YASKAWA

MOTOSIGHT™ 2D INSTRUCTIONS

FOR: SMART PENDANT

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

YRC1000 INSTRUCTIONS
YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000 MAINTENANCE MANUAL
YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

YRC1000micro INSTRUCTIONS
YRC1000micro OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000micro MAINTENANCE MANUAL
YRC1000micro ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

YASKAWA SMART PENDANT INSTRUCTIONS

Have the following information available when contacting the YASKAWA Representative:
- System
- Primary Application
- Software Version *(Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version})*
- Warranty ID *(Located on Robot Controller)*
- Robot Serial Number *(Located on Manipulator data plate)*
- Robot Sales Order Number *(Located on Robot controller data plate)*

The Americas YASKAWA Representative

- 24-hour Telephone Number: **(937) 847-3200**
  Use for urgent or emergency needs for technical support, service and/or replacement parts
- Routine Technical Inquiries: *techsupport@motoman.com*
  Allow up to 36 hours for response

Part Number: 187439-1CD
Revision: 6

MANUAL NO. HW1486351⑥

DANGER

- This manual explains the MotoSight 2D software of the YRC Controller. Read this manual carefully and be sure to understand its contents before handling the YRC Controller. Any matter, including operation, usage, measures, and an item to use, not described in this manual must be regarded as “prohibited” or “improper”.
- General information related to safety are described in “Chapter 1. Safety” of “YRC CONTROLLER INSTRUCTIONS”. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of “YRC CONTROLLER INSTRUCTIONS”.

CAUTION

- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place before operating this product.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

NOTICE

- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact your local YASKAWA representative to order a new copy. Be sure to tell the representative the manual number listed on the front cover.

NOTE

- This instruction manual is applicable to both the YRC1000 and YRC1000micro controller.
- The description of “YRC Controller” refers to “YRC1000” and “YRC1000micro” in this manual unless otherwise specified.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the YRC Controller

In this manual, the Notes for Safe Operation are classified as “DANGER”, “WARNING”, “CAUTION”, or “NOTICE”.

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.

Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.

Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.

Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.

NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

Even items described as “CAUTION” may result in a serious accident in some situations.

At any rate, be sure to follow these important items.

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” and “CAUTION”.

<YRC1000>

DANGER

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the Smart pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the top of the Smart Pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in PLAY (AUTOMATIC) mode or in REMOTE mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button

- Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop

- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  - Turning ON the YRC1000 power
  - Moving the manipulator by using the Smart Pendant
  - Running the system in the check mode
  - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the upper right of the Smart Pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator

<YRC1000micro>

DANGER

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the Smart Pendant is turned OFF.
  - Press the emergency stop button on the top of the Smart Pendant or on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in play mode or in the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button

- Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop

- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  - Turning ON the YRC1000micro power
  - Moving the manipulator by using the Smart Pendant
  - Running the system in the check mode
  - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop button is located on the top right of the Smart Pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator.

<YRC1000micro only>

DANGER

- In the case of not using the Smart Pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety).
- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the safety signal short circuit connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

<YRC1000/YRC1000micro>

WARNING

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  - Check for a problem in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the Smart Pendant to a safe place after use.

If the Smart Pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the Smart Pendant left unattended, which may result in personal injury and/or equipment damage.

General Safety on the Smart Pendant

CAUTION

- Be careful not to drop the Smart Pendant on the floor.
- Pay attention to the handling of the cable so that it will not stumble on the Smart Pendant cable.
- Handle carefully so as not to damage the cable.
- Do not place the Smart Pendant with the touch screen facing down.
- Do not place the Smart Pendant close to a heat source or in direct sunlight.
- Do not place the Smart Pendant in an environment with excessive dust, humidity or strong magnetic fields.
- Pay attention not to adhere chemicals, cutting oil (including coolant), rust preventive oil, organic solvent etc. to the Smart Pendant.
- Do not clean the Smart Pendant with scrubbing sponges. Use a soft cloth and a little water or diluted neutral detergent (mild cleaning liquids).
- Operate the touch screen with your fingers, or use a touch-pen designed for use with capacitive screens. Never use sharp objects (ex. screwdriver) for operating the touch screen. This could damage the touch screen.
- Make sure not to get foreign objects or liquid from the USB connector.
- Do not connect the Smart Pendant to anything except for the YRC controller.

Definition of Terms Used Often in This Manual

<YRC1000>

The MOTOMAN is a YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the YRC1000 Controller, the YRC1000 Smart Pendant, and supply cables.

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
YRC1000 Controller	YRC1000
YRC Controller Smart Pendant	Smart Pendant
Cable between the manipulator and the YRC Controller	Manipulator cable

<YRC1000micro>

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the YRC1000micro controller, manipulator cables, the YRC1000micro Smart Pendant, and the YRC1000micro Smart Pendant safety signal short circuit connector (optional).

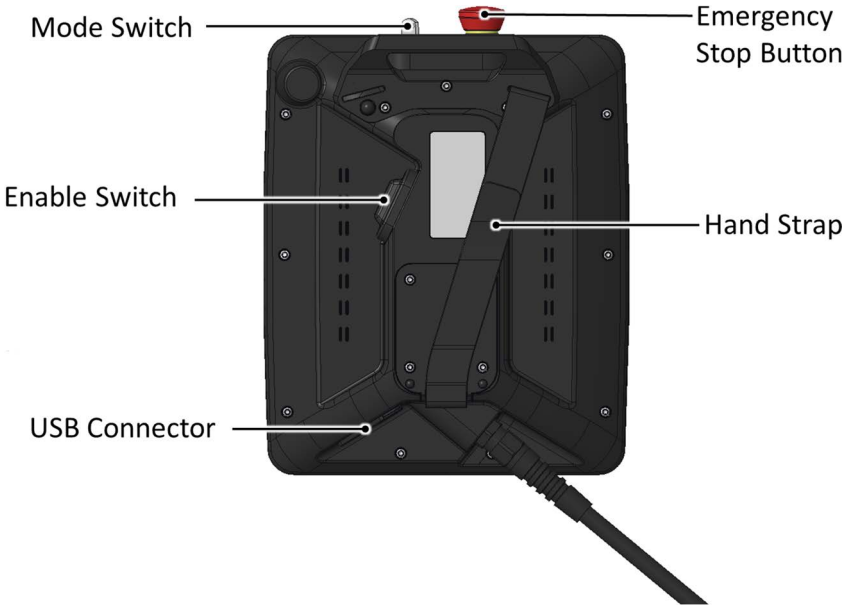
In this manual, the equipment is designated as follows:

Equipment	Manual Designation
YRC1000micro Controller	YRC1000micro
YRC1000micro Smart pendant	Smart Pendant
Cable between the manipulator and the YRC Controller	Manipulator cable
YRC1000micro Smart pendant safety signal short circuit connector	Smart Pendant safety signal short circuit connector (optional)

<YRC1000/YRC1000micro>

Descriptions of the Smart Pendant, buttons, and displays are shown as follows:

Equipment		Manual Designation
Smