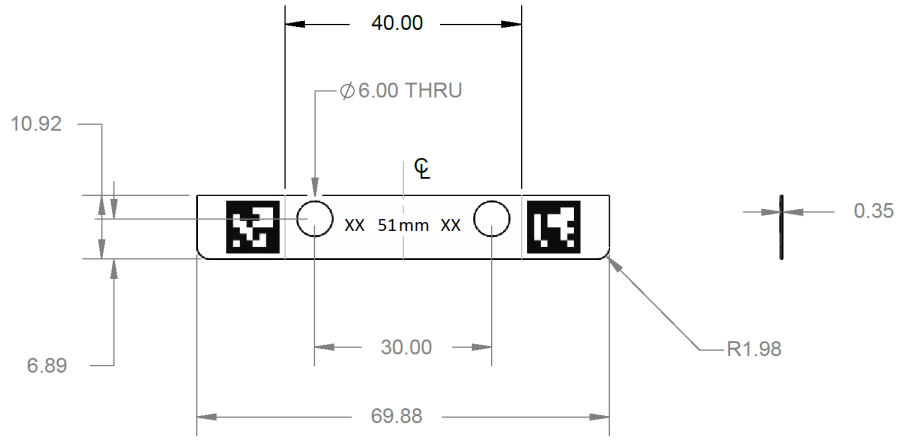
ArUco Label Dimensions, Diagrams

An ArUco is a square graphic data matrix, similar to a QR code (see images below). A target sticker utilizes a left and right ArUco to help align the IntelliGuide Vision Gripper camera by:

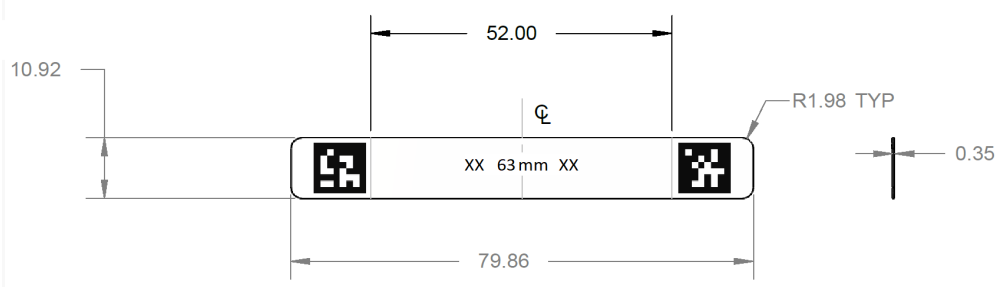
- calculating the center of each ArUco
- calculating the exact distance between the two ArUco center points (ArUco Distance relative to the camera)
- calculating the line between the two ArUco center points (ArUco Rotation relative to the camera).

These calculations help determine the camera's relative location -- such as distance and level -- in the work-envelope space.

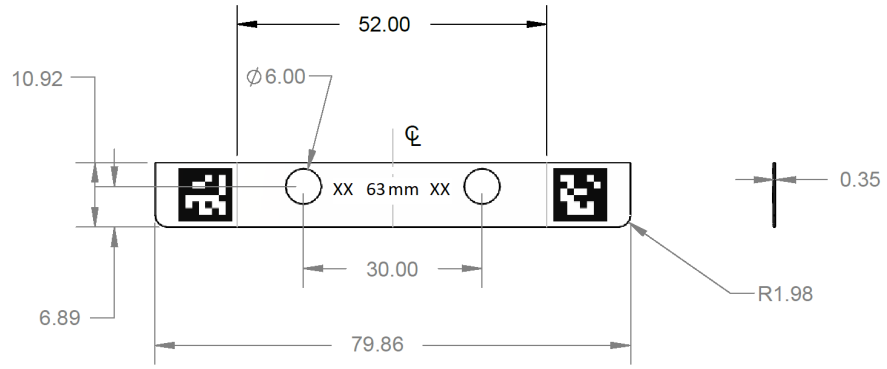
NOTE: In the ArUco examples below, distance in shown in millimeters.



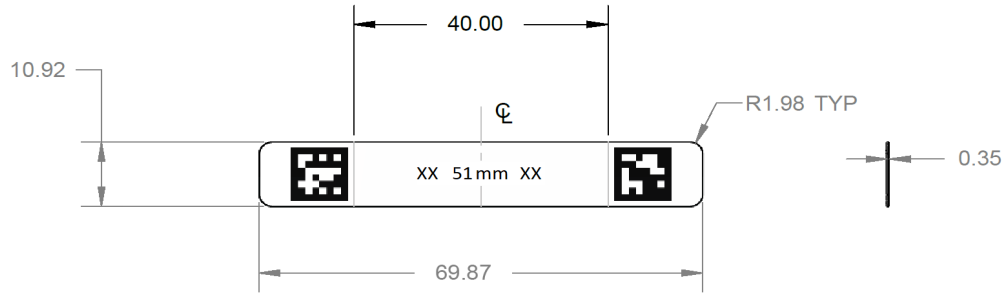
Label, Front Narrow, Teach Plate
- Distance Center-to-Center of ArUco Square: 51 mm (displayed as "xx 51 mm xx" in example above)
- ArUco Size: 9x9 mm
- Part # 500372



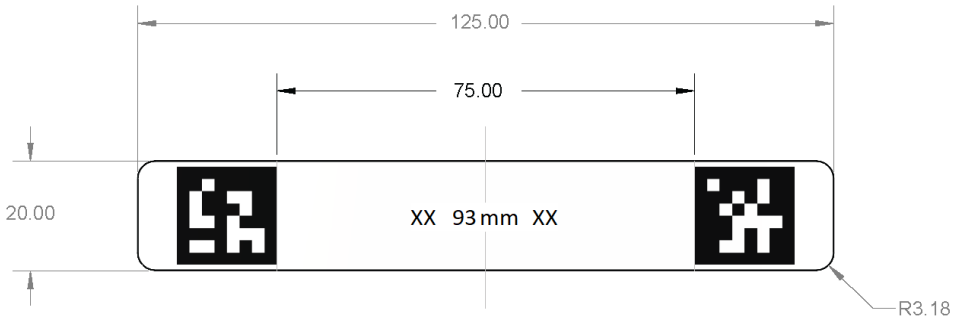
Label, Top Wide, Vision, Teach Plate
- Distance Center-to-Center of ArUco Square: 63 mm (displayed as "xx 63 mm xx" in example above)
- ArUco size: 9x9 mm
- Part #500373



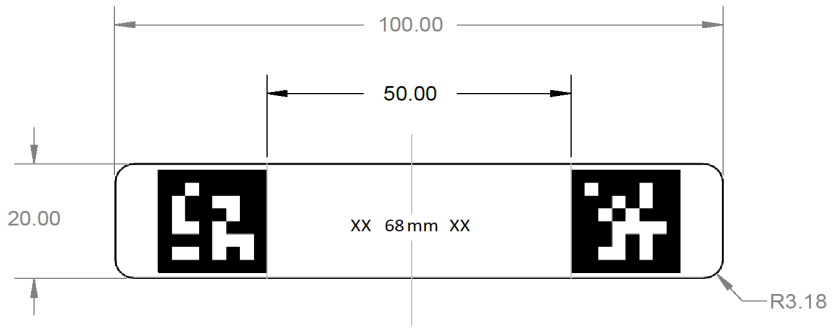
Label, Front Wide, Vision, Teach Plate
- Distance Center-to-Center of ArUco Square: 63 mm (displayed as "xx 63 mm xx" in example above)
- ArUco Size: 9x9 mm
- Part #500374



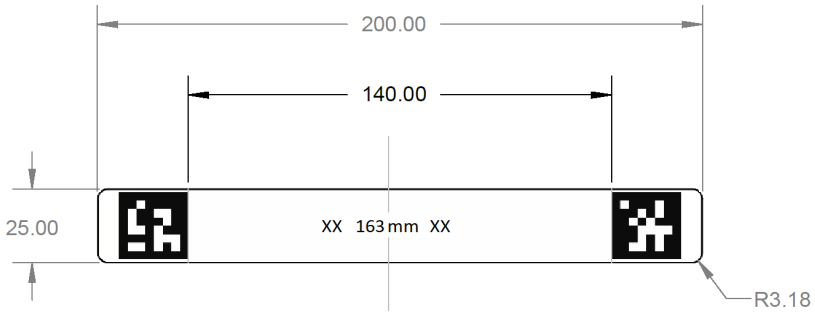
Label, Top Narrow, Vision Teach Plate
- Distance Center-to-Center of ArUco Square: 51 mm (displayed as "xx 51 mm xx" in example above)
- ArUco Size: 9x9 mm
- Part #500375



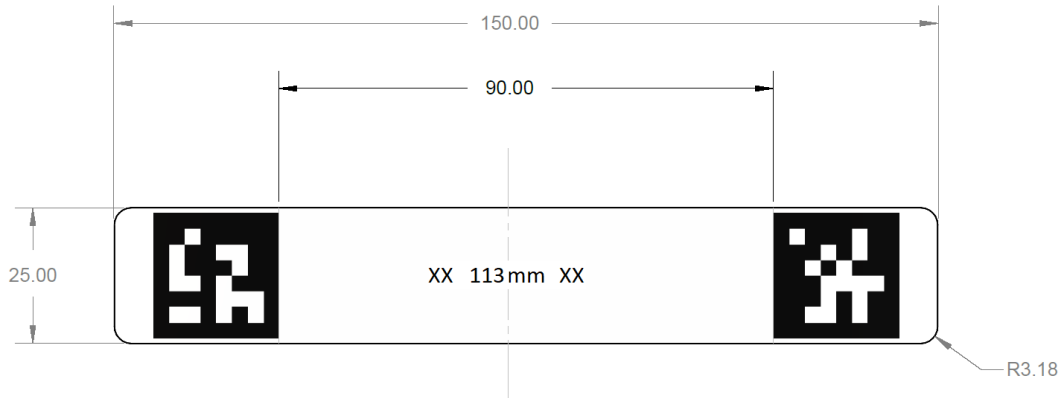
Label, Medium Wide, ArUco
- Distance Center-to-Center of ArUco Square: 93 (displayed as "xx 93 mm xx" in example above)
- ArUco Size: 18x18
- Part #620523



Label, Medium Narrow, ArUco, IntelliGuide
- Distance Center-to-Center of ArUco Square: 68 mm (displayed as "xx 68 mm xx" in example above)
- ArUco Size: 18x18 mm
- Part #620525



Label, Large Wide, ArUco, IntelliGuide
- Distance Center-to-Center of ArUco Square: 163 mm (displayed as "xx 163 mm xx" in example above)
- ArUco Size: 23x23 mm
- Part #620526



620527 - Label, Large Narrow, ArUco, IntelliGuide
- Distance Center-to-Center of ArUco Square: 113 mm (displayed as "xx 113 mm xx" in example above)
- ArUco Size: 23x23 mm
- Part #620527

ArUco Label Kits

Use ArUco label kits to get started with Auto-Teach.

PART NUMBER	KIT	QUANTITY IN EACH
620515-1	ArUco labels for SBS Plates	
500372	Teach Plate Label, Front Narrow	1
500373	Teach Plate Label, Top Wide	1
500374	Teach Plate Label, Front Wide	1
500375	Teach Plate Label, Top Narrow	1

PART NUMBER	KIT	QUANTITY IN EACH
620522-1	ArUco labels, Small	
500373	Teach Plate Label, Small Wide	12
500375	Teach Plate Label, Small Narrow	12

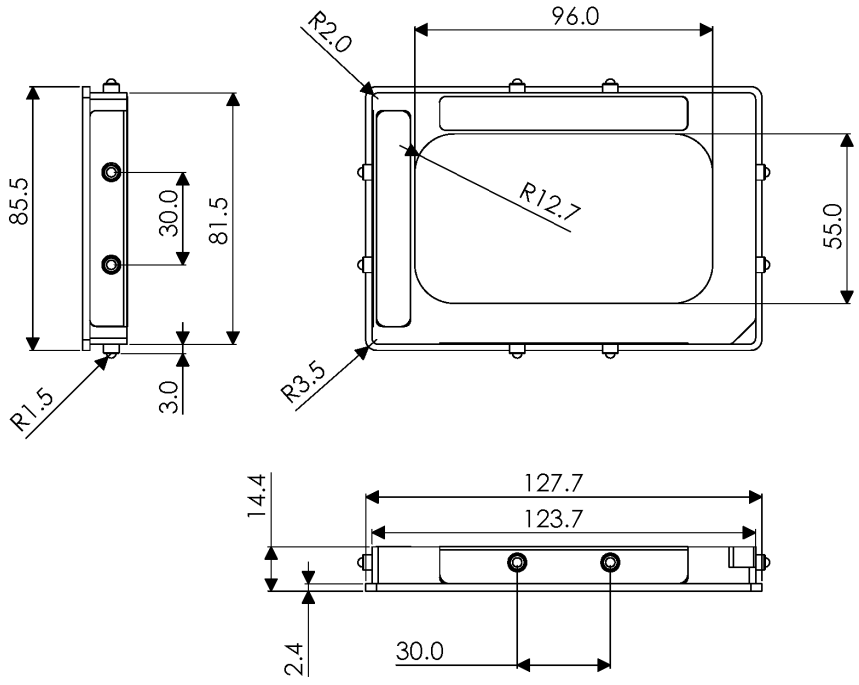
PART NUMBER	KIT	QUANTITY IN EACH
620528-1	ArUco labels, Medium	
620523	Teach Plate Label, Medium Wide	12
620525	Teach Plate Label, Medium Narrow	12

PART NUMBER	KIT	QUANTITY IN EACH
620529-1	ArUco labels, Large	
620526	Teach Plate Label, Large Wide	12
620527	Teach Plate Label, Large Narrow	12

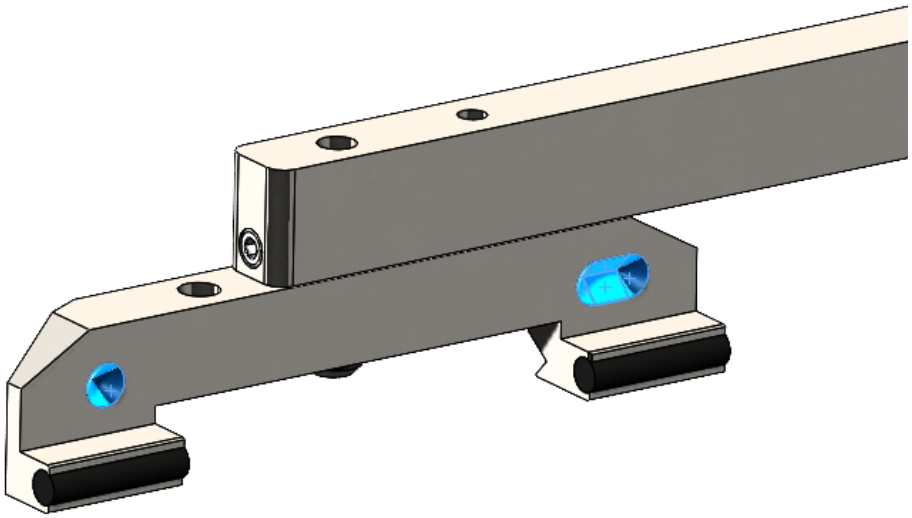
IntelliGuide Vision Gripper Teach Plate

The IntelliGuide Vision Gripper Teach Plate is used for teaching an entire SBS Plate Hotel via Vision. The eight (8) protruding M5 rolling ball tip set screws are designed to lock into the notches in the gripper fingers to provide a reliable grip for teaching hotel shelves where the plate cannot slip in the figures, which would create inaccuracies.

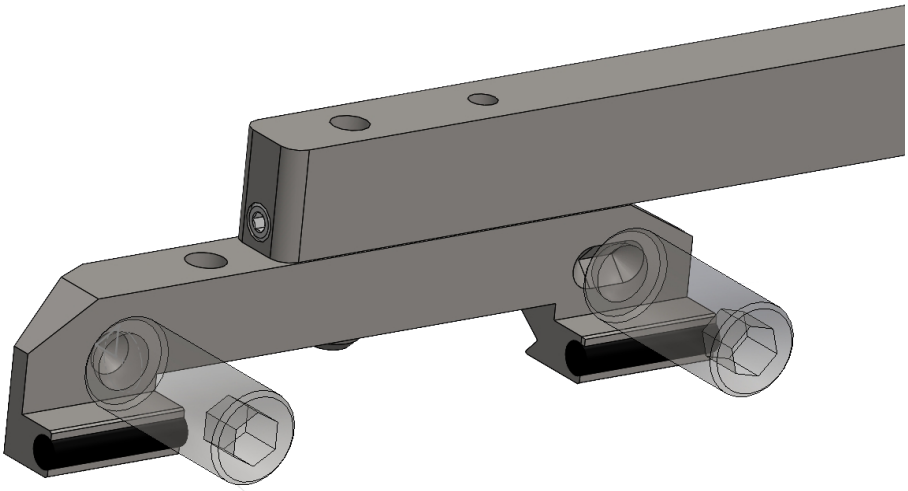
NOTE: All dimensions are in millimeters.



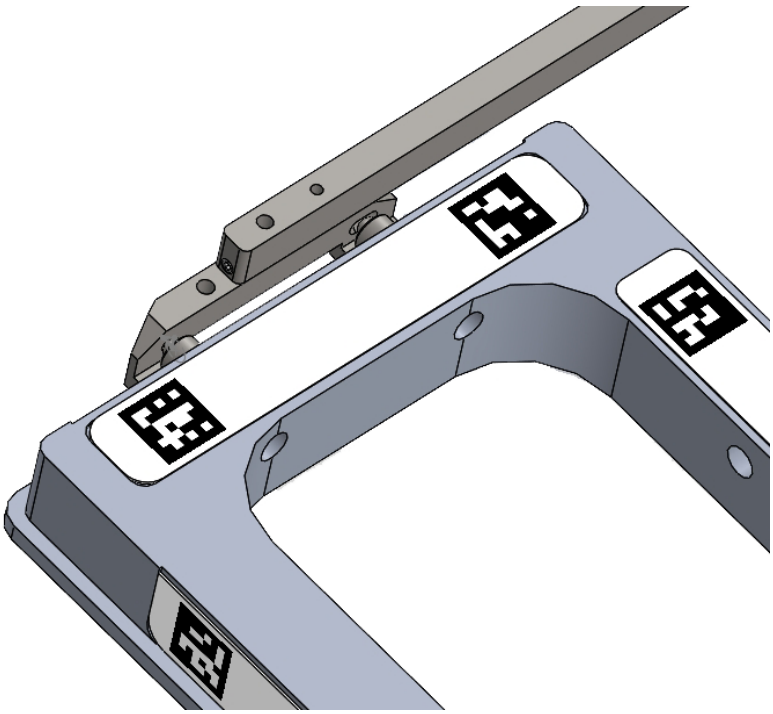
IntelliGuide Vision Gripper Teach Plate Dimensions



Recessed Holes on SBS Plate Gripper Fingers for Aligning w/Rolling Ball Tip Set Screws



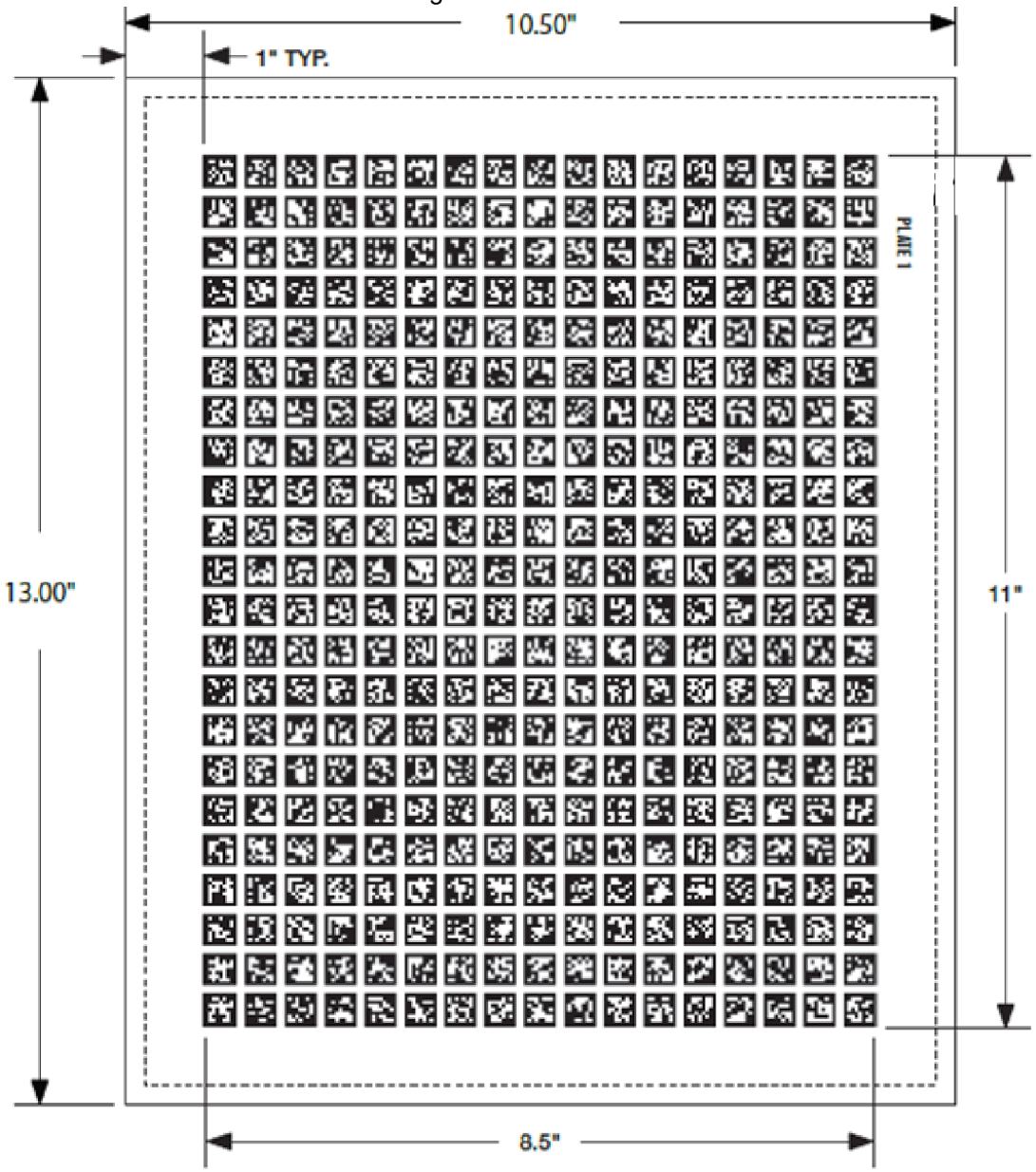
Ball Tip Set Screws in Recessed Holes on SBS Plate Gripper Fingers



Teach Plate with SBS Plate Fingers

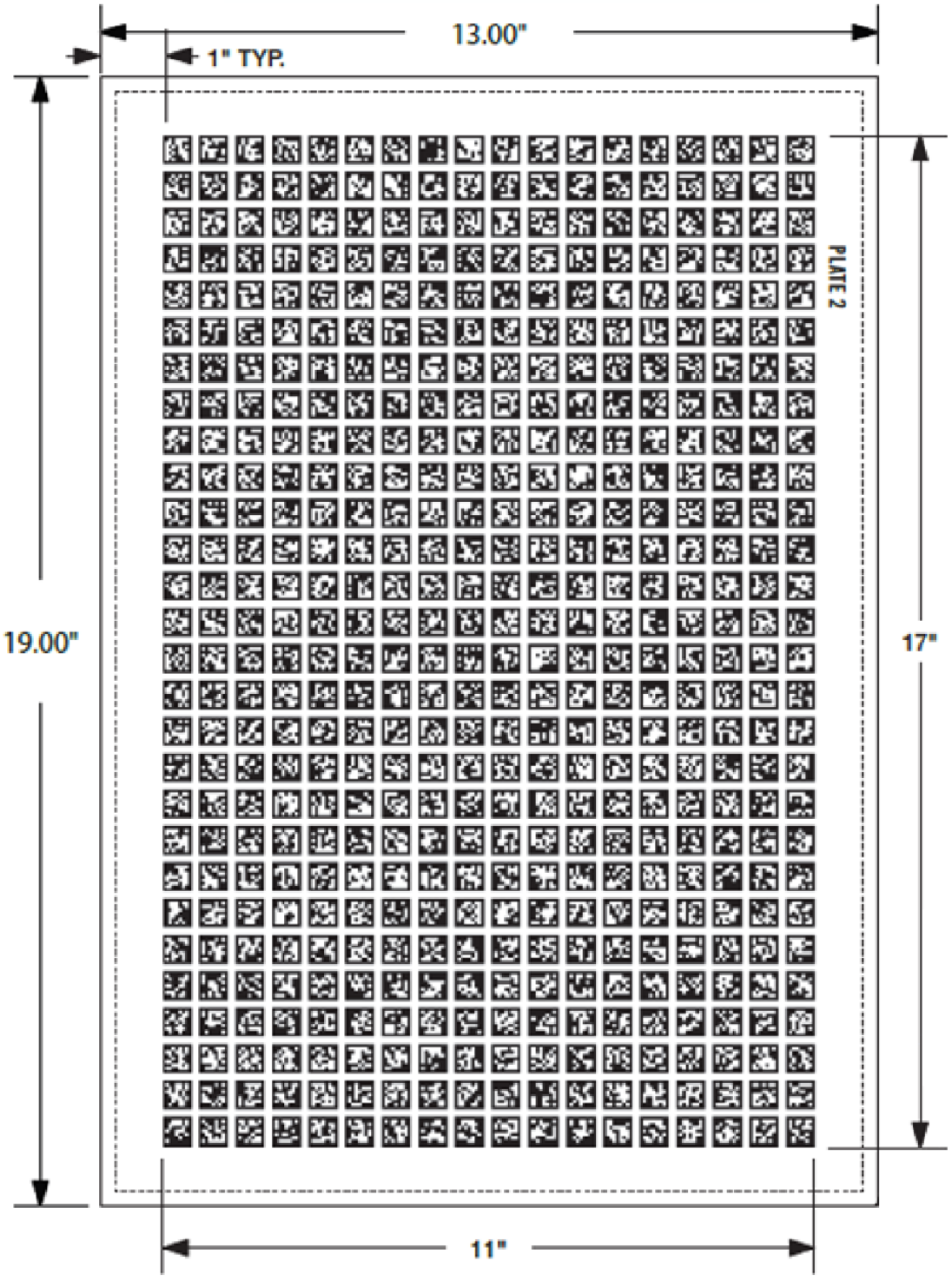
ArUco Calibration Targets

The 8.5x11 with 10 mm Calibration Target below is for use with Arm Reach under 700 mm.



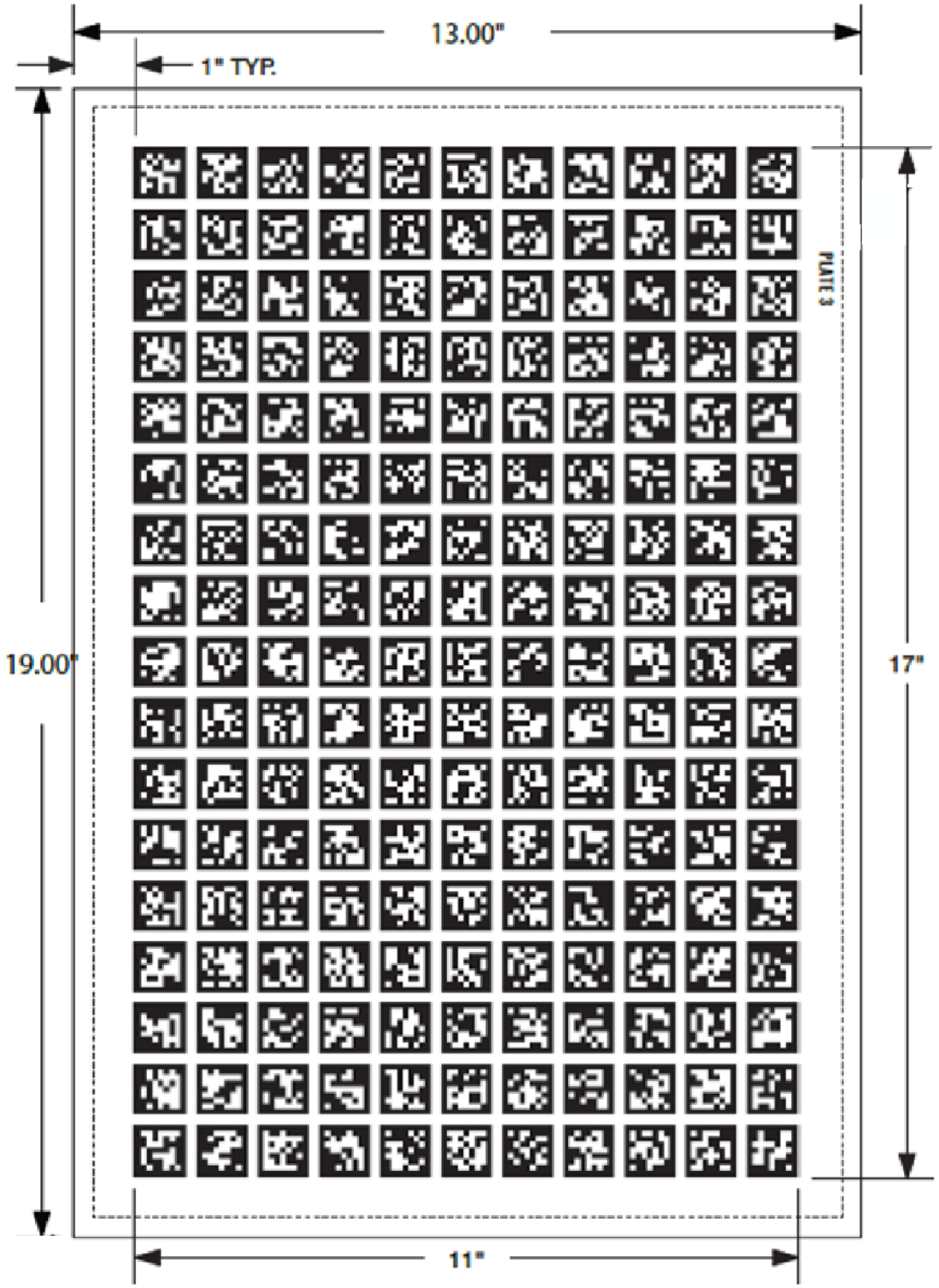
ArUco Calibration Target - 8.5x11 with 10.5 mm

The 11x17 with 12.5 mm Calibration Target below is for use with Arm Reach over 700 mm and with focal distances of 150 mm or less. (Factory default focal distance is 150 mm)



ArUco Calibration Target - 11X17 with 13 mm

The 11" x 17" with 22 mm Calibration Target below is for use with Arm Reach over 700 mm and with custom focal distances over 150 mm.



ArUco Calibration Target - 11x 17 with 22 mm

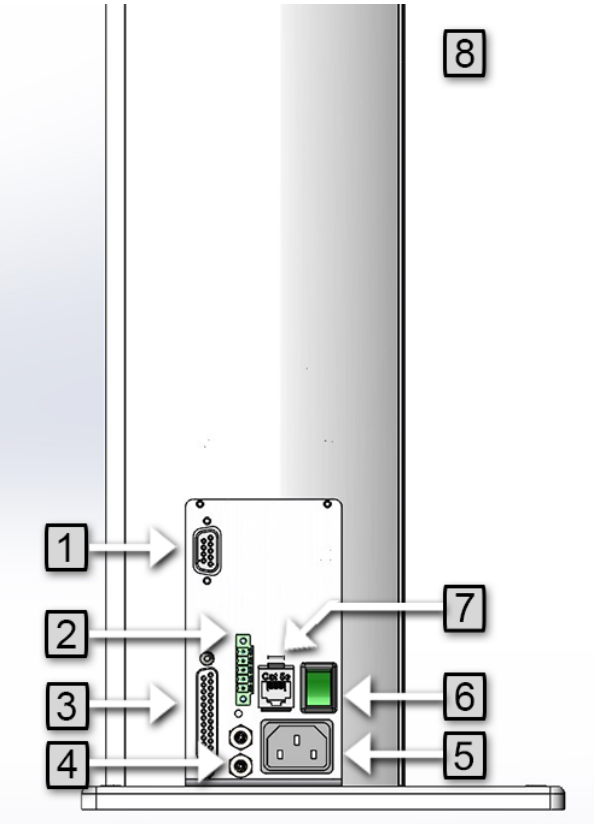
Product Numbers

Product Number	Product
PF0V-MA-00001	IntelliGuide v23
PF3V-MA-00001	IntelliGuide v60
620515-1	Kit, ArUco labels, SBS Plates
620522-1	Kit, ArUco labels, small
620528-1	Kit, ArUco labels, medium
620529-1	Kit, ArUco labels, large
620521-1	Teach Plate, with ArUco markers
620530-1	ArUco Calibration Target, 8.5x11, 10.5 mm
620531-1	ArUco Calibration Target, 11X17, 13 mm, small
620532-1	ArUco Calibration Target, 11x 17, 22 mm, large
397673	Plate Fingers for IntelliGuide v23

3. Operation

Connecting to the Robot

Plug in all required peripheral devices and interface connectors, such as the power cable (number 5 below) and the Ethernet connector (number 7 below) in this Facilities Panel diagram.

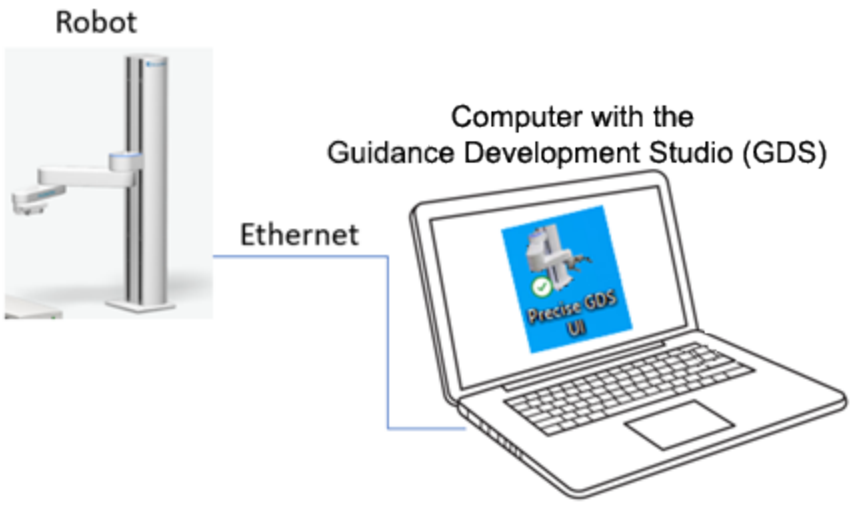


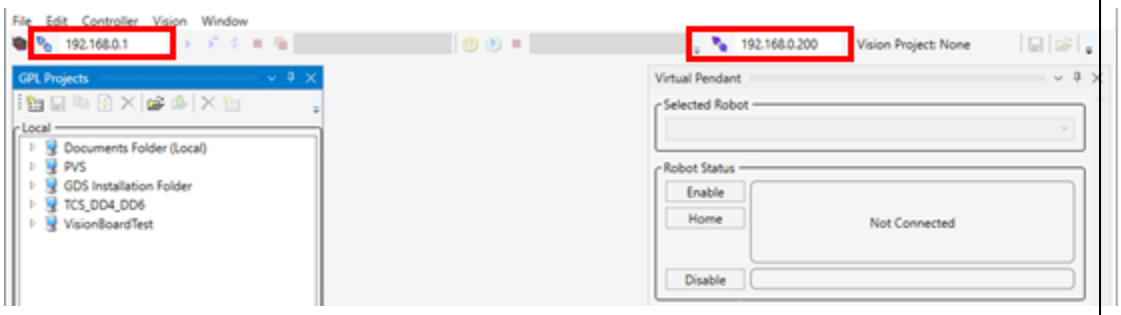
Facilities Panel, Key

Annotation	Name	Description
1	9 Pin D Sub Connector	RS-232 Serial Port, 24 VDC, for optional RS-232 devices. The ground can be used for the optional teach pendant.

Annotation	Name	Description
2	E-Stop Connector	E-Stop and Cell Interlock Signals. Required.
3	25 Pin D Sub Connector	GIO Module for connecting general digital inputs and outputs. See the robot manual for details.
4	Pneumatic Ports	For attaching air lines for optional pneumatic gripper.
5	Power Entry Module	For IEC plug. Contains dual fuse drawer.
6	Power Switch	Lighted power switch. Enable this last after all interfaces and power connectors are plugged in.
7	Ethernet Connector	Ethernet to computer cable. Required for communicating via the interface.
8	Status Light	A blinking light indicates the normal state, a solid light indicates an error, and no light indicate a possible issue with the controller.

To connect the computer to the robot and display the IntelliGuide Vision Gripper interface, perform the following steps.

Step	Action
1.	Use an Ethernet cable to connect the computer to the Ethernet port of the robot.  ***NOTE:*** *For more information about the Guidance Development Studio (GDS), refer to the GDE/GDS user manual.*

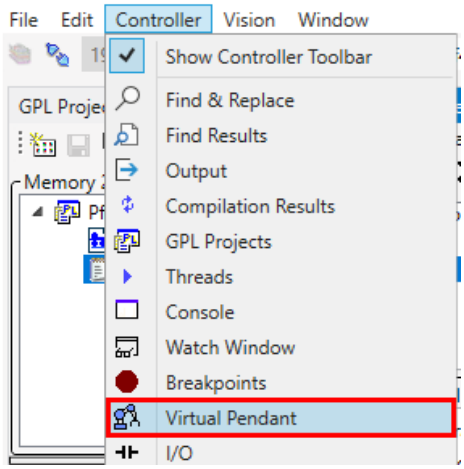
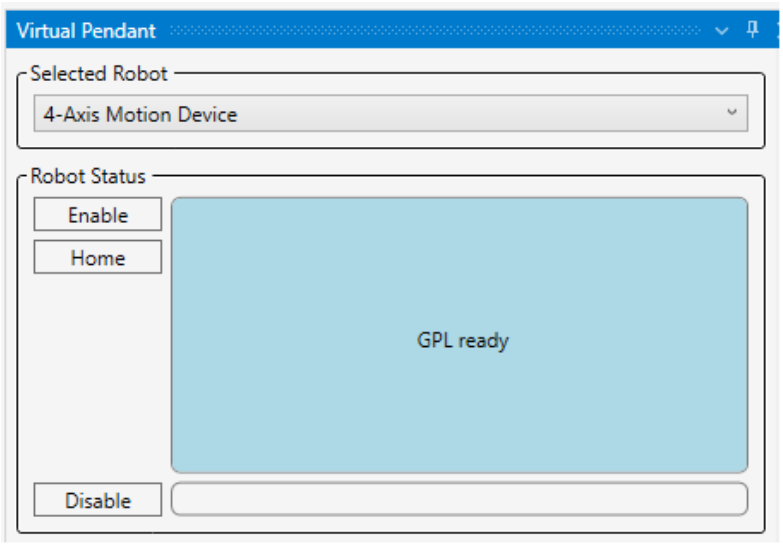
Step	Action
2.	Start the Guidance Development Studio (GDS), and enter the IP addresses to establish communication with the robot and the remote vision server. The default IP address for the robot is 192.168.0.1. The default IP address for the vision server is 192.168.0.200. Click **Connect**. ***NOTE:*** *The robot and the computer with installed GDS must be on the same network.* 

Enabling Power and Homing the Robot

Homing a robot requires initializing or resetting it to a known reference point within its workspace, often termed the "home position" or "home location." This process involves moving the robot to a predefined starting position, aligning its end-effector with a specific target, and calibrating its sensors and actuators for accurate movement and positioning, whether by manual controls or software commands.

For this manual, we assume that the factory calibration is performed. In this case, homing the robot means only clicking the **Home** button so the home offsets are applied if the user power cycled the robot.

Perform the following steps to enable power and home the robot.

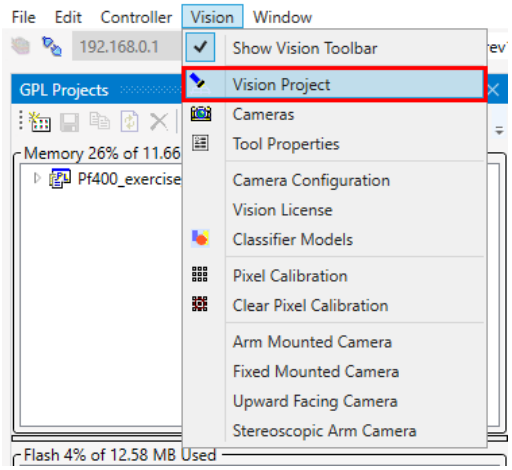
Step	Action
1.	With the robot and laptop connected and GDS running, in GDS, open the **Controller** drop-down menu and select **Virtual Pendant**. 
2.	The Virtual Pendant displays. Click **Enable**, which enables the motor power. After the power is enabled, click **Home** to home the robot.  **CAUTION** **Robot Movement** Depending on the robot's type, it may move during homing. Be aware of the robot's movements, and ensure nothing is obstructing the robot's motion during the homing process. 

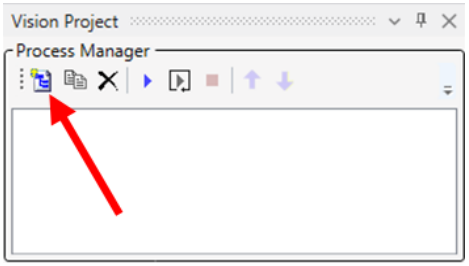
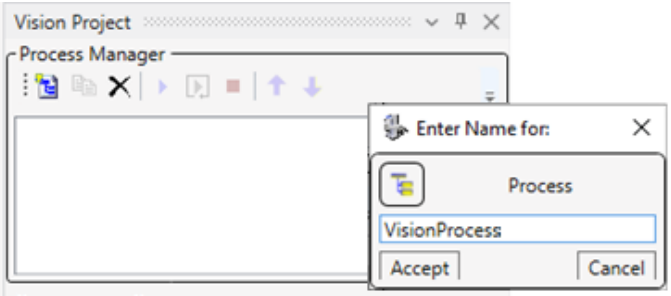
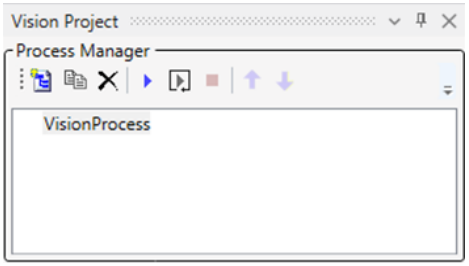
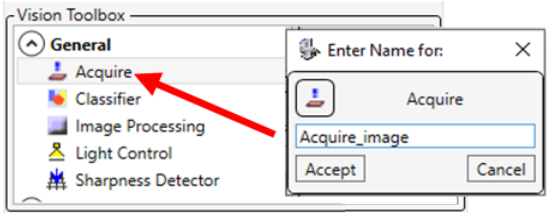
Creating an IntelliGuide Vision Project

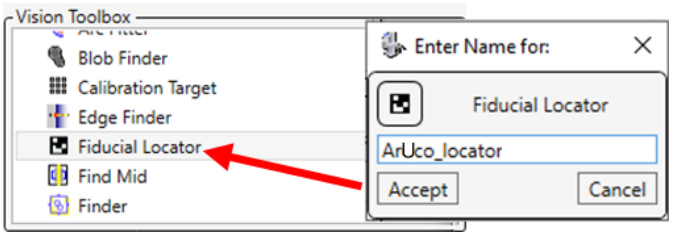
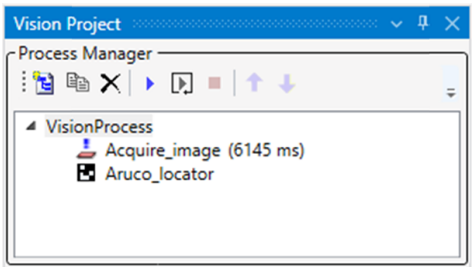
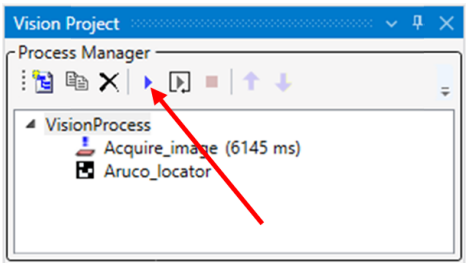
This section will take you through the steps of creating an IntelliGuide vision project and process. The procedure involves acquiring images and analyzing ArUco data, if it is present in the image, to test vision processes before integrating them into a robot's operational workflow. It's a preparatory step to ensure the vision system functions correctly before deploying it in practical robot operations.

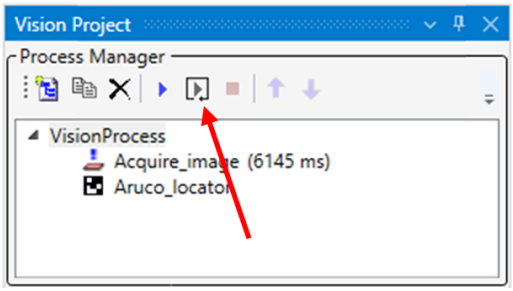
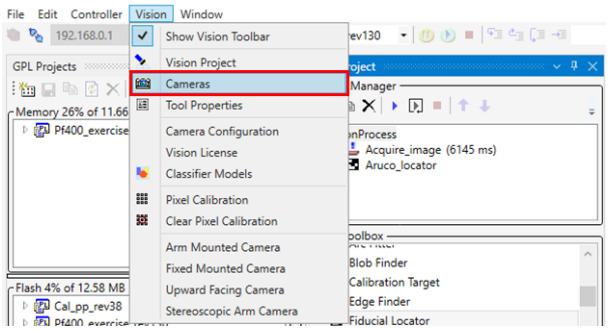
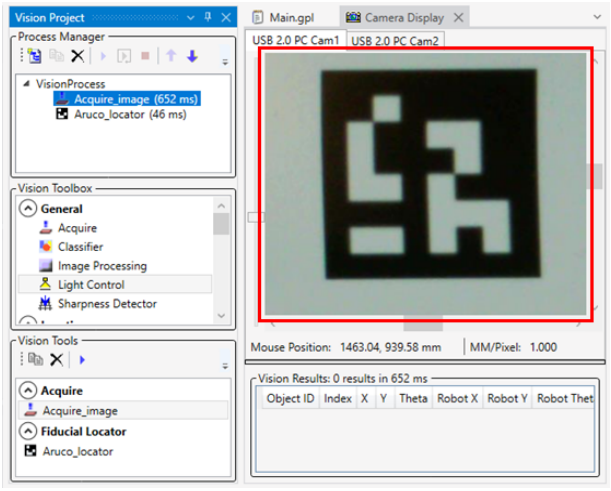
In most cases, only a single vision process is executed in order to perform the complete machine vision task. Typically, this vision process will take a picture and then utilize vision tools to locate a part and validate some key features or dimension. However, if a more complex machine vision operation is required, you can execute multiple vision processes, which can be stored in a *Vision Project*.

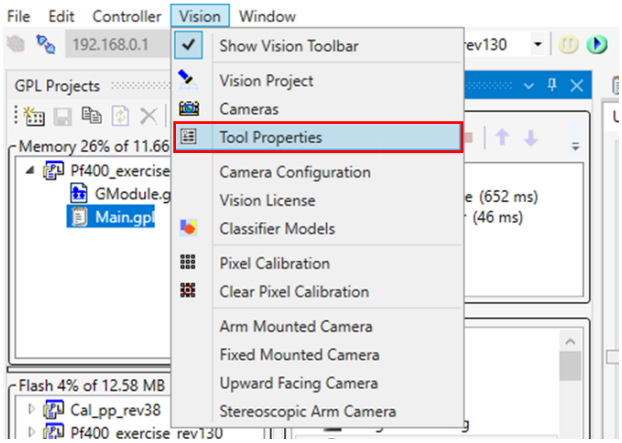
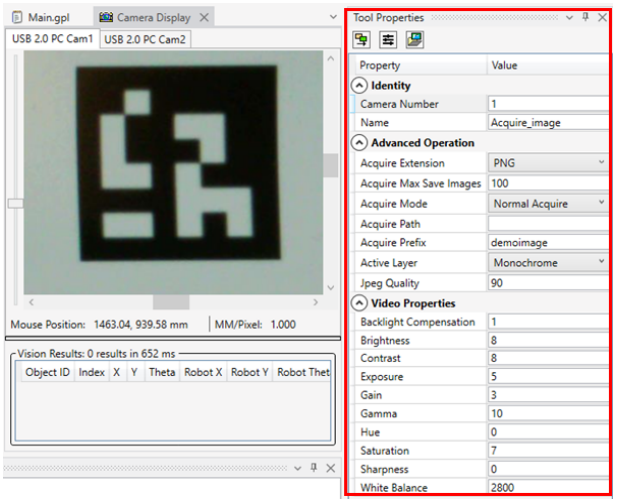
To create an IntelliGuide vision project, perform the following procedure.

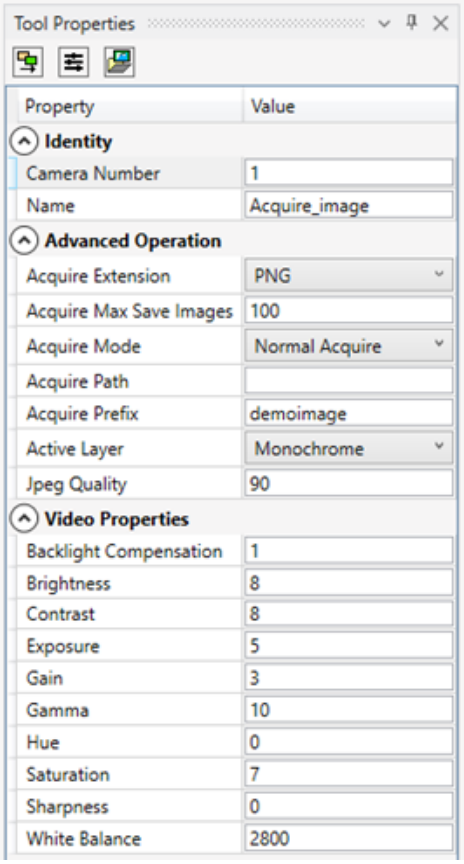
Step	Action
1.	In GDS top menu, open the **Vision** drop-down menu and select **Vision Project** to display the Vision Project window. 
2.	The Vision Project section will contain three windows: • **Process Manager**: Build and run processes. • **Vision Toolbox**: Select from various Vision Tools. • **Vision Tools**: User specific vision tools for your processes.

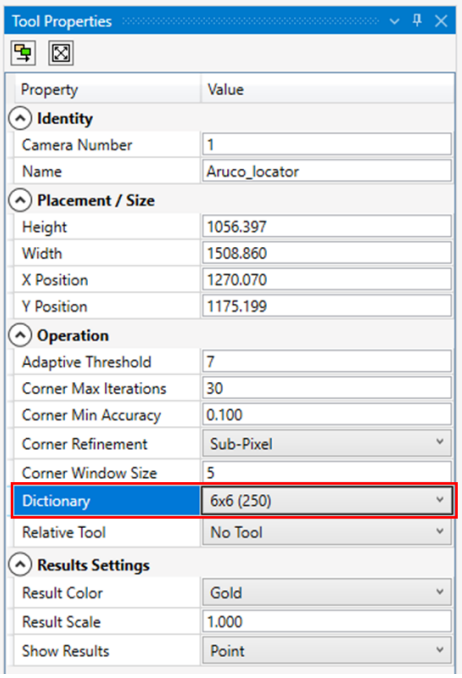
Step	Action
3.	In the **Process Manager** window, click **Create a new process** . 
4.	In the **Enter Name For:** popup window, enter a process name, any name you want, and click **Accept**. 
5.	The process name will then display in the **Process Manager** window. 
6.	In the **Vision Toolbox** window, double-click the **Acquire** vision tool to create a new vision tool. In the popup window enter any name and click **Accept**. This tool will enable the camera to take a snapshot of whatever it sees and display this image. 

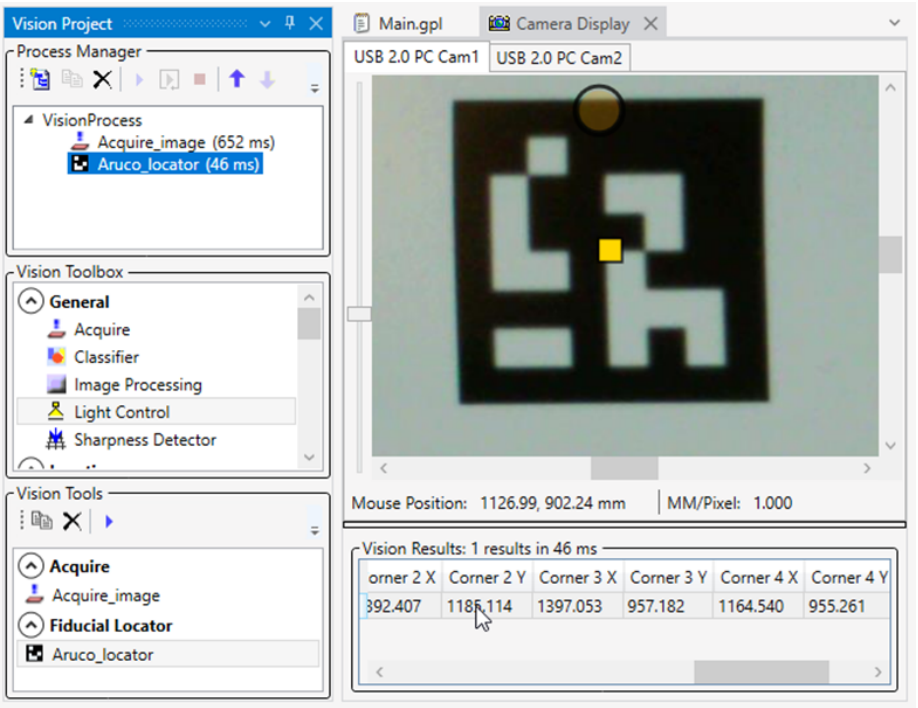
Step	Action
7.	In the **Vision Toolbox** window, double-click **Fiducial Locator**, and enter any name into the popup window. A fiducial locator detects a marker in the camera's field of view. It is used as a point of reference to help determine location. Click **Accept** when you are finished. 
8.	Drag the two newly created vision tools into the **Process Manager** window. 
9.	In the **Process Manager** window, click**Run the selected process** to test the image acquisition and the ArUco locator tools. This will execute the vision process by acquiring a new image and applying the associated vision tools. The process will run through once. ***NOTE:*** *The tools will run sequentially in the order they are listed, from top to bottom.* 

Step	Action
10.	You can also select **Run the selected process in continuous mode**, which will loop the process until you stop it. 
11.	Open the **Vision** drop-down menu and select **Cameras** to display the acquired image and the processed results. ***NOTE:*** *The acquired image is a snapshot the camera took of what it sees.* 
12.	The image displays. In this example, the ArUco displays what the camera sees. The results, camera coordinates, and robot coordinates, are displayed in the window below the image. 

Step	Action
13.	To adjust the vision tool properties, open the **Vision** drop-down menu and select **Tool Properties**. 
14.	On the right side of the screen, the **Tool Properties** window will display the properties of the acquired image. 

Step	Action
15.	You may need to adjust the acquisition parameters in the Tool Properties window based on the environment where the robot is located. The default parameters are only used for reference and a starting point when setting up the vision application.. The default settings for the Image Acquisition tool are shown below.  Tool Properties Property / Value **Identity** Camera Number: 1 Name: Acquire_image **Advanced Operation** Acquire Extension: PNG Acquire Max Save Images: 100 Acquire Mode: Normal Acquire Acquire Path: Acquire Prefix: demoimage Active Layer: Monochrome Jpeg Quality: 90 **Video Properties** Backlight Compensation: 1 Brightness: 8 Contrast: 8 Exposure: 5 Gain: 3 Gamma: 10 Hue: 0 Saturation: 7 Sharpness: 0 White Balance: 2800

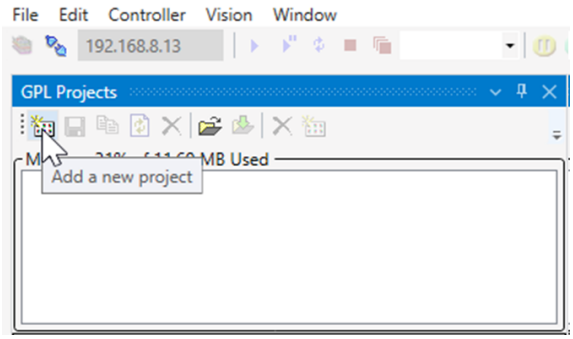
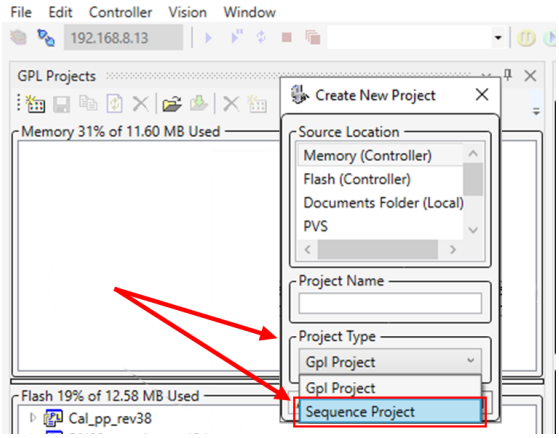
Step	Action
16.	Use the correct **ArUco Dictionary** for setting up the Fiducial Locator tool. For each teach plate that Brooks supplies, a 6x6 ArUco dictionary is used. ***NOTE:*** *If you change the dictionary, make sure to select the correct one. There are few different ArUco dictionaries, including:* • *4x4 - contains 50 ArUco markers* • *5x5 - contains 100 ArUco markers* • *6x6 - contains 250 ArUco markers* • *7x7 - contains 1000 ArUco markers* 

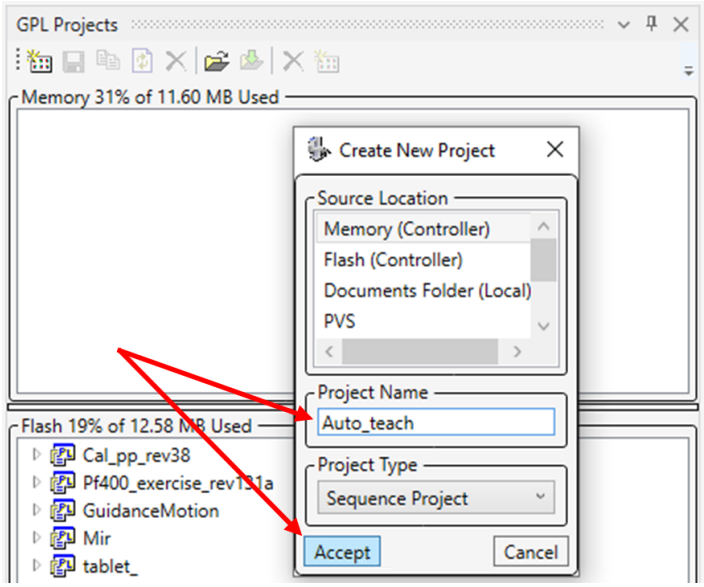
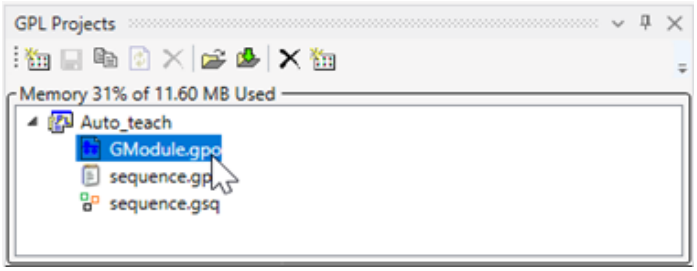
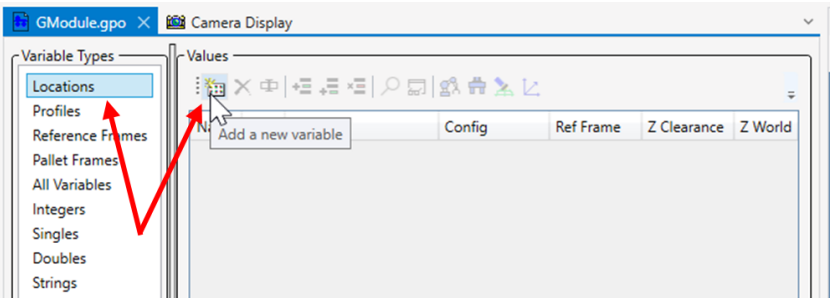
Step	Action
17.	If the **Acquire** and **Fiducial** tools are configured correctly, the image should look clear and the results from the tool will be displayed when the user selects the vision tools. 

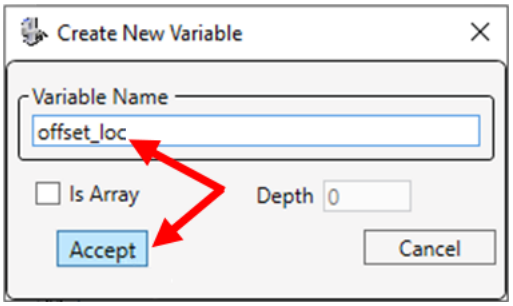
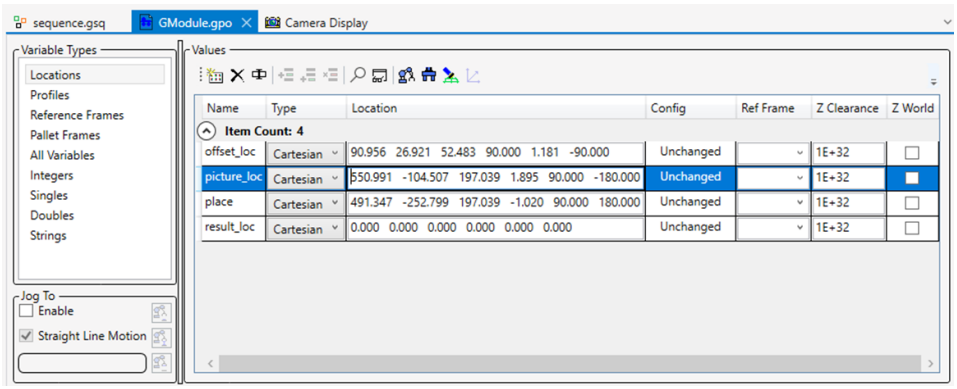
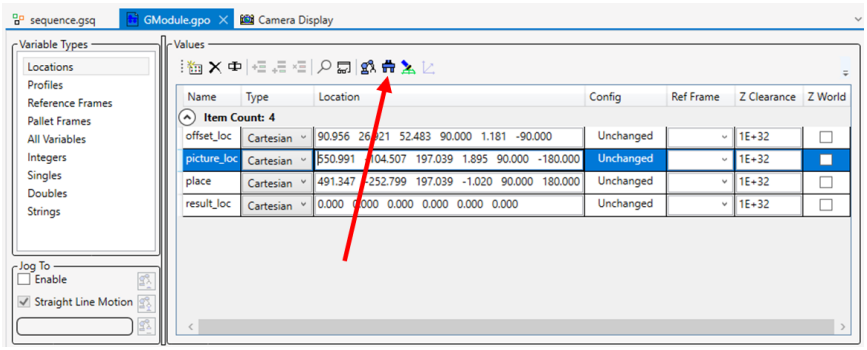
Creating an IntelliGuide Vision Offset

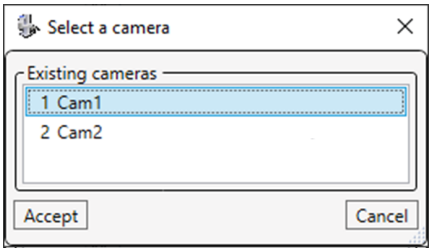
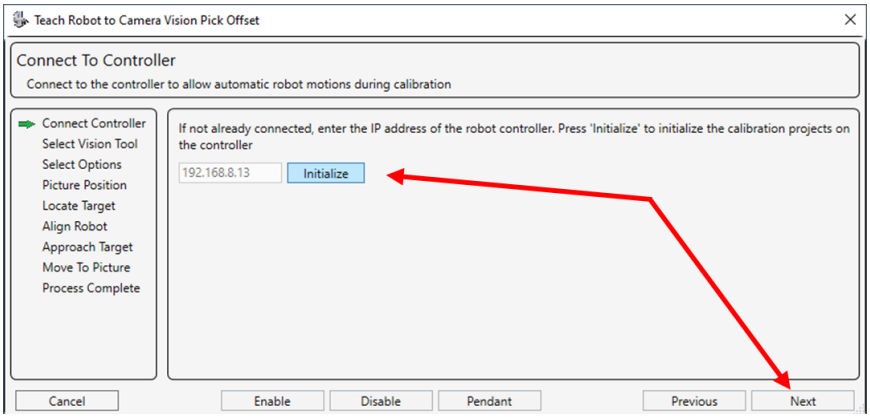
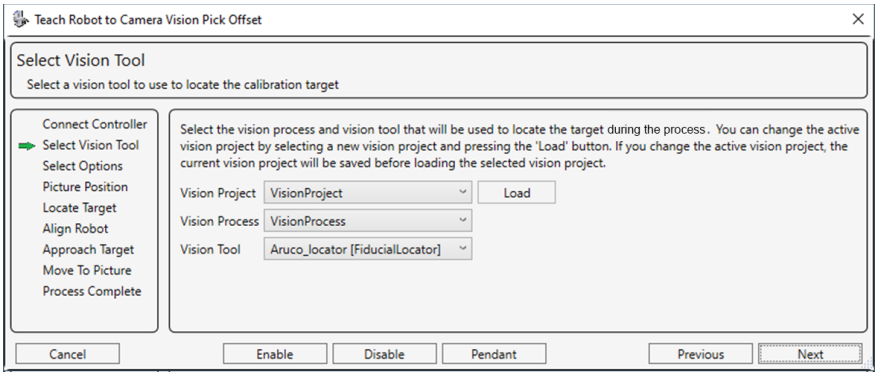
Processing images identifies fiducial markers and calculates a midpoint. However, this alone isn't enough for the robot. A vision offset guides the robot's movement from the midpoint to pick up the object, ensuring accurate interaction.

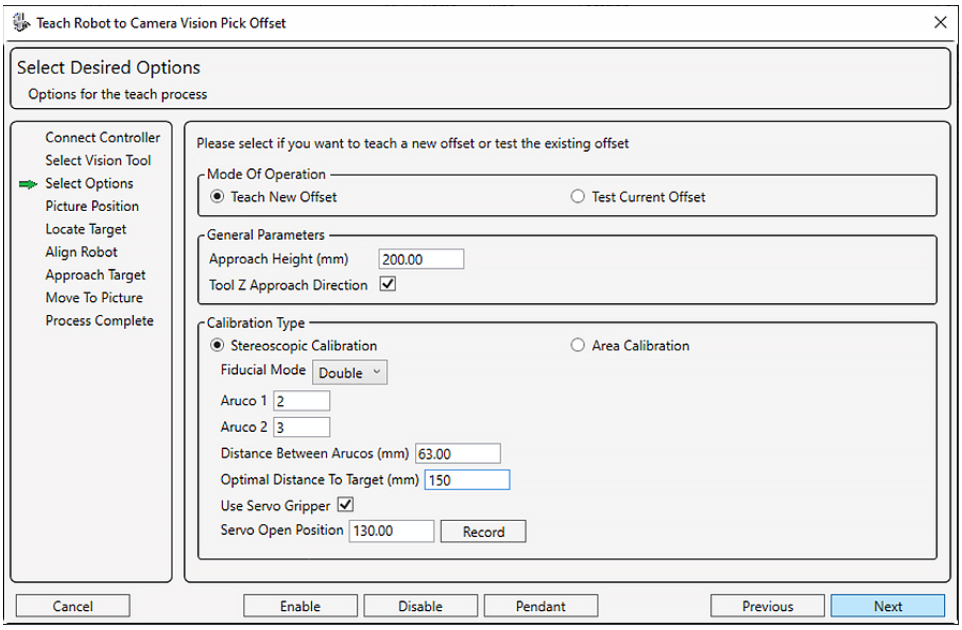
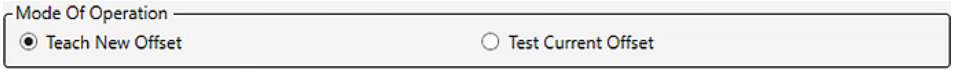
Perform the following procedure to create an IntelliGuide vision offset.

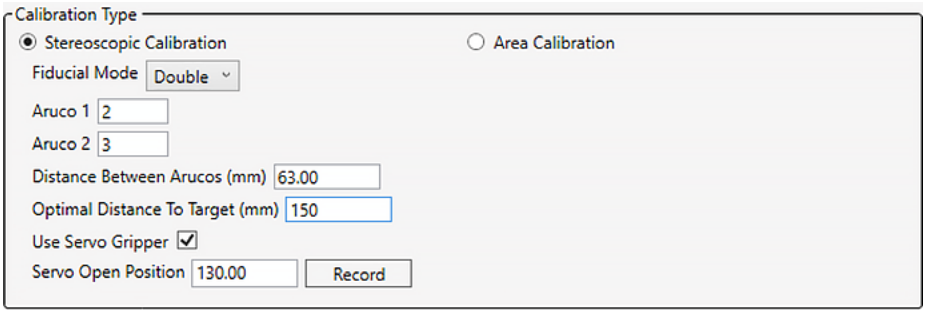
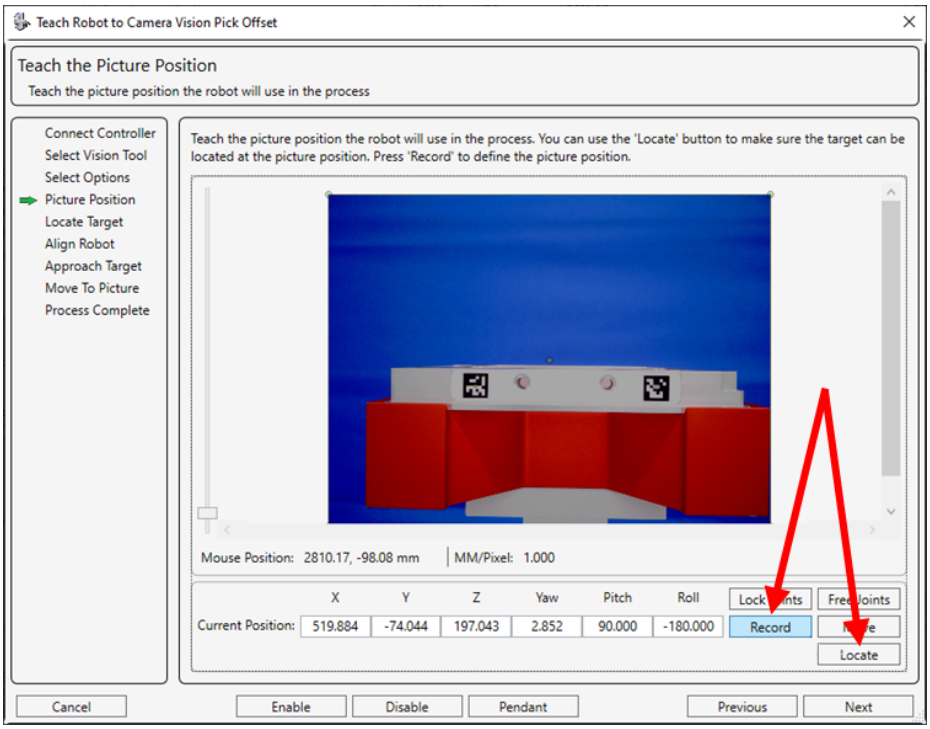
Step	Action
1.	In the **GPL Project** window, click **Add new project** to create a project. 
2.	In the Create New Project popup window, open the **Project Type** drop-down menu and select **Sequence Project**. 

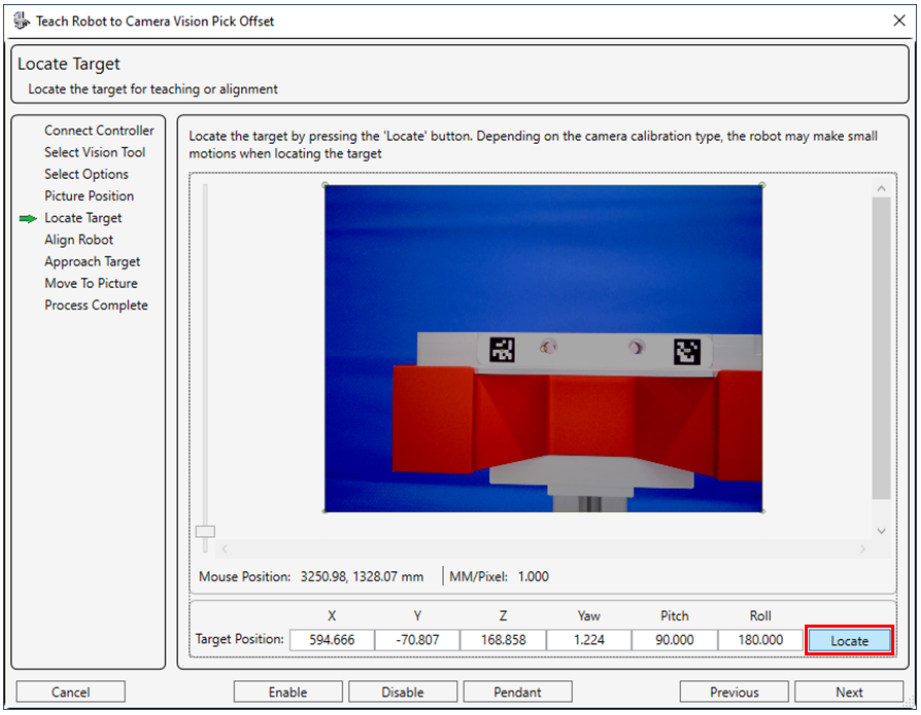
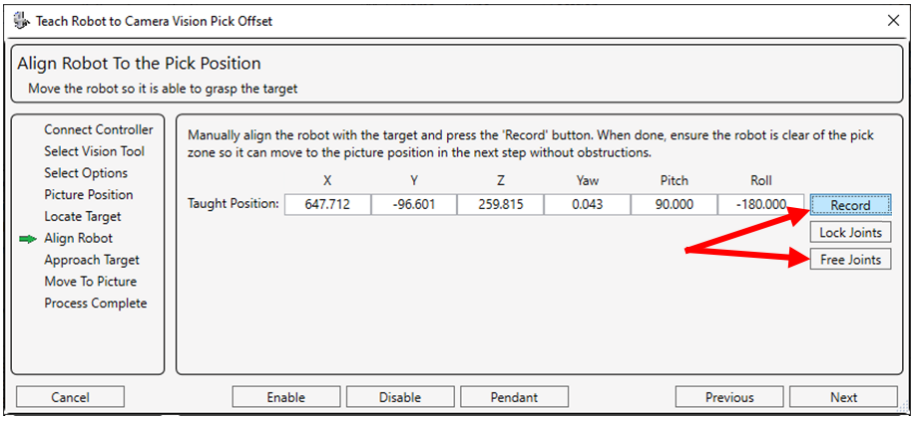
Step	Action
3.	Add a **Project Name** for the project, any name, and click **Accept**. 
4.	In the **Auto_teach** window, double-click on **GModule.gpo** to add and edit location. 
5.	In the **GModule.gpo** window, select **Locations** from the list of variable types, and click **Add new variable** to add a location. 

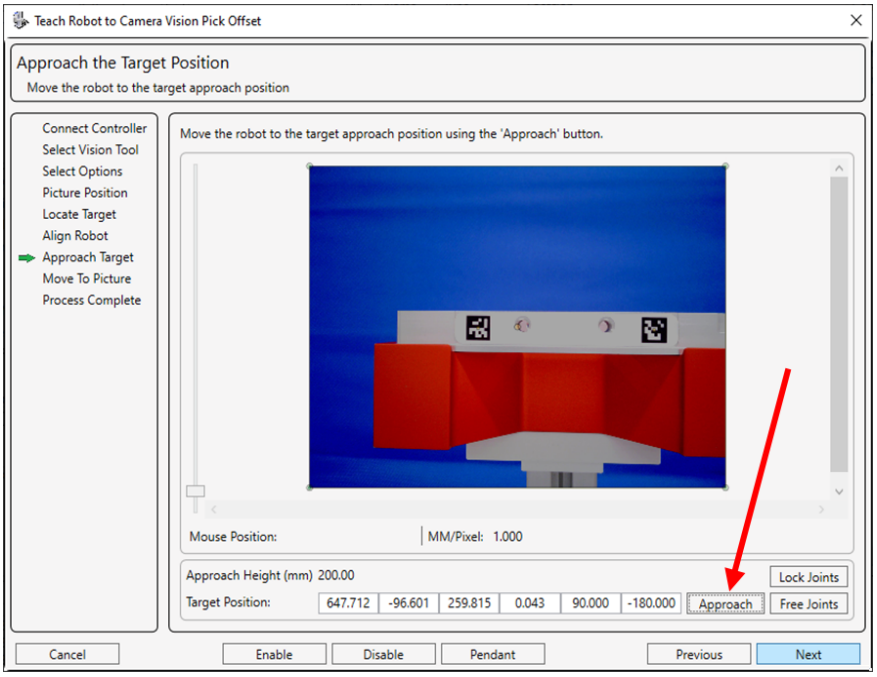
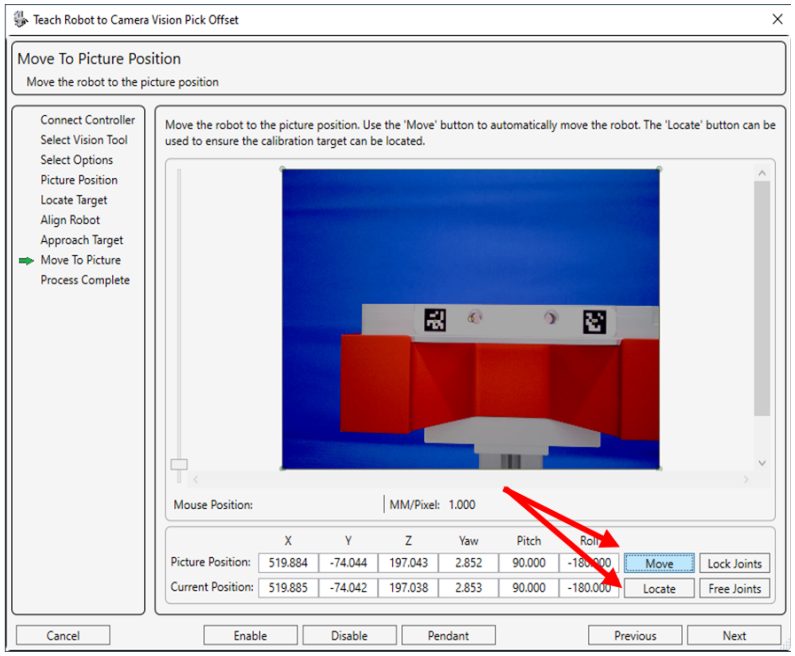
Step	Action
6.	In the **Create New Variable** popup window, add a **Variable Name** for the location and click **Accept**. 
7.	Repeat the preceding steps to add a few more locations. 
8.	To access the **Vision offset wizard**, click the **Teach vision pick offset** button in the **GModule.gpo** window. 

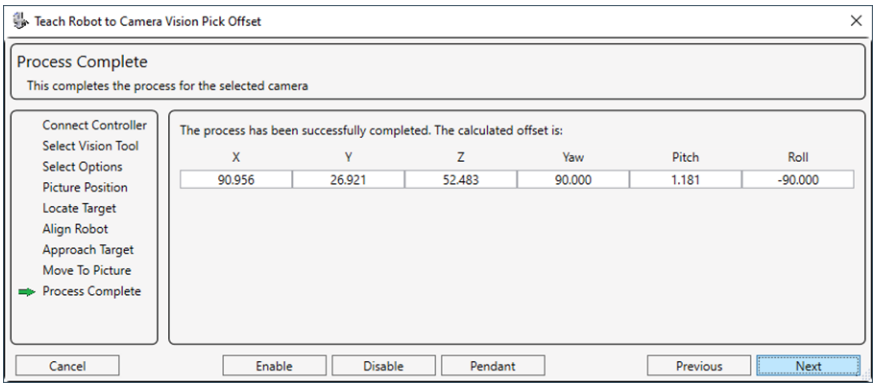
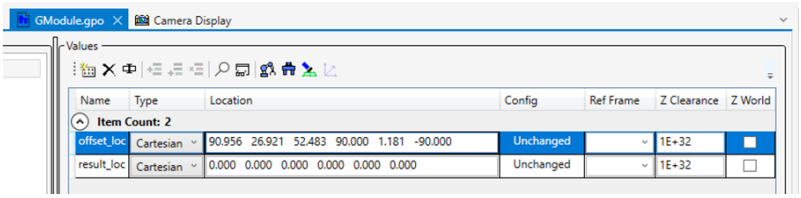
Step	Action
9.	In the **Select a camera** popup window, select the camera number (for this example, you will use camera 1, the front camera), and click **Accept**. 
10.	In the next window, click the **Initialize** button to load the required system files and initialize the vision system, then click **Next**. 
11.	In the Select a Vision Tool window, load and select the related **Vision Project**, **Vision Process**, and **Vision Tool**. Click **Next** when you are finished. ***NOTE:*** *Be specific. If you have multiple vision projects, the chosen tools are crucial for the offset's accuracy. In this case, for example, the ArUco locator tool is required to detect the offset effectively.* 

Step	Action
12.	Make selections on the **Select Desired Options** page. 
13.	In the **Mode of Operation** section of the options page, select the option for **Teach New Offset** or **Test Current Offset**. 
14.	In the **General Parameters** section, define the safe approach height. ***NOTE:*** *Safe approach height refers to the distance between the robot's gripper and the target object, ensuring that the gripper's fingers do not collide with the target during image acquisition. It allows the robot to have clear visibility of the target while avoiding any potential collisions during the picking process.* 

Step	Action
15.	In the **Calibration Type**, specify the Fiducial mode, single or double. This example shows double ArUco detection. Define the ArUco numbers, the distance between the fiducial markers, and the optimal distance to the target. Define the servo open position, how much the gripper fingers should open in order for the gripper to safely go around the target. When you are finished, click **Next**. 
16.	In the Teach the Picture Position window, click **Record** to save the current location that will be used to take a picture of the teach plate with the two ArUcos labels. The location should be recorded so the two ArUcos are in the field of view, and the distance matches the originally configured optimal distance of 150 mm. Click **Locate** to take the image and confirm that the location is appropriate for the operation. Click **Next** when you are finished. 

Step	Action
17.	In the Locate Target window, click **Locate**. This is an automated operation, and the robot will enable power and move so that it can take stereo images of the target. Click **Next** when you complete the operation. 
18.	In the Align Robot to the Pick Position window, free the joints by clicking **Free Joints** and aligning the end effector with the target to be picked. Click **Record** when the end effector is perfectly aligned. This is critical step for setting up a proper offset. Click **Next** when you are finished. 

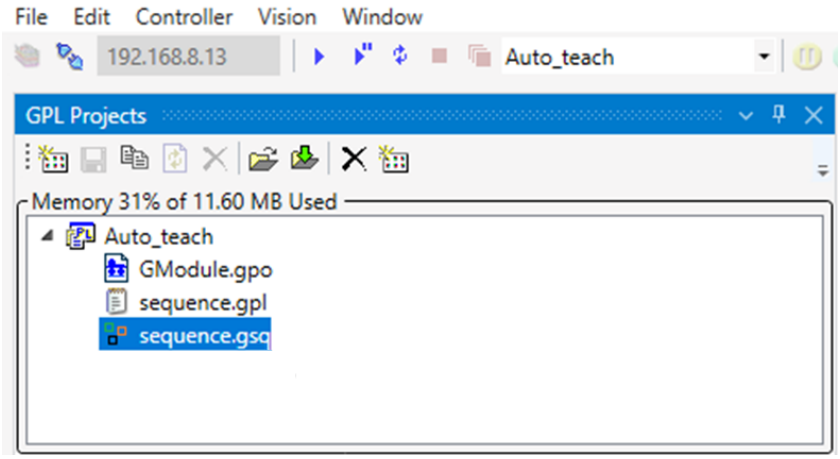
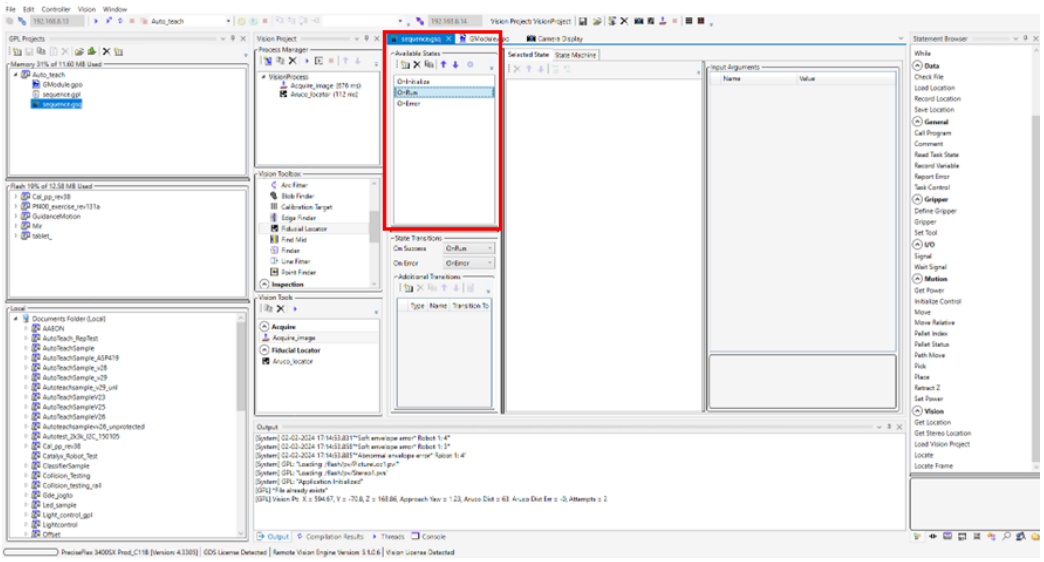
Step	Action
19.	In the Approach the Target Position window, click **Approach** to approach the target. The robot will move and approach the target. Click **Next** when you are finished. 
20.	In the Move to Picture Position window, click the **Move** button to move to the picture location. At this stage, you can use **Locate** to ensure the target can be located and the label is in the camera's field of view. Click **Next** after you complete the motion. 

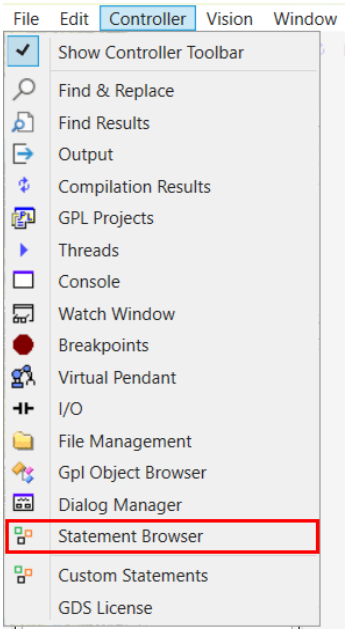
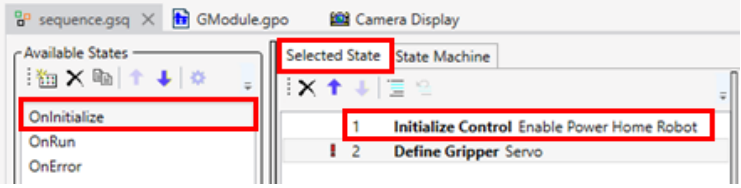
Step	Action
21.	After you click Next, the Process Complete window will display. 
22.	Confirm that the offset was recorded in the selected location variable in the GModule.gpo window. 

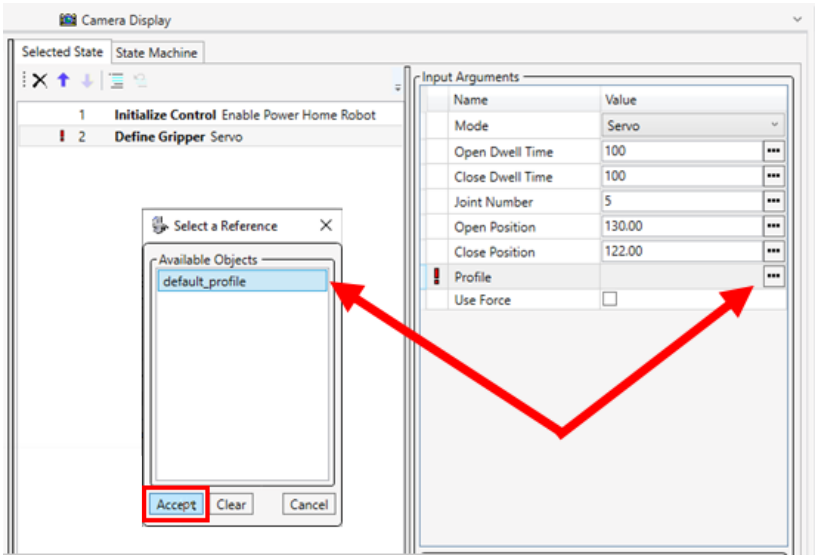
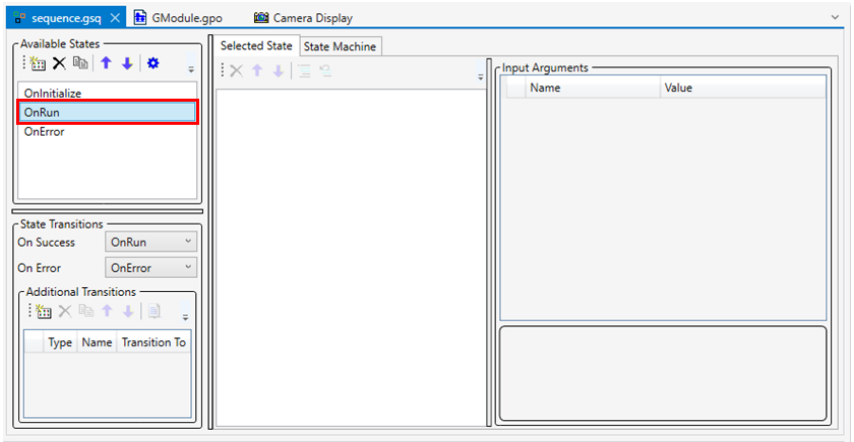
Auto-Teach and Pick and Place

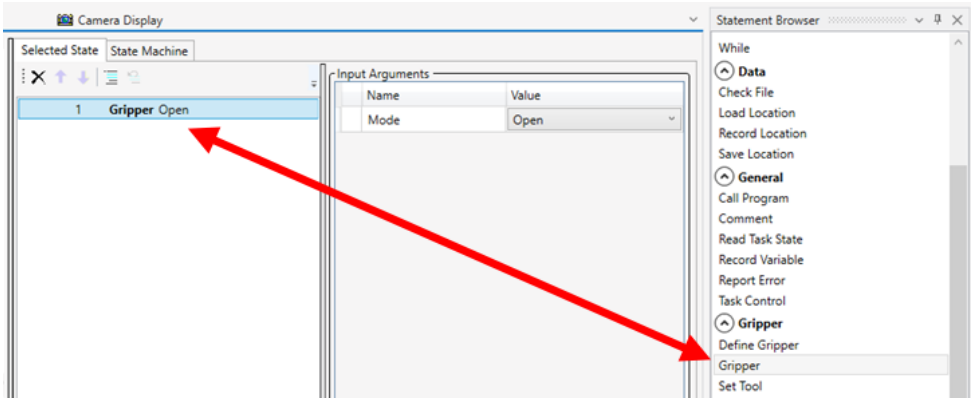
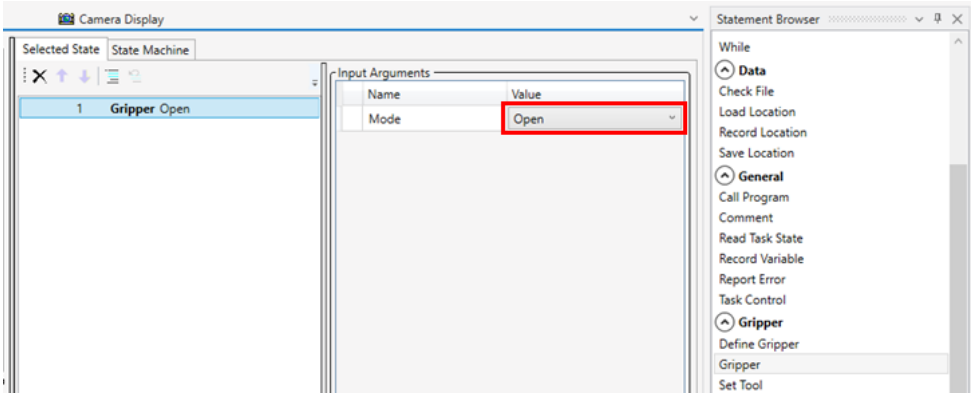
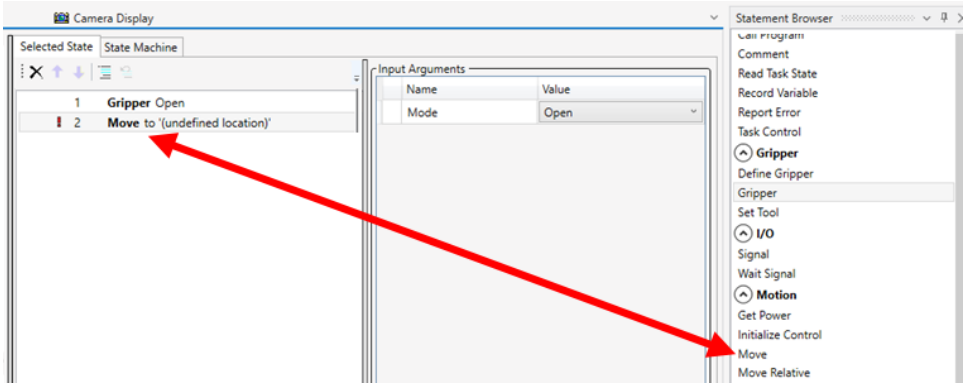
In the Auto-Teach process, you teach the robot to locate an object. In the Pick and Place process, you teach the robot to grab the object it located and do something with it. You do this with a simplified form of programming, where you drag and drop pre-programmed commands into a sequence of steps.

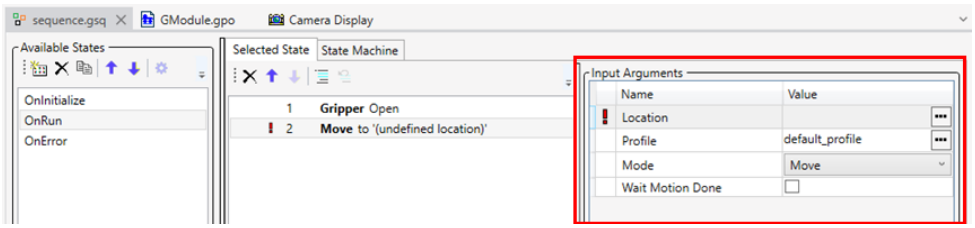
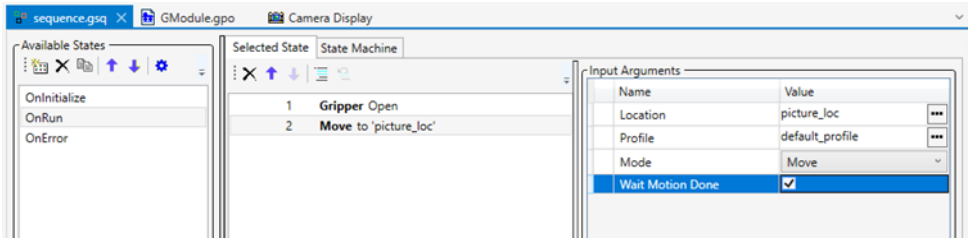
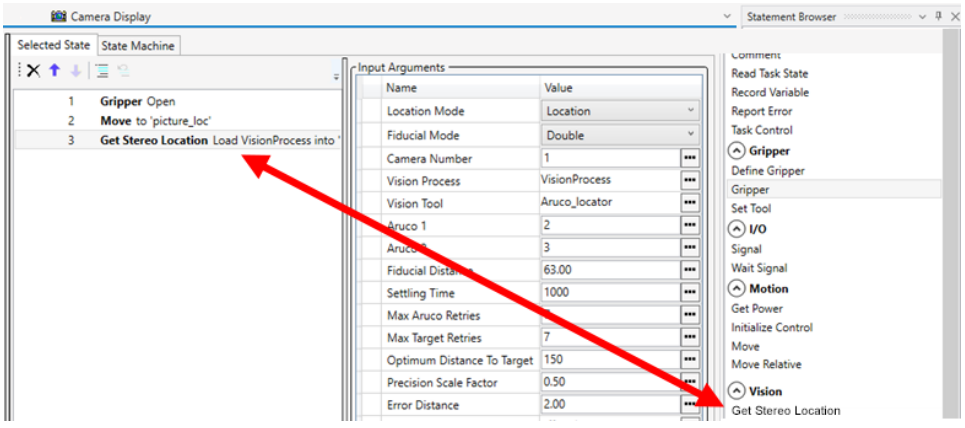
Perform the following procedure.

Step	Action
1.	Double-click on the sequence project you constructed in Creating an IntelliGuide Vision Offset. 
2.	After selecting the sequence project, the edit panel will display the Available States. From here, you can add statements to the project. 

Step	Action
3.	If the Statement Browser window is not displaying, open the Controller drop-down menu and select **Statement Browser** to enable it. 
4.	When the default sequence is created, it comes pre-configured with three default states: • OnInitialize: the intial state where the robot needs to initialize • OnRun: the secondary state where the robot will initiate the operation • OnError: the state where the robot will end up in case of an error. You have the option to edit statements (the individual commands that you are trying to execute) and add or remove states (the collections of statements). In the Available States window, select the **OnInitialize** state. In the Selected State window, the **Initialize Control** statement will be enabled. 

Step	Action
5.	To add the motion profile, under Input Arguments, go to **Profile** and click the three dots on its right. When the Select a Reference window pops up, select the profile from the list. Click **Accept** when you are finished. 
6.	After configuring the OnInitialize statement, edit the OnRun state. In the Available States window, select the **OnRun** Statement. ***NOTE:*** *In the following steps, you will create an Auto-Teach, pick-and-place program by using the available statements. The program logic that is part of the OnRun statement will include manipulating the gripper, moving to the picture location, using the vision to locate the target, and executing the pick-and-place routine.* 

Step	Action
7.	To start the sequence, in the Statement Browser on the right side of the screen, click the **Gripper** statement and drag and drop it into the Selected State window. This will give access to manipulating the open/close state of the gripper. 
8.	In the Input Arguments window, select the **Open** state for the gripper. 
9.	In the Statement Browser, drag and drop the **Move** statement into the Selected State window. 

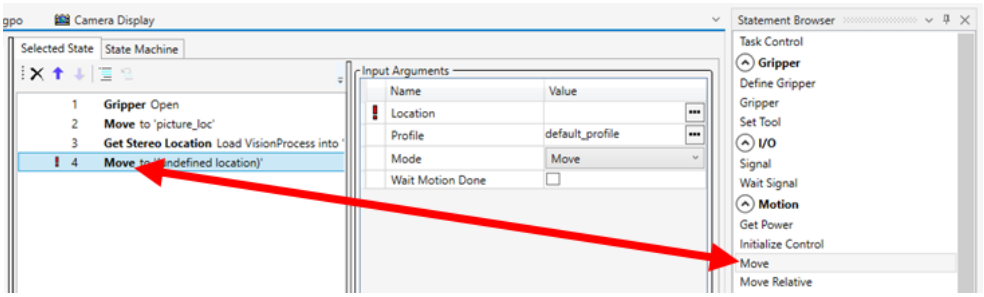
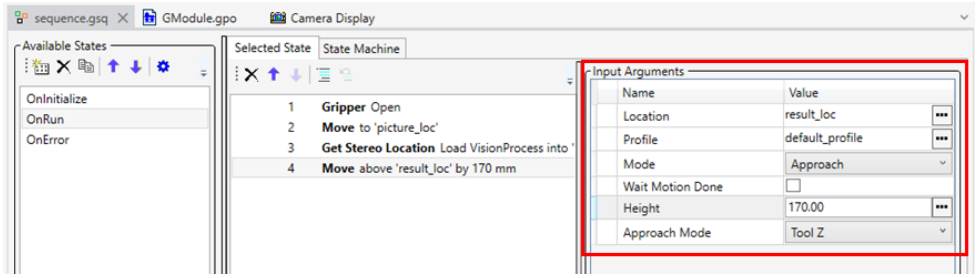
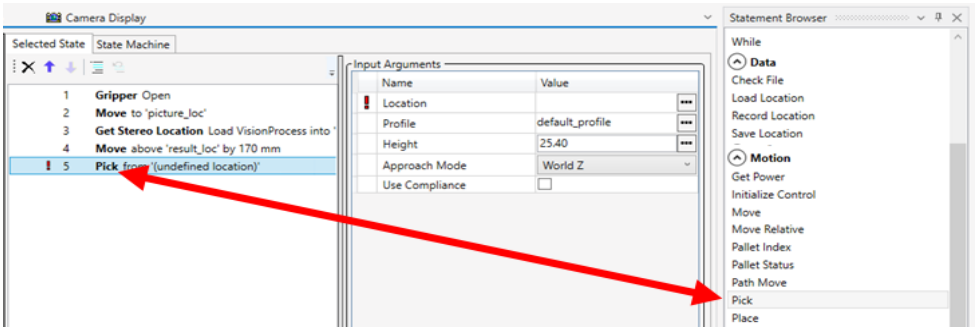
Step	Action
10.	After adding the Move statement to the list of commands, edit the Input Arguments by adding the location and desired profile. In the mode for Move, the user has options to Move, Approach, and Move to the Location. This step is to add a Move statement and program the robot to move to the predefined picture location. ***NOTE:*** *If a statement is not configured properly, the interface will display an exclamation mark in front of the newly added statement. After completing the required information, the exclamation mark will disappear.* 
11.	If more settling time is required for this particular motion, enable the **Wait Motion Done** option. This will ensure that the robot is at the desired location before the next step in the program is executed. In this case, this is required since the picture location is where the robot will need to arrive before the vision system acquires the image for detecting the fiducial markers. 
12.	To detect the fiducial markers and teach the stereo location, drag and drop the **Get Stereo Location** statement from the Statement Browser window to the OnRun state window. 

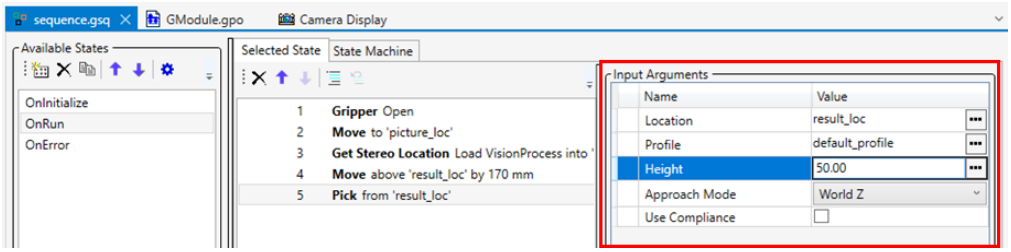
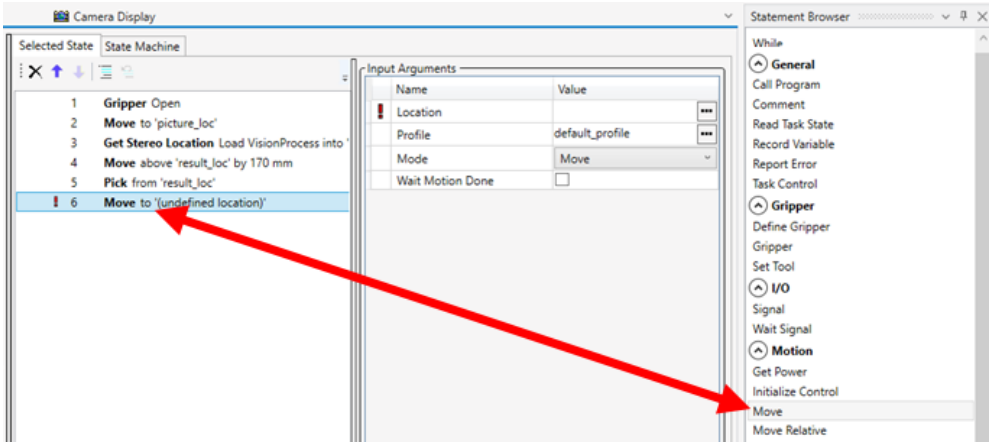
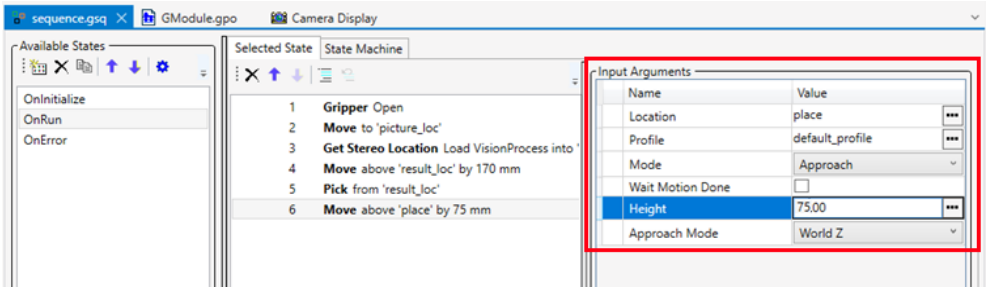
Step	Action
13.	It is important to fill out the **Input Arguments** to apply the statement correctly. The table below defines the Input Arguments.

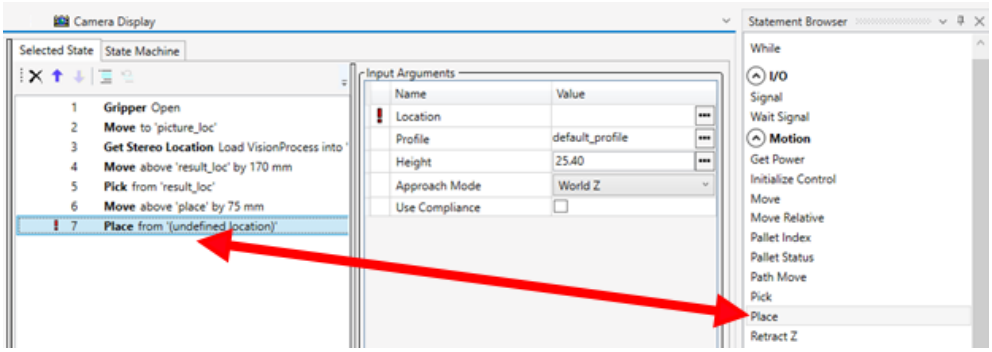
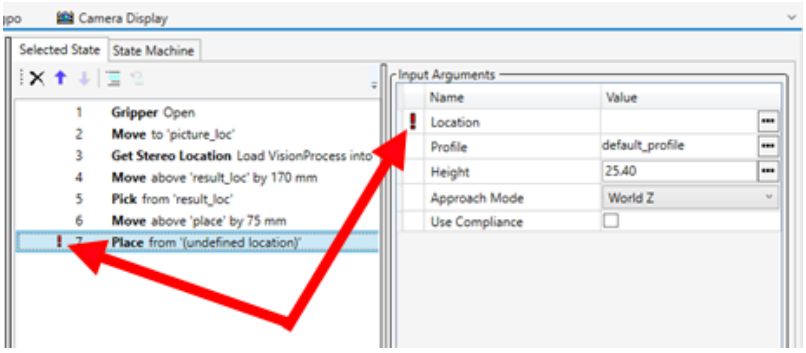
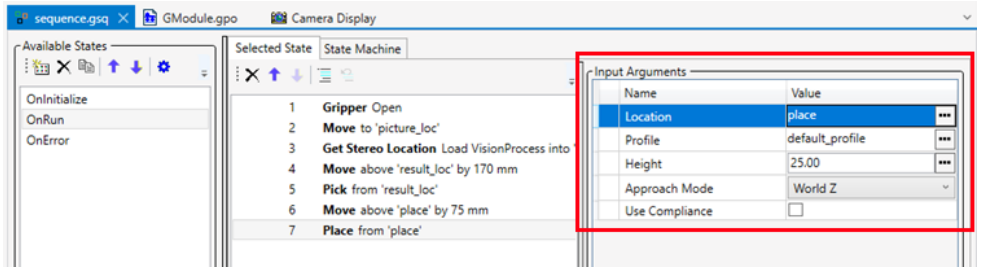
Input Arguments

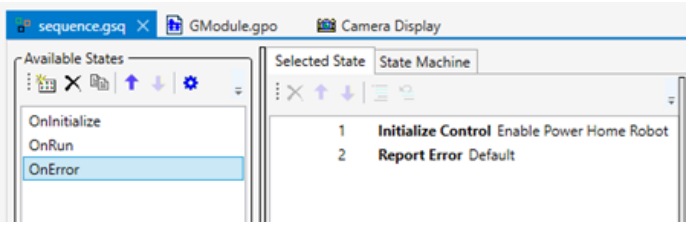
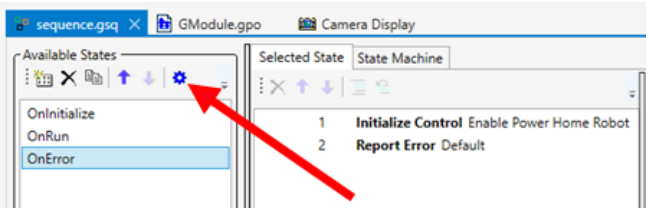
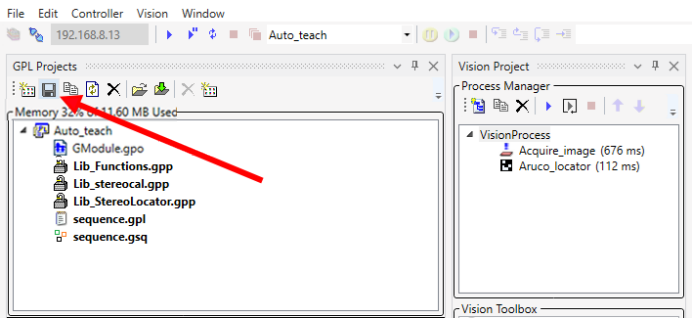
Name	Value
Location Mode	Location
Fiducial Mode	Double
Camera Number	1
Vision Process	VisionProcess
Vision Tool	Aruco_locator
ArUco 1	2
ArUco 2	3
Fiducial Distance	63.00
Settling Time	1000
Max ArUco Retries	7
Max Target Retries	7
Optimum Distance To Target	150
Precision Scale Factor	0.50
Error Distance	2.00
Offset	offset_loc
Location	result_loc

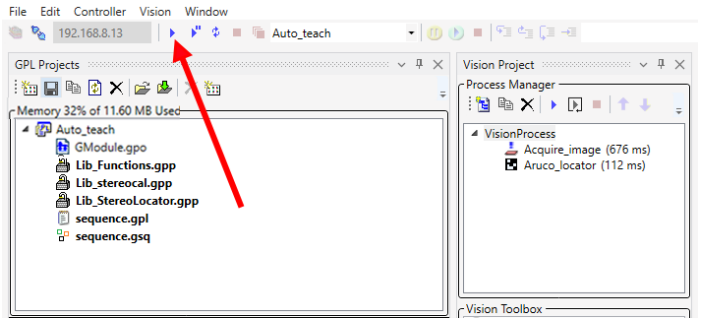
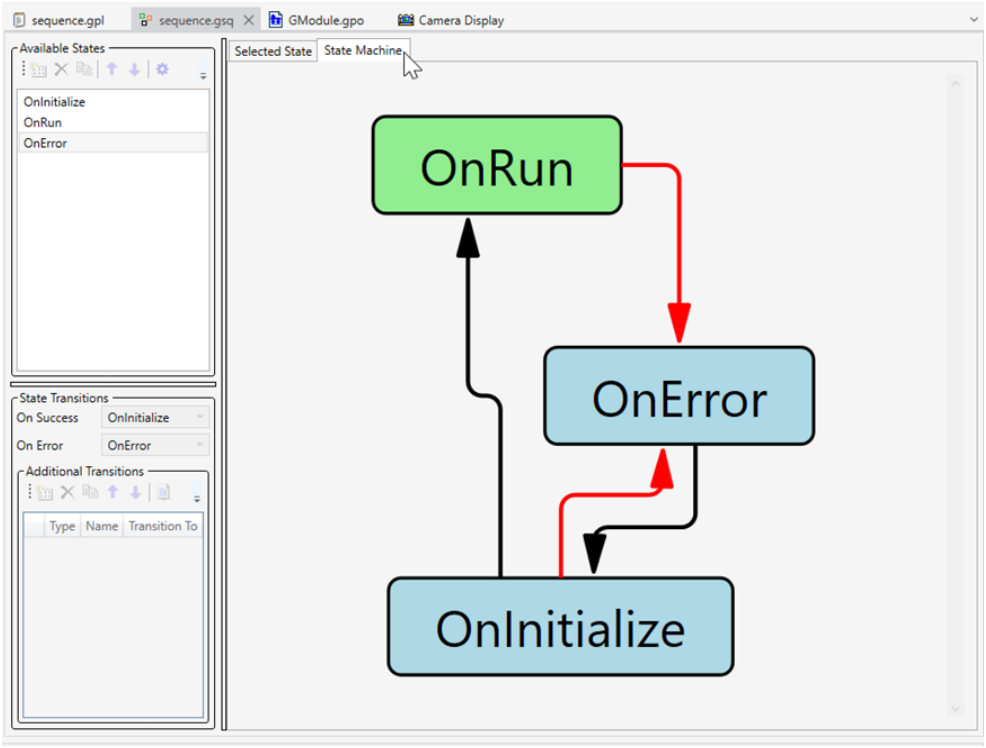
Location Mode: This parameter configures the statement and defines if a single location or reference frame is used as a place destination after the target is located and the destination location is constructed.
Fiducial Mode: Options for double or single ArUco mode. Use double fiducial mode for this setup
Camera Number: Camera index 1 is the front camera and index 2 is the bottom camera.
Vision Process: Select the preconfigured vision process that includes the tool used for detecting fiducial markers.
Vision Tool: The tool that will be used for detecting the fiducial markers.
Aruco 1 and Aruco 2: Contain the numeric representation of the fiducial markers. Fiducial distance is the distance between the two ArUco markers (center to center).
Fiducial Distance: The distance between the centers of the two ArUco markers.
Settling Time: The time between the robot arriving at the location and taking the image
Max Aruco Retries and Max Target Retries: The maximum number of retries for the vision system to detect the fiducial markers and calculate the center point.
Optimum Distance to Target: The distance between camera and target. Distance is specified during the robot's calibration and is given as a parameter in the form of range. The optimal distance in this section should be within the range given when the vision system was calibrated.
Precision Scale Factor: An error tolerance parameter used to detect inaccuracies in the vision location of the ArUcos. The range of values should be between 0.1 and 1. The default value is 0.5. This can be changed to adjust the allowed error in the location process.
Error Distance: The maximum allowed distance error between the calculated fiducial distance and the expected fiducial distance. The distance error is specified in mm. For example, if the Fiducial distance (Distance between the fiducial markers in mm - center to center) is 63mm, Error Distance of 2mm will result of total allowable measured distance of 63 +/- 2mm between the ArUco markers.
Offset: The vision offset that was configured. It represents the position transformation between the target and the actual pick location (if applicable).
Location The result location after the predefined offset is applied the resulting location will be the actual location used for picking the part.

Step	Action
14.	After the vision system acquires the image and constructs the location by detecting the fidicial markers, the robot will need to approach and move to the newly constructed location.
15.	From the statement browser, drag and drop the **Move** statement into the **OnRun**> Selected State window. 
16.	Edit the input arguments of the Move statement to include the **result_loc** in **Location**. This is the location where the vision system will save the newly constructed location from detecting the fiducial markers and apply the offset location that was taught in the previous section. Set the move **Mode** to **Approach** and set the **Height** to the desired approach distance and direction. In this case, the robot will approach the location in Tool Z at 170 mm distance from the target. 
17.	For this step, drag and drop the **Pick** statement. It combines all required operations to pick the target: approaching and moving to the target, closing the gripper, and departing from where the target was located. 

Step	Action
18.	The approach and depart distances and mode are defined in the Input Arguments section for the operation. Specify the location of the target. In this case it will be the **result_loc** that was constructed after executing the Auto-Teach routine. For this motion, use the **default_profile**, for the **Profile**, and set the approach height to 50 mm and the **Approach Mode** to **World Z**. 
19.	After the part is picked, the next steps will be to transfer it and place it in the destination nest. Drag and drop the **Move** statement to the list of commands in the Selected State window. 
20.	Configure the Input Arguments parameters to include the destination location. In this case, the destination **Location** is named **place**. For motion **Profile**, use **default_profile**. The **Mode** of operation will be **Approach**, the approach **Height** will be 75 mm, and **Approach Mode** will be **World Z**. 

Step	Action
21.	To complete the cycle, the last step will be to add the **Place** statement so the part can be transferred and placed into the destination nest. From the Statement Browser, drag and drop the **Place** statement into the Selected State window. 
22.	***NOTE:*** *Any missing information in the Input arguments list will be identified with an exclamation Point.* 
23.	Set the target **Location** to **place**, the **Profile** to **default_profile**, the **Approach** height to 25 mm, and the **Aproach Mode** to **World Z**. 

Step	Action
24.	In the Available States window, click the **OnError** state to modify it. For this example, you can use the default **OnError** routine. In this state, the system will reinitialize (**Initialize Control** statement) and report if any error occurs (**Report Error** statement). 
25.	After completing all the steps for defining the pick and place routine, the final requirement is to generate the code by clicking the **Generate the GPL code from the sequence** gear icon in the Available States window. Generating the code is required every time changes are made in the sequence of operations. 
26.	After the code is generated, save it by clicking the **Save** icon in the GPL Projects. 

Step	Action
27.	Before starting the project, make sure the teach plate is located in the pick location and nothing is obstructing the motion of the robot. The nest where the plate will be placed should be empty so the robot can compleete the step. Click Start to start the project. 
28.	Click the State Machine tab to display and review the state blocks. The active state will be colored green color if no errors are detected while the routine is active. 

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4. Vision Toolkit

Vision Tools perform all the runtime operations needed to acquire and process an image captured from a camera.

Each instance of a tool is:

- a vision object with a graphical front-end
- a property list for configuring the tool for operation
- a read-only list of results properties that can be used by other vision objects to create more complex machine vision and logical operations.

The graphical front-ends allow the vision tools to be positioned over a captured image and so simplify their training.

ToolKit Summary

The Vision Tools Functions table below summarizes the primary function of each of the vision tools. The Type broadly categories each tool as to whether it:

- "Acquires" an image
- "Finds" an object
- "Inspects" a region
- "Enables an LED."

Click the links in the table below to see detailed description.

Vision Tools Functions

Vision Tool	Type	Description
Acquisition Tool	Acquires	Captures an image from a camera or loads it from a disk file, and stores the image into a frame buffer.
Fiducial Locator	Finds	Searches a specified region of the image and returns the location of the detected ArUco marker. Returns the coordinates of the center and the four corners of the ArUco marker.

Vision Tool	Type	Description
Barcode Reader Tool	Inspects	Reads a variety of standard 1D and 2D barcodes and returns the barcode type and the value of the barcode.
Light Control	Enables LED	Enables, disables, and adjust the brightness levels of the integrated LEDs

Acquisition Tool

A vision tool that captures an image from a camera or loads it from a disk file, and stores the image into a frame buffer. The table below shows the Acquisition Tool Properties.

Property Name	Data Type	Range	Description
1. Identity			
Name	**String**	n/a	Standard Identity properties
Type	**String**	n/a	
3. Operation			
Camera	**Integer**	1 - 6	Standard Operation property
GainBlue	**Single**	0-12 (set to -1 if not a color camera)	These properties scale the intensity values for each of the three color layers as they are read from the camera. This permits the color intensities to be balanced.
GainGreen	**Single**		
GainRed	**Single**		
3A. Advanced Operation			
AcquireBuffer-Image	**Boolean**	True / False	If True, a copy of the image is stored into a secondary buffer when the image is acquired. This must be set True if the original image is to be restored by a subsequent Acquisition tool that has its **AcquireMode** set to "RESTORE_ORIGINAL." For resolutions greater than 640x480, setting this value to False, if not needed, can save a few milliseconds of execution time. Set False by default.

Property Name	Data Type	Range	Description
Acquire-Extension	**List**	BMP / PNG	If this tool is set to automatically save a camera image to a disk file, this property specifies whether the image should be saved as a non-compressed bitmap (BMP) or as a compressed image in a lossless format (PNG) or as a compressed image in a lossy format (JPG). The PNG and JPG file formats are smaller, but requires more CPU time to create.
AcquireFill-GrayLevel	**Integer**	0 - 255	If the **AcquireMode** is defined as "CLEAR_BUFFER," all of the pixels in the image buffer are set to the intensity value specified by this property.
AcquireMax-CurrentCount	**Integer**	0 - 99999	When the **AcquireMode** is set to ACQUIRE_AND_SAVE or SAVE_ONLY, the **AcquireMaxSaveImages** property defines the largest index that is appended to the **AcquirePrefix** to generate the name of the file in which the image is stored. If **AcquireMaxSaveImages** is -1, the next highest unused index values is assigned up to the maximum value of 99999. So, existing image files will not be over-written. If **AcquireMaxSaveImages** is set >0, **AcquireMaxCurrentCount** will indicate the next index. When the limit specified by **AcquireMaxSaveImages** is reached, **AcquireMaxCurrentCount** is automatically reset to 0. This permits the last **AcquireMaxSaveImages** files to be saved without consuming more and more disk space (but existing image files will be over-written). In this mode of operation, **AcquireMaxCurrentCount** can be manually changed or automatically altered by a robot control program to reset the next index to a specific value. The value of **AcquireMaxCurrentCount** is not stored with the vision project and is reset to 0 each time the vision project is loaded.
AcquireMax-SaveImages	**Integer**	-1 - 99999	

Property Name	Data Type	Range	Description
AcquireMode	**List**	NORMAL_ ACQUIRE / ACQUIRE_ AND_SAVE / CLEAR_ BUFFER / PLAY_FROM_ DISK / LIVE_VIDEO / SAVE_ONLY / RESTORE_ ORIGINAL	"NORMAL_ACQUIRE" - acquires a single image from the specified camera and places it into a frame buffer. "ACQUIRE_AND_SAVE" - performs the same operation as "NORMAL_ACQUIRE" and then saves the image to a disk file. "CLEAR_BUFFER" - Sets all of the pixels in a buffer to the intensity value specified by **AcquireFillGrayLevel**. This is useful before an AOI copy is performed. "PLAY_FROM_DISK" - restores an image from a disk file. The disk file is specified by the **AcquirePath** and **AcquirePrefix** (see below). If there are multiple numbered image files with the same prefix, each time the Vision Process is executed, the contents of the next sequential file will be copied to the image buffer. "LIVE_VIDEO" - continuously updates the vision display with the latest image from the camera. This is a system setup mode that facilitates setting the camera f-stop, focus, **VideoGain**, and **VideoOffset**. "SAVE_ONLY" - stores the contents of the current frame buffer to a disk file. This enables a GPL program to execute a vision process that saves selected frame buffers for later access. "RESTORE_ORIGINAL" - restores the contents of the current frame buffer to its original value at the time that the image was first captured. Requires that **AcquireBufferImage** is set to True when the image is first captured.
AcquirePath	**String**	n/a	String that defines the path to the disk file when **AcquireMode** is set to "ACQUIRE_AND_SAVE" or "PLAY_FROM_DISK'." If blank (""), the path defined in the Preferences will be used. If the path does not contain a ':' (i.e. C:\...), **AcquirePath** will be appended to the path where the PreciseVision application is stored, e.g. "C:\Program Files\Precise Automation\PreciseVision #.#\"
AcquirePrefix	**String**	n/a	String that defines the disk file name (excluding the required .BMP extension) when **AcquireMode** is set to "'ACQUIRE_AND_SAVE" or "PLAY_FROM_DISK." If blank (""), the file name defined in the Preferences will be used. This string is combined with AcquirePath, a numerical index, and the ".BMP" file extension to generate the disk file name for saving or loading vision images.

Property Name	Data Type	Range	Description
ActiveLayer	**List**	Monochrome / RedLayer / GreenLayer / BlueLayer	Specifies the type of data to be loaded into the image frame buffer for processing by subsequent vision tools. For grayscale cameras, only "Monochrome" image buffers are available and each pixel in the frame buffer has a value from 0 to 255 that defines its grayscale intensity. For color cameras, the frame buffer can be loaded with one of four types of data: monochrome, red, green or blue. The monochrome mode produces the same results as a grayscale camera. The red, green and blue modes load the intensity data for a single color. For example, if "RedLayer" is selected, the image frame buffer will contain values that indicate the intensity (response) of only the red receptors of the camera. Tools that are applied to this image will only be operating on the red color layer of the camera. The one exception is the "Pixel Color Window" Tool. When this tool is executed, it automatically accesses all three of the RGB color layers of an image and is unaffected by the setting of the **ActiveLayer** property.
AoiAcquire	**Boolean**	True / False	For cameras (such as most IDS uEye USB models) that support acquiring only a portion of the full field of view, these parameters define the rectangular section of the image to be acquired. If a reduced size AOI is acquired, the camera acquisition time will be reduced. Different Acquire tools can have different sized and positioned AOI's. However, when switching between different AOI's, there is typically a significant time delay. To acquire an AOI, set **AoiAcquire** True and define the height, width and position of the AOI. The AOI dimensions and position are specified in calibrated units (mm) like most tools instead of pixels.
AoiHeight	**Single**	0 - FOV (mm)	
AoiWidth	**Single**	0 - FOV (mm)	
AoiXpos	**Single**	0 - FOV (mm)	
AoiYpos	**Single**	0 - FOV (mm)	
FlatFieldEnabled	**Boolean**	True / False	If True, each captured image is automatically compensated for uneven background lighting by adding a sample image that was previously saved. The saved image is automatically inverted and normalized such that when it is added to a new image, a very light uniform (flat) background is produced. This can make it easier to distinguish objects when there are background lighting variations, especially if binary vision tools are utilized. See below for a description of the Special Feature Buttons for capturing the sample image.
ImageFile	**String**	n/a	Read-only string that displays the currently selected vision image file. This value is only displayed when the **AcquireMode** is set to "PLAY_FROM_DISK."

Property Name	Data Type	Range	Description
LoadFirstImage	**Boolean**	True / False	This is a convenience feature for setting the display of a sequence of images back to the first image and is only valid during the "PLAY_FROM_DISK" mode. That is, when this property is set to TRUE, the disk file that satisfies **AcquirePath** and **AcquirePrefix** and has the lowest index values will be loaded into the image buffer.
3B. Trigger			
TriggerActive	**List**	Low_to_High / High_to_Low	If **TriggerEnable** is True, this property defines if the picture is to be when the digital input signal transitions from low to high or high to low.
TriggerEnable	**Boolean**	True / False	If this property is True, the image capture is delayed until a digital input signal of the correct state is received by the camera.
TriggerTimeout	**Integer**	1 - 30	If **TriggerEnable** is True, this property specifies the time in seconds that the system will wait for the trigger to occur before an error is generated (-4019 Vision Process Failed).
4. USB Cameras			

Property Name	Data Type	Range	Description
BackLight Compensation	**Integer**		These properties change the operation of USB cameras. The properties that a camera supports and the range of values for each property will vary from one camera model to the next and the software driver used to access the camera. When a camera is attached by PreciseVision, its supported properties, the range of allowed values and the default values are automatically sampled. The range for each supported property is displayed by the "Adjust Video Properties" Special Features window. Special attention should be paid to the **Exposure** and **PixelClock** properties since these affect the time it takes to acquire an image. See the documentation provided with the camera for specific information on the setup of its supported properties.
Brightness	**Integer**		
ColorEnable	**Integer**		
Contrast	**Integer**		
Exposure	**Integer**		
ExposureTime	**Single**		
Focus	**Integer**		
Gain	**Integer**		
GainBoost	**Integer**		
Gamma	**Integer**		
Hue	**Integer**		
Offset	**Integer**		
PixelClock	**Integer**		
Saturation	**Integer**		
Sharpness	**Integer**		
WhiteBalance	**Integer**		

Property Name	Data Type	Range	Description
Zoom	**Integer**		

This tool performs the basic image capture operation from a color or monochrome camera and stores the image in a frame buffer. Consequently, this tool is normally the first tool in each Vision Process.

Multiple cameras can be accessed by this tool and their gains and offsets can be controlled to optimize the brightness range for the field of view. To facilitate setting up a camera's gain, offset, focus, and f-stop, the camera image can also be continuously acquired and displayed in the Camera Display Window.

Normally, when this tool is executed, a camera image is immediately captured. However, if **TriggerEnable** is True, executing this tool primes an image capture, but the picture is not immediately taken. The image capture is delayed until a digital signal, which is directly connected to the camera, is asserted. For applications where the timing of the image capture relative to an external event is critical, trigger mode can significantly reduce latency and jitter. As a debugging convenience, if a Vision Process is manually executed using the PreciseVision GUI and the process contains an **Acquisition** that has triggering enabled, a window is display to confirm if the camera should wait for an external trigger or if the picture should be taken immediately. This window is not displayed if the Vision Process is remotely initiated from a Guidance Controller.

Camera triggering is not supported on all cameras. Consult the camera's hardware documentation for specific information on whether it supports external triggering and how this is implemented.

Most vision tools analyze the data that is stored in a frame buffer by an Acquisition tool, generate results, and leave the frame buffer unmodified. However, if an "Image Process" tool is executed (e.g. a low pass filter), the data stored in the frame buffer is altered so that all subsequent tools operate on the modified image data. In these cases, it is sometimes convenient to restore the original contents of the frame buffer. This can be done by executing an Acquisition Tool with the **AcquireMode** set to "RESTORE_ORIGINAL." This operation restores the original image data from an in-memory buffer, and is therefore much faster than storing an image to a file and then reloading. In order for this mode to operate properly, the original Acquisition tool must have its **AcquireBufferImage** property set to True. When this property is true, a copy of the camera image is generated in memory when the acquisition is performed.

If the background lighting is not uniform, **FlatFieldEnabled** can be set to automatically add a previously saved inverted normalized image of the background lighting. This will produce a "flat" background that will help to highlight the features of parts within the field of view. Enabling this function adds about 1 msec of processing time to a 752x480 grayscale image. (See the Special Feature Buttons below.)

As both a demonstration feature and as an aid in remotely diagnosing problems, this tool can be used to easily store captured images to a disk file and to reload images stored to the disk. To store

images, the **AcquireMode** must be set to "ACQUIRE_AND_SAVE" or "SAVE_ONLY." To load files, the mode must be set to "PLAY_FROM_DISK." For any of these modes, the disk file name is constructed by combining the **AcquirePath** with the **AcquirePrefix** and an optional numerical index followed by the .BMP file extension. Each time that an **Acquisition Tool** is executed with "ACQUIRE_AND_SAVE" or "SAVE_ONLY" set, the system automatically increments the numerical index to create a new disk file. Likewise, each time that the **Acquisition** is executed with "PLAY_FROM_DISK," the system automatically searches the file folder for the file with the next larger numerical index. This automatic indexing allows a series of images to be conveniently generated or replayed.

Fiducial Locator

The Fiducial Locator searches a specified region of the image and returns the location of the detected ArUco marker. It returns the coordinates of the center and the four corners of the ArUco marker.

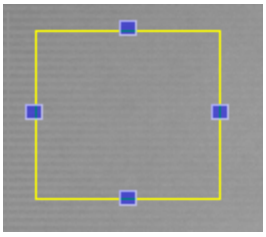
Property name	Data Type	Range	Description
Identity			
Camera number	Integer	1-2	Standard Operation properties 1 – Front facing camera 2 – Bottom facing camera
Name	String	N/A	Standard Identity properties
Placement/Sise			
Height	Single	0 - AOI (mm)	These values define the height and width of the vision tool in calibrated units (mm). These values are automatically updated when the tool is adjusted with the mouse or can be manually entered for more Width Single precise adjustments.
Width	Single	0 - AOI (mm)	
X Position	Single	0 - AOI (mm)	Position (in calibrated units, mm) of the center of the vision tool in the coordinates of the vision image. These values are automatically updated when the tool is graphically repositioned and re-oriented during training and if the vision tool is placed relative to another vision tool during runtime.
Y Position	Single	0 - AOI (mm)	
Operation			

Property name	Data Type	Range	Description
Adaptive Threshold	Integer	1-100	Constant for adaptive thresholding before finding contours.
Corner Max Iterations	Integer	1-n	Maximum number of iterations for stop criteria of the corner refinement process (default 30). If the number of iterations is too high, it may affect the performance. On the other hand, if it is too low, it can result in poor sub-pixel refinement.
Corner Min Accuracy	Double	0.001-n	Minimum error for the stop criteria of the corner refinement process (default: 0.1)
Corner Refinement	List	None/SubPixel/Contour	The corner refinement method. **SubPixel** - refine the corners locations using corner subpixel accuracy. **Contour** - refine the corners locations using the contour-points line fitting.
Corner Window Size	Integer	1-n	Window size for the corner refinement process (in pixels) (default 5). This parameter determines the maximum window size for the corner refinement process. High values can cause close corners of the image to be included in the window area, so that the corner of the marker moves to a different and incorrect location during the process. Also, it may affect performance.
Dictionary	List	Dict4X4_250 / Dict5X5_250 / Dict6X6_250 / Dict7X7_250 / Dict7X7_1000	The ArUco marker dictionary configuration to use when executing the algorithm. The dictionary specifies the size and the codification of the markers. The dictionary might be defined to have markers that are 5x5 bits, meaning each marker is a 5x5 grid where each cell can be black or white. The dictionary defines which patterns of black and white cells correspond to which marker IDs.
Relative Tool	String	N/A	
Results Settings			
Result Color	List	Gold / Blue / Violet / Red / Black / White	The color to use when rendering the result markers on the screen
Result Scale	Double	0-n	The scale for the size of the result

Property name	Data Type	Range	Description
Show Results	List	NONE / POINT / LINE / FRAME / ARC	Alters how the results of a tool are graphically displayed. Each vision tool has a default method for display, e.g. a line or a frame. This property allows the graphical display to be changed. For example, a Fixed Frame Tool is normally displayed as a reference frame. However, if it is being used as a datum line or a point, its display can changed to a line or a point for visual clarity. This property does not affect the actual results of the tool.

Barcode Reader Tool

A Vision tool that reads a variety of standard 1-D and 2-D barcodes and returns the barcode type and the value of the barcode.



Barcode Reader Tool

Property Name	Data Type	Range	Description
1. Identity			
Name	**String**	n/a	Standard Identity properties
Type	**String**	n/a	
2. Placement/Size			

Property Name	Data Type	Range	Description
Angle	**Single**	0 (*non-rotating*)	Standard Placement/Size properties. The X and Y values define the center of the region to be analyzed. The Height and Width define the dimensions of the region. The AOI cannot be rotated, but rotated barcodes can be identified (see **SkewTolerance**).
Height	**Single**	0 - AOI (mm)	
Width	**Single**	0 - AOI (mm)	
XPos	**Single**	0 - AOI (mm)	
YPos	**Single**	0 - AOI (mm)	
RelAngle	**Single**	0	
RelXPos	**Single**	0 - AOI (mm)	
RelYPos	**Single**	0 - AOI (mm)	
3. Operation			
Camera	**Integer**	1 - 6	Standard Operation properties
Relative-ToolName	**List**	n/a	
ProcessLevel	**Integer**	0 - 5	Controls the speed with which regions are processed verses accuracy. A lower value will process images more quickly but will result in a lower successful read-rate. The default value is 2.

Property Name	Data Type	Range	Description
SkewLineJump	**Integer**	1 - 9	In order to recognize barcodes that are not aligned along the horizontal or vertical axes of the camera, the **SkewTolerance** and **SkewLineJump** must be adjusted. The approximate permitted angular deviations of a barcode from a horizontal or vertical orientation for various settings of the **SkewTolerance** are as follows: 0 - up to 5 degrees 1 - " " 13 " 2 - " " 21 " 3 - " " 29 " 4 - " " 37 " 5 - " " 45 " The **SkewLineJump** determines how many lines are skipped during the portion of the scanning process that is specifically for locating skewed barcodes. 1 means that every line in the region is tested. Lower values for this parameter will increase the processing time but may be useful for poor quality images. If the barcode is aligned along the X or Y axes, the **SkewTolerance** should be set to 0 and the **SkewLineJump** should be set to 9 to minimize the tool's processing time.
SkewTolerance	**Integer**	0 - 5	
3A. Advanced Operation			
AllowDuplicates	**Boolean**	TRUE / FALSE	If a barcode is badly damaged, the same barcode maybe reported twice within the same image. If this parameter is FALSE, duplicate results are only reported a single time. If TRUE, the same value can be returned multiple times in the same image.
Bottom_To_Top	**Boolean**	TRUE / FALSE	These parameters specify the directions in which the software will scan looking for barcodes. If the barcodes always appear in the same orientation, turning off the unneeded scanning directions will reduce execution time. Also, see **SkewTolerance** for the ability to identify barcodes that are not oriented vertically or horizontally.
Left_To_Right	**Boolean**	TRUE / FALSE	
Right_To_Left	**Boolean**	TRUE / FALSE	
Top_To_Bottom	**Boolean**	TRUE / FALSE	
5. Results Settings			

Property Name	Data Type	Range	Description
MaxResults	**Integer**	-1 or 1 to n	Standard Results Settings properties
ResultOnNotFound	**Boolean**	TRUE / FALSE	
ShowResults	**List**	NONE / FRAME / LINE / POINT	
ShowResultType	**Boolean**	TRUE / FALSE	If **ShowResultValue** is TRUE, the identified barcode value will be displayed on top of the barcode in the camera window. In addition, if **ShowResultType** is TRUE, the display will include the type of the barcode that was found.
ShowResultValue	**Boolean**	TRUE / FALSE	
6. Results			
ResultErrorCode	**Integer**		Standard Results properties X and Y position represent the centroid of the located barcode.
ResultAngle	**Single**	0 (non-rotating)	
ResultXPos	**Single**	mm	
ResultYPos	**Single**	mm	
ResultCode	**String**		The type of the barcode, e.g. UPCA. *[GPL: VisResult.InfoString]*
ResultCodeDirection	**Integer**		Indicates the scanning direction used to locate the barcode *[GPL: VisResult.Info(1)]* 1 - Left to right 2 - Bottom to top 4 - Right to left 8 - Bottom to top
ResultCodeValue	**String**		The value of the barcode. *[GPL: VisResult.InfoString]*

This tool reads a variety of popular types of 1-D and 2-D barcodes. More than one barcode can be located within a single AOI and the barcodes can be of different types (although searching for multiple types of barcodes increases execution time). The value of the barcode as well as its type are returned by this tool and can optionally be displayed in the camera window on top of the identified barcode.

This tool can locate barcodes that are oriented in any direction (although barcodes that are approximately horizontal or vertical are processed most quickly). This tool will operate on grayscale or color images, with grayscale images being processed more rapidly and more reliably due to the single image plane and higher quality edges.

In order to reliably detect barcodes and to determine their correct values, the following should be kept in mind:

- As a general rule-of-thumb, the thinnest bar should be at least 3 pixels wide. Likewise, the smallest gap between bars should be at least 3 pixels wide.
- If a barcode is not horizontal or vertical but is tilted (skewed), the minimum bar and gap width should be increased to at least 5 pixels since diagonal lines look like stair steps and alternately are thick and thin.
- Even if the barcode's position is well known, white space should be included in the AOI around the barcode so that the software can detect the start and end of the bars or squares.

The Barcode Reader Tool can detect a number of different codes and can correctly operate even when the barcode is at any orientation or the image is somewhat degraded or the barcode is slightly defective. However, the execution speed of this tool can be optimized by reducing the generality of the property settings, such as reducing the size of the AOI to be searched, disabling unneeded barcode types, reducing the skew tolerance, etc.

Special Feature Buttons (located above the property editor)

Select Codes

Clicking this button displays a window that can restrict the types of barcodes that are detected during the scanning process. Disabling unneeded types will reduce the execution time of the tool. Currently, variations of the following types of 1-D and 2-D barcodes can be detected: *Code 39, Code 93, Code 128, Code 25 (interleaved and non-interleaved), Codabar, EAN-8, EAN-13, UPC-A, UPC-E, PDF-417, Data Matrix, Databar, and Patch Codes*.

Advanced Settings

Clicking this button displays a window that presents more advanced properties of the barcode tool whose default values are normally acceptable. For convenience, this window also contains duplicates for some of the common properties that are contained on the standard Property Display. The table below describes the operation of the unique Advanced Settings.

Advanced Settings

Property Name	Data Type	Range	Description
Convert UPC-E to EAN-13	**Boolean**	TRUE / FALSE	If TRUE, UPC-E barcodes are automatically converted into EAN-13. This is FALSE by default.

Property Name	Data Type	Range	Description
GammaCorrection	**Integer**	1 - n	If this value is not 100, a Gamma Correction equal to **GammaCorrection**/100 will be applied to adjust the overall illumination of the AOI. By default, this value is 100, which means don't apply a correction.
Line Jump	**Integer**	1 - 9	This property determines how many lines are skipped during the initial scan for a barcode. 1 means that every line in the region is tested. Lower values for this parameter will increase the processing time but may be useful for poor quality images. This value is 1 by default.
Median Filter	**Boolean**	TRUE / FALSE	If TRUE a median filter is applied to the AOI before scanning for the barcode. This can eliminate small flaws in high resolution images. It should not be applied to low resolution images since this will blur the transitions between bars and gaps. This is FALSE by default.
Max Length	**Integer**	1 - 999	Specifies the largest number of characters in the barcode including any checksum characters. Set to 999 by default.
Min Length	**Integer**	1 - 999	Defines the minimum acceptable number of characters in a valid barcode value. Set to 4 by default.
Min Space Width	**Integer**	0 - n	Defines the minimum acceptable width of spaces between bars. Spaces that are smaller than this size are ignored. By default, this value is 0, which implies that the system will automatically determine the minimum acceptable width.
Noise Reduction	**Integer**	0 - n	If greater than 0, the AOI is filtered before being scanned to eliminate marks that are unlikely to be part of the barcode. Larger values will reduce larger marks. This can be helpful in poor quality images. A typical value is 10. By default, this is set to 0.
Numeric Barcode	**Boolean**	TRUE / FALSE	If TRUE, only numeric barcodes are identified. By default, this value is FALSE.
Quite Zone	**Integer**	0 - n	When a line in the image is scanned, regions that are not preceded by this number of white pixels are ignored. Set to 0 by default.
Show Check Digits	**Boolean**	TRUE / FALSE	If TRUE, the barcode check digit will be included in the barcode value. This property only applies to barcode types with built-in check digits, such as Code 128. Set FALSE by default.
Use Oversampling	**Boolean**	TRUE / FALSE	If TRUE, 3 sequential lines at a time are scanned and their average pixel value is used to determine the barcode. This is useful for images that contain both white and black speckles. Set FALSE by default.

Examples

The following two examples demonstrate the Barcode Reader Tool identifying the same character pattern presented as both a 1-D Code 39 and a 2-D Data Matrix pattern. In and , the darker blue boxes display the barcode type and value as determined by this tool.

Barcode Type and Value

Barcode Type and Value

Light Control

Light Control enables, disables, and adjust the brightness levels of the integrated LEDs.

Property Name	Data Type	Range	Description
1. Identity			
Camera number	Integer	1-2	Standard Operation properties 1 – Front facing camera 2 – Bottom facing camera
Name	String	N/A	Standard Identity properties
3. Operation			

Property Name	Data Type	Range	Description
Brightness %	Integer	0-100	Integrated light brightness level. 0 – disabled 100 – highest brightness level
LED Bank	Integer	1-2	Integrated light source selection 1. Front facing light source 2. Bottom facing light source
Time Delay (ms)	Integer	0-n	Delay for executing the light control tool in ms.

5. Camera Calibration

Stereoscopic Calibration

The IntelliGuide Vision Gripper is installed and calibrated from the factory. The only time it should need recalibration is when you replace the IntelliGuide Vision Gripper, remove its cover, or after major software updates. This chapter covers IntelliGuide Vision Gripper calibration.

Stereoscopic calibration is a process where multiple images of the calibration target are acquired, and calculations are performed to create the calibration model. The defined calibration model is used by the vision system to define location in space (X,Y,Z, and Yaw) after detecting fiducial markers (ArUco). The defined location in space can be used for picking targets, auto teaching routines, creating offsets etc.

For proper functionality of the IntelliGuide Vision Gripper, you must perform a stereoscopic calibration for each camera. The calibration is unique for each camera, and it cannot be transferred to another camera. That means that if the calibration model is lost, you must execute the routine again.

Requirements:

- Fully calibrated robot
- Installed IntelliGuide Vision Gripper with properly adjusted focal length.
- Preferable if the robot homing procedure is already executed.
- The robot is mounted on a surface where no other devices or machinery is causing vibration that can be transferred to the arm or the calibration board.
- Loaded vision project used specifically for stereoscopic camera calibration.
- The assumption is that all required licenses are installed.

> ***NOTE:*** Brooks recommends that the light source is consistent and the vision process is tested before starting the calibration.

CAUTION

Robot Movement

During the stereoscopic camera calibration, the robot will automatically move to locations.

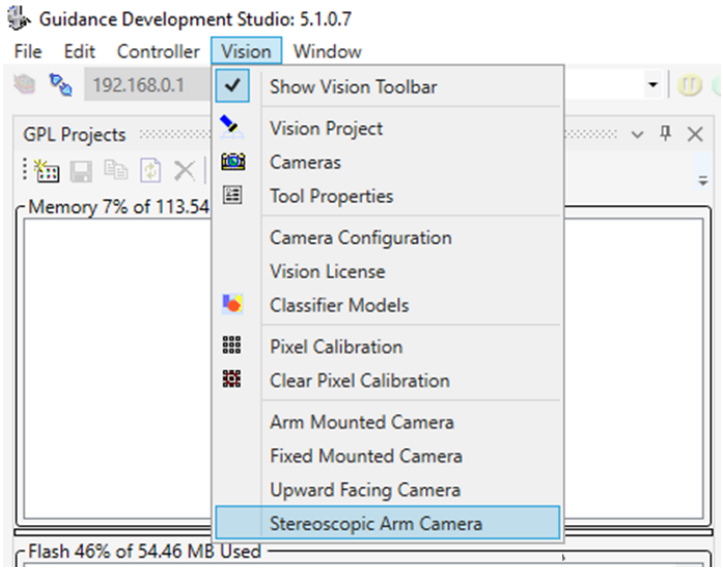
It's important to position the robot properly before the process is started, and ensure nothing is obstructing the robot's motion during the calibration process.

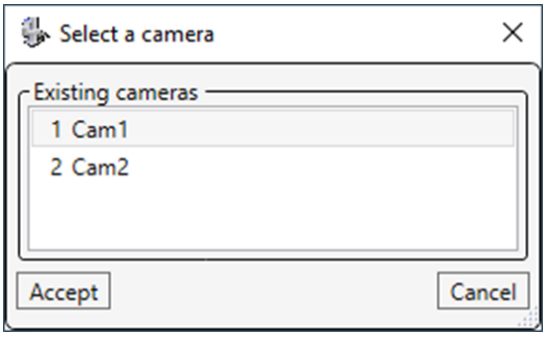
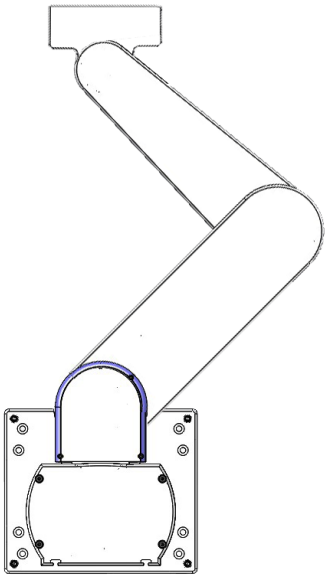
Before starting the calibration procedure, make sure the robot and the vision system are accessible and connection can be established.

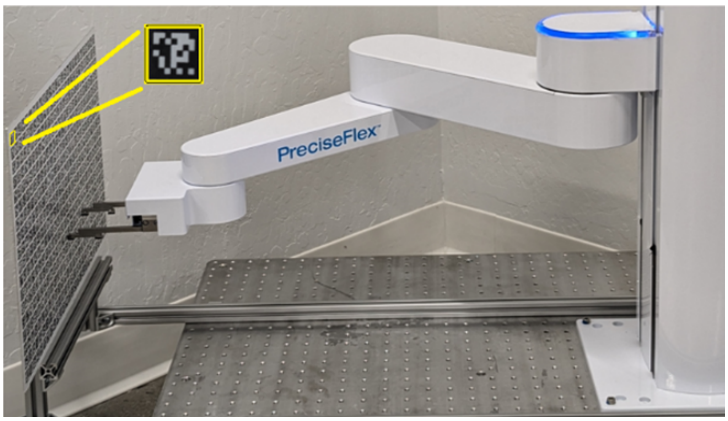
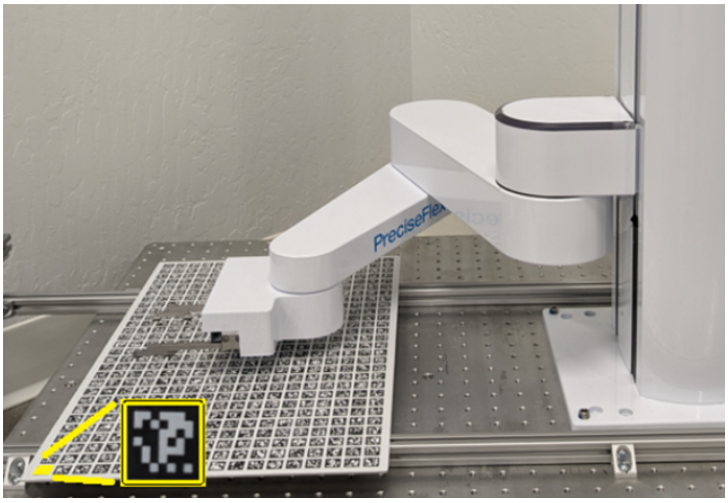
You must create or use existing vision projects that include vision processes with the image Acquisition Tool and Fiducial Locator tools configured as part of the vision process. If no vision project is available, the user can follow the steps for creating vision project described in the document earlier.

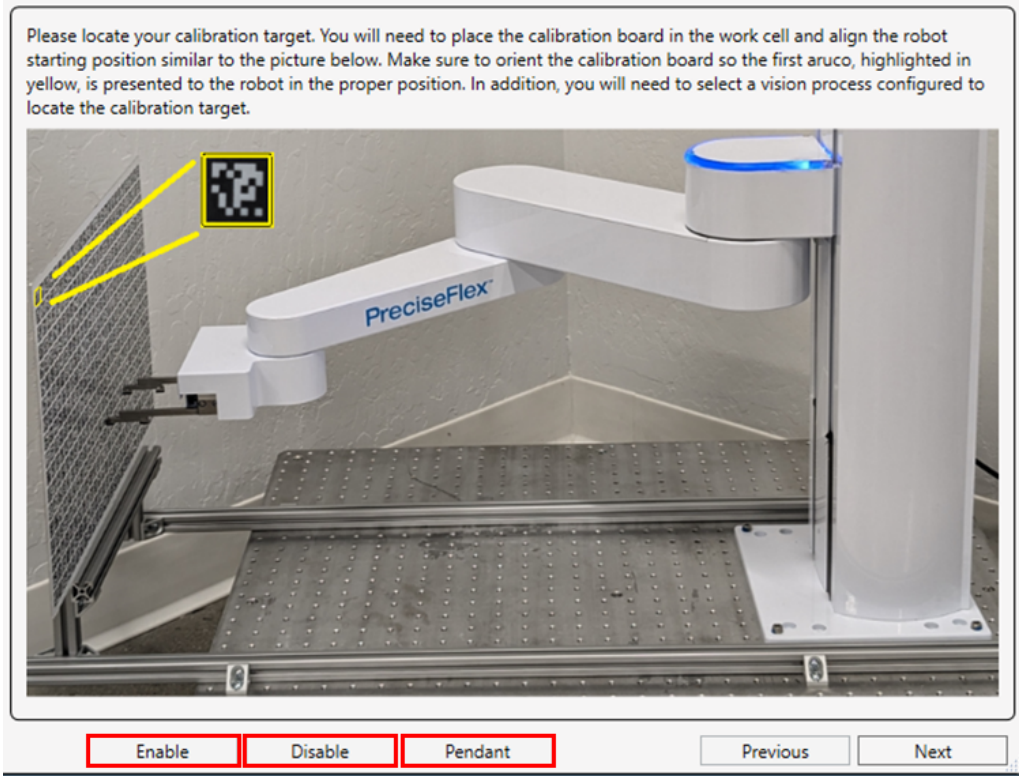
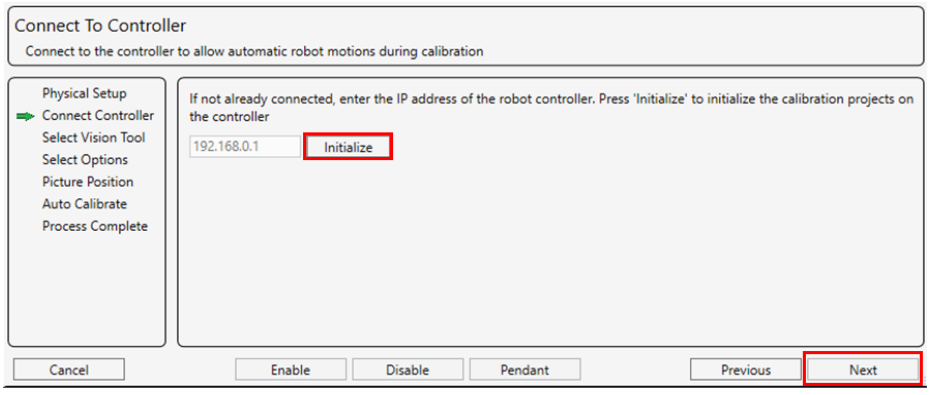
For successful execution of the stereoscopic calibration routine, use the ArUco calibration board provided by Brooks.

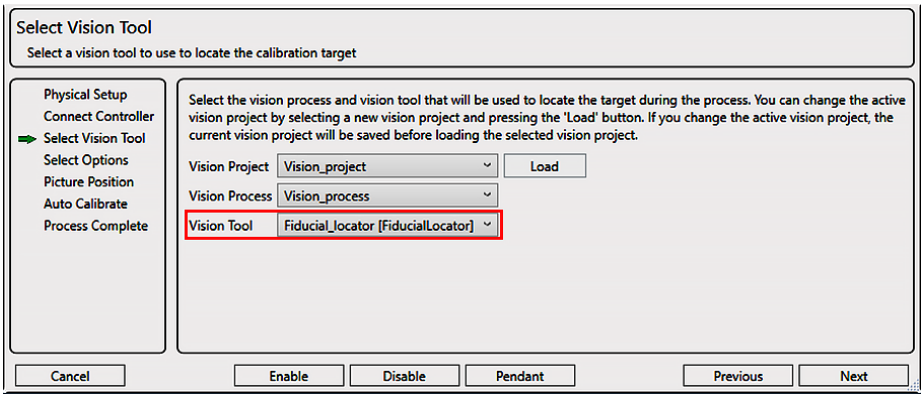
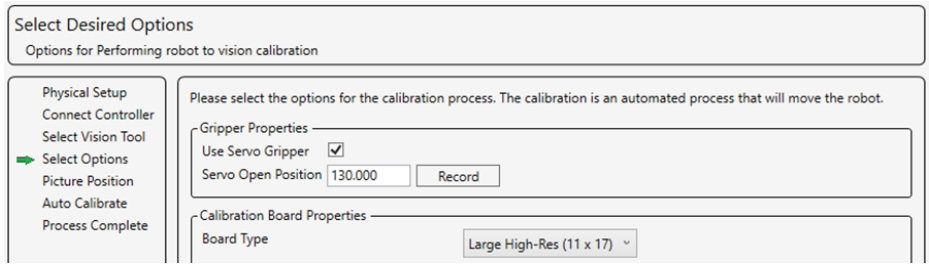
To execute a stereoscopic calibration routine, perform the following steps.

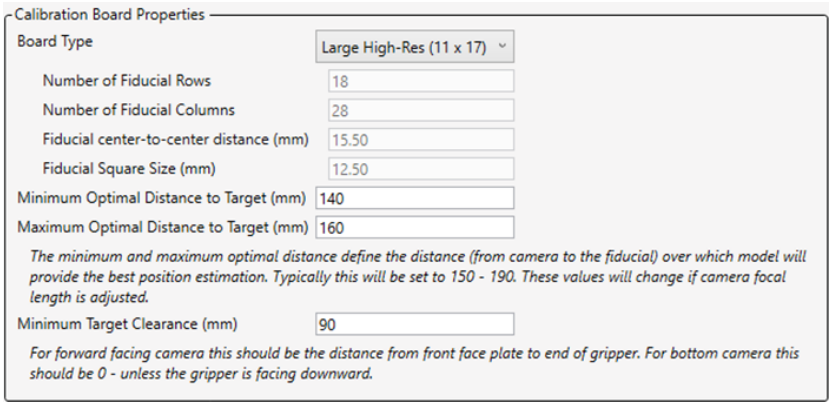
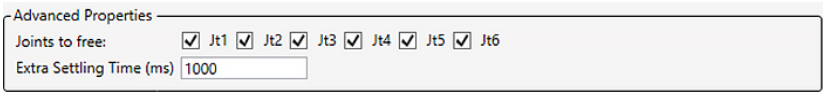
Step	Action
1.	From the main toolbar, open the **Vision** drop-down menu and select **Stereoscoping Arm Camera** to initialize the wizard 

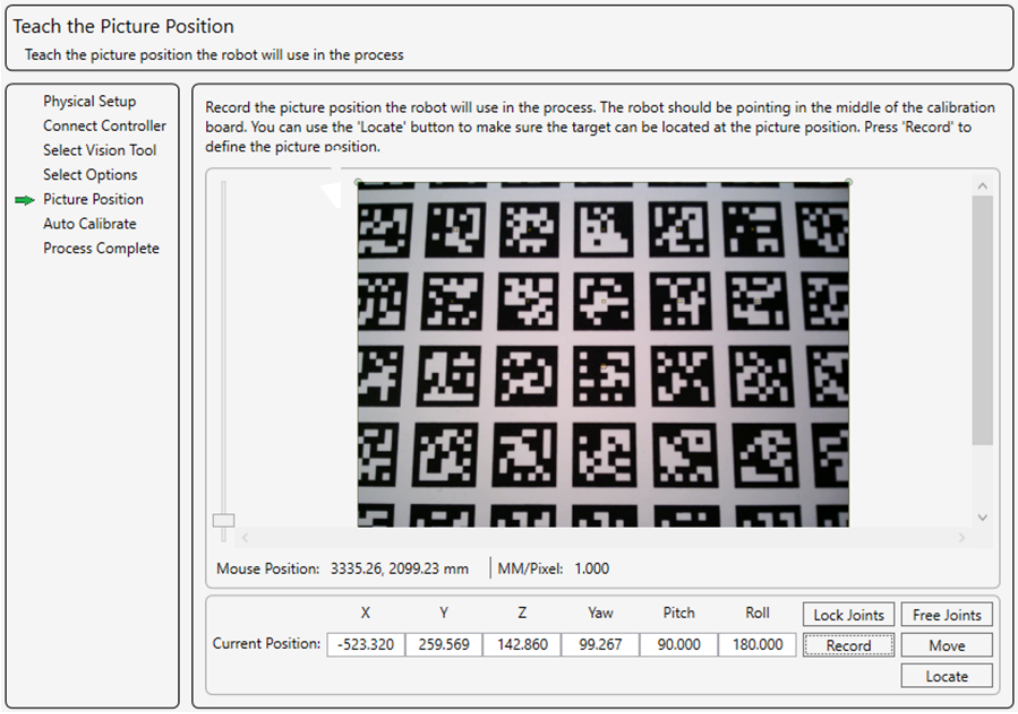
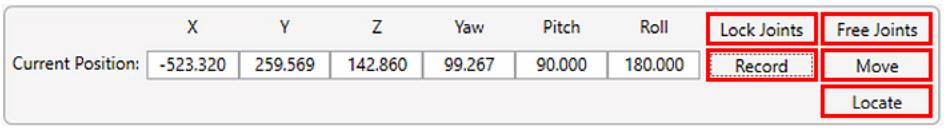
Step	Action
2.	In the popup window, select the camera to be calibrated and click **Accept**. For this example, calibrate camera 1, which is the front-facing camera. 
3.	It is important to properly position the robot and calibration board. Start by bending the robot's arm into a *righty* configuration. 

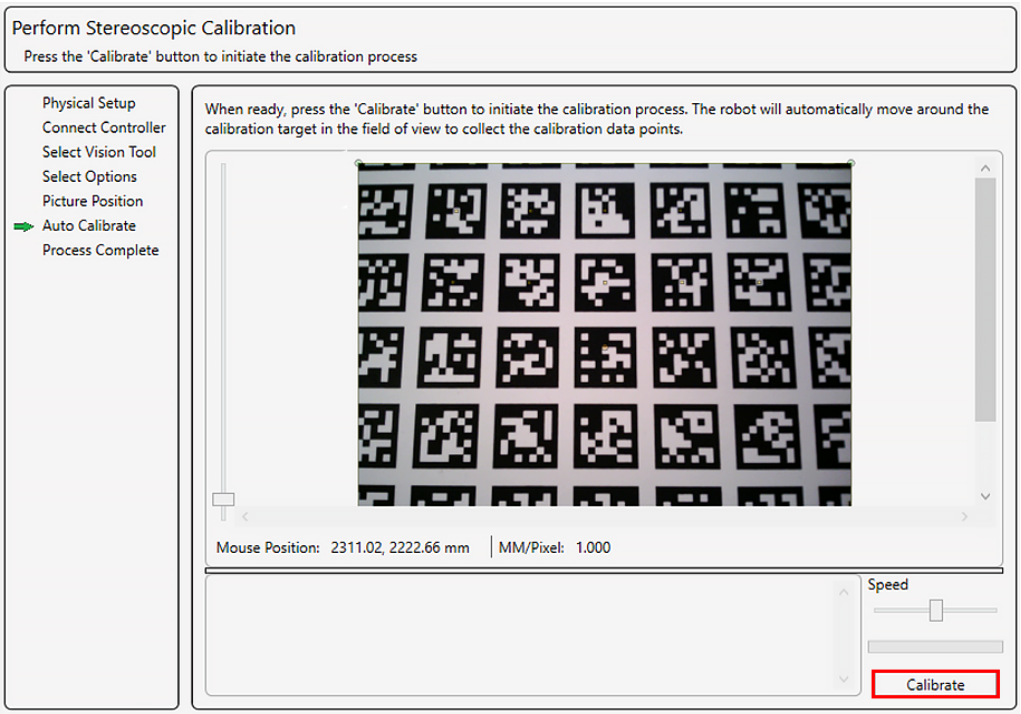
Step	Action
4.	If the front camera is being calibrated, place the ArUco board in front of the robot. The ArUco number 0 should be in the top-left corner when viewed from the camera's perspective. Place the arm so the camera is facing the center of the ArUco board at approximately 0.5 to 1 inches/ 12.7 to 25.4 mm from the end of the gripper fingers. 
5.	For the bottom camera, the ArUco number 0 should be in the far-left corner under the camera. When calibrating the bottom camera, place the robot arm so the camera is approximately 1 inch/ 25.4 mm above the center of the calibration board 

Step	Action
6.	When positioning the arm, make sure all four corners of the board are accessible and the robot can reach all of them. The camera must have clear views of the ArUco markers located in the corners of the board. This instruction is described in detail in the wizard window. If you are required to jog the robot to position the arm properly, click the **Pendant** button to access the virtual jog pendant. You can manipulate the power state from the **Enable/Disable** buttons. When all the conditions are met, click **Next**. 
7.	Click **Initialize** to initialize the vision system. This will load the required system files into the controller memory. After the system files are loaded, the **Next** button will be active. Click **Next**. 

Step	Action
8.	In the Select Vision Tool step, the proper vision project must be loaded. The vision project must contain vision processes that includes Image Acquisition and Fiducial vision tools. Test the process before starting the calibration procedure. The Fiducial tool for the calibration process should be configured as show below. In the **Vision Tool** drop-down menu, select **Fiducial Locator**. 
9.	In Select Desired Options, configure all required options for performing the vision calibration. ***NOTE:*** *This is a critical step. Be careful to configure the parameters properly.* 
10.	Gripper Properties • **Use Servo Gripper** - by default the IntelliGuide Gripper is a servo gripper type. • **Servo Open Position** – the position where the gripper fingers are considered open. You can either input numbers to tell the system the open position for the gripper, or you can click **Record** to save the current position of the gripper. 

Step	Action
11.	Calibration Board Properties: • **Board Type** drop-down menu. Based on the type of board you select, some of the parameters will be populated automatically. You have the option to select **Custom Board** and all information related to number of **Fiducial Rows** and **Fiducial Columns**. ArUco distance (**Fiducial center-to-center distance**) and **Fiducial Square size** will need to be populated. • **Minimum Optimal Distance to Target** and **Maximum Optimal Distance to Target** are the distances from the camera of the IntelliGuide Vision Gripper to the target. Note that from the factory, the focal length and the optimal distance are configured at 150 mm. • **Minimum Target Clearance** is the distance from the front plate of the gripper to the end of the gripper (this parameter ensures that the gripper's fingers will not collide with any objects when the vision system is performing Auto-Teach. 
12.	Advanced Properties: • **Joints to free** – in the wizard, some of the steps require you to free the joints and move the robot manually. You have the option to specify which joint should be put in free mode. By default all the joints are selected. • **Extra Settling Time** – this is the time that the robot will wait to completely settle during the Auto-Teach routine. In this step, you have the option to reduce or increase the settling time. By default, the time is set to 1 second.  When all settings are updated, click **Next**.

Step	Action
13.	For Teach the Picture Position, make sure the robot arm is positioned so that the camera is pointing in the middle of the calibration board and the distance from the camera plate to the calibration target is 0.5 - 1 inch/12.7 to 25.4 mm if no fingers are installed. If gripper fingers are installed, the distance between the edge of the fingers to the calibration target should be 0.5 - 1 inch/12.7 to 25.4 mm. 
14.	To manually move the arm, click **Free Joints** to free the joints, and after the arm is placed in the correct location, click **Lock Joints** lock the arm into position. After the arm is correctly placed and joints are locked, click **Locate** to take a picture and confirm that the calibration target is visible. When the arm is placed close to the calibration target, it is possible the image will look blurry. This is expected, and during the calibration routine, the arm will automatically move away to take multiple images. After the arm is positioned and a picture is taken, click **Record** to save the location. Click **Move** to position the robot in the recorded picture location. 
15.	After the last operation, the **Next** button will become active. Click **Next**.

Step	Action
16.	In Perform the Stereoscopic Calibration, click **Calibrate** in the lower right corner. **CAUTION** **Robot and Calibration Target Movement** During stereoscopic camera calibration, the robot will automatically move to locations close to the four corners of the calibration target. Do not obstruct robot motion. Do not move the calibration target. 
17.	The speed of the motion during the calibration routine can be adjusted by moving the Speed slider. By default, the speed is set to 50%. 
18.	The calibration process will take approximately 15-20 minutes. The process for calibrating the bottom camera is the same as calibrating the front camera. The difference is in the placement of the calibration board.

6. Appendices

Appendix A: Specifications

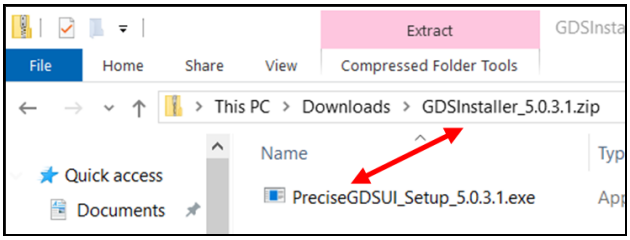
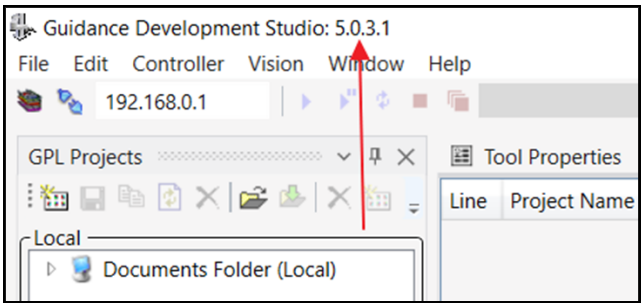
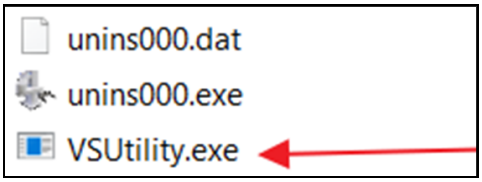
Cameras	Forward looking and downward looking
Weight	IntelliGuide v23 - 1.476 lbs (669.5 g) IntelliGuide v60 - 2.354 lbs (1067.76 g)
Resolution	SMP, H:2592, V:1944
Pixel Size	H:1.4 µ, V:1.4 µ
Lens	6 mm Manual adjustment require recalibration
Working Distance	150 mm (as configured)
Focal Length	2.8 mm
FOV (H):	72°
Lighting	PWM-controlled LED lighting
Precision, Typical from Static Position at Working Distance	±0.18 mm in X/Y/Z, ±0.19° in rotation. (Results can vary with application)
Barcode Formats 1D	Code39 (standard and extended) Code128 (standard and short) Code25 (ITF) Codebar (Codabar) EAN_8 EAN_13 UPC_E UPC_A Code39Checksum Code39StartStop Code25Checksum Code93
Barcode Formats 2D	PDF_417 (standard and Micro) DATA_MATRIX DATABAR PATCH_CODES Aztec QR Code
Software	Programming via Guidance Development Suite (GDS) Compatible with Guidance Programming Language (GPL) Compatible with TCP Command Server

Appendix B: VSUtilities

Installing GDS and Confirming Its Version

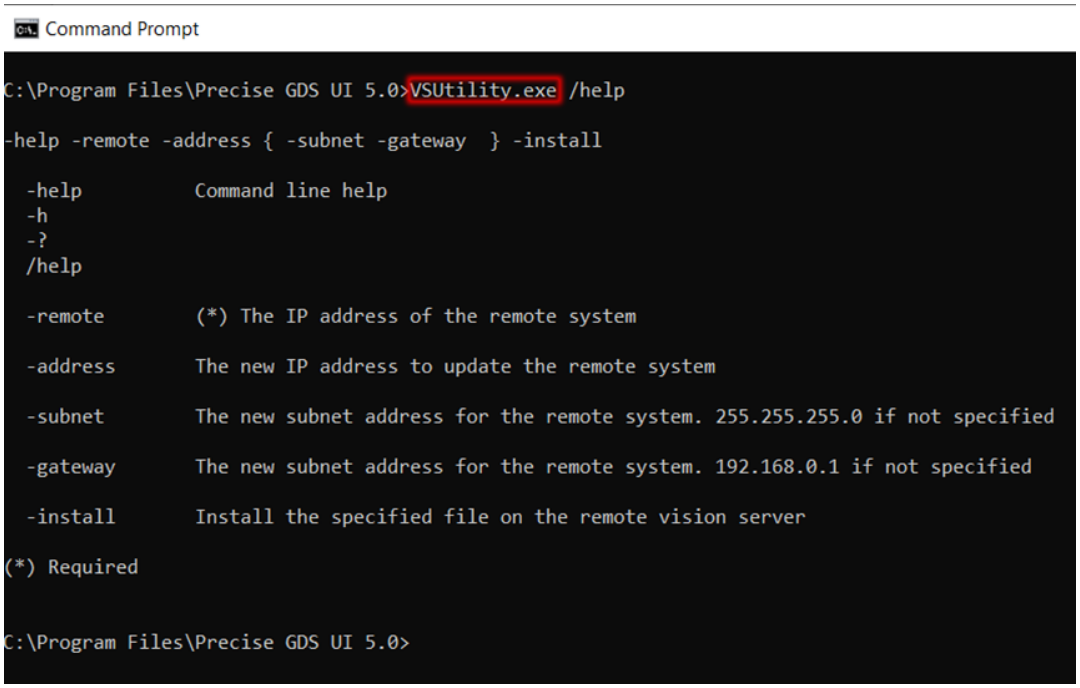
"VSUtilities" is an executable file that uses PowerShell commands to perform remote operations on the grippers, such as IP address changes and updating software. In order to use the VSUtilities, make sure the matching version of GDS is installed on your computer.

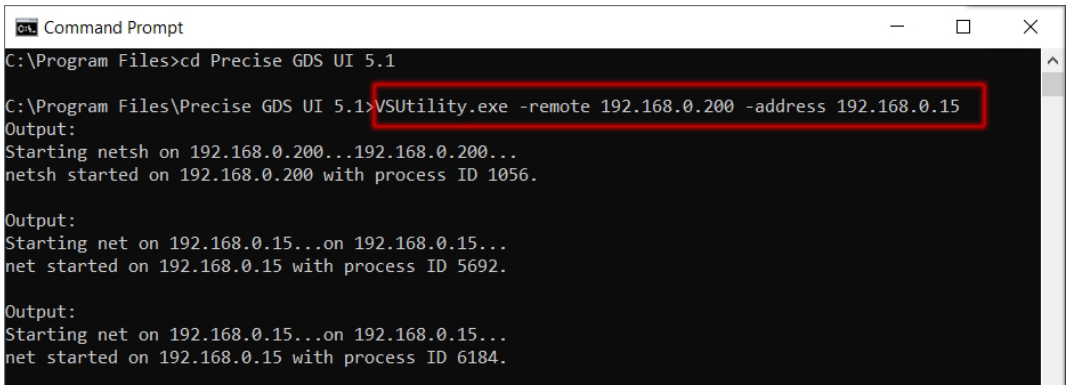
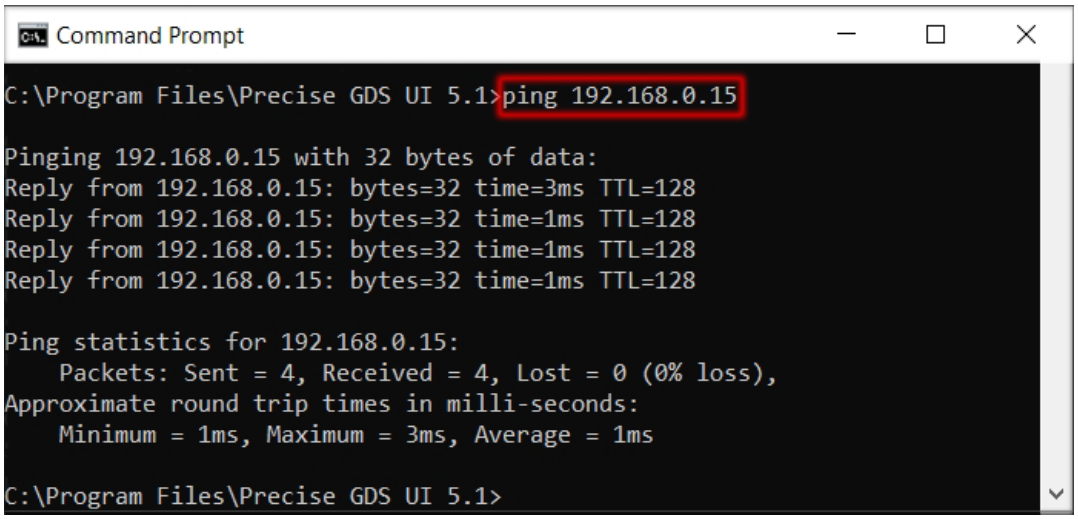
Perform the following procedure.

Step	Action
1.	Download "GDSInstaller_[version number].zip" from the Brooks website, https://www.brooks.com/support/brooks-preciseflex-support/software-updates/
2.	Double-click "GDSInstaller_[version number].zip" to extract GDS software, then double-click "PreciseGDSUI_setup[version number].exe" to install it. 
3.	After the installation is completed, open GDS, and confirm that the version of the executable file and the software version displayed in the title bar are the same. 
4.	Within the program installation path (For example: C:\Program Files\Precise GDS UI 5.0), locate the "VSUtility.exe" file to confirm the completed installation. 

Changing the IntelliGuide Vision Gripper IP Address

To change the IntelliGuide Vision Gripper IP Address, execute the VSUtility.exe via the Windows Command prompt. Perform the following procedure.

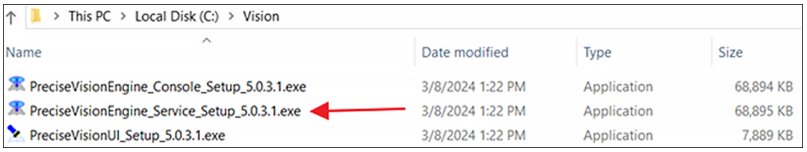
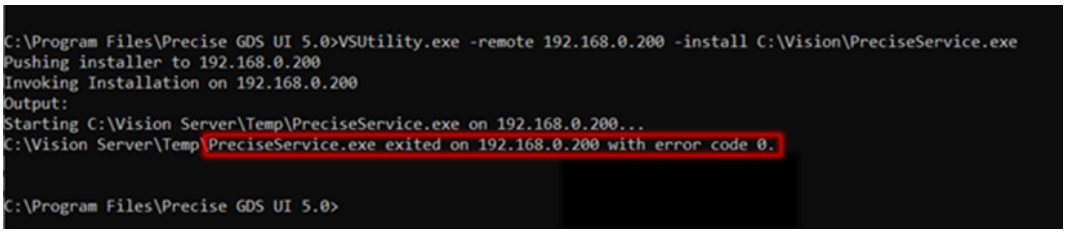
Step	Action
1.	Make sure your computer has an IP Address compatible with the robot and IntelliGuide. ***NOTE:*** *For IP address compatibility, consult the controller manual that applies to your robot.*
2.	At the bottom of the screen, bring up the Command Prompt via **Start > Windows Systems > Command Prompt**.
3.	Navigate to the folder containing VSUtilities.exe (Use “cd” command to change directories). 

Step	Action
4.	Enter **VSUtility.exe -remote CurrentAddress -address TargetAddress** where: • **CurrentAddress** is the current IPv4 Address of the IntelliGuide • **TargetAddress** is the IPv4 Address that you would like to update the IntelliGuide to. 
5.	When the process is finished, ping the IP address to confirm connectivity. 

Updating IntelliGuide Vision Gripper Software

To update IntelliGuide Vision Gripper software, perform the following procedure.

Step	Action
1.	Download "VisionInstallers_(version number).zip" from the Brooks website, https://www.brooks.com/support/brooks-preciseflex-support/software-updates/.

Step	Action
2.	Click on "VisionInstallers_(version number).zip" to extract the contents.
3.	Copy the extracted files into the folder C:\Vision. Create the folder on your C: drive if it doesn't already exist. 
4.	At the bottom of the screen, type "Command Prompt" into the Windows Search field.
5.	Navigate to the folder containing "VSUtility.exe."
6.	Enter **VSUtility.exe -remote VisionGripperIpAddress -install PreciseVisionEngineServicePath** where: • "IntelliGuideIpAddress" is the Current IP Address of the IntelliGuide • "PreciseVisionEngineServicePath" is the path to the Precise Vision Engine Service Setup Executable (For example: C:\Vision\PreciseVisionEngine_Service_Setup_5.0.3.1.exe)
7.	Wait for the program to return "Exited with error code 0." 
8.	Check GDS to make sure that the Remote Vision Engine Version is updated and correct after connecting to IntelliGuide.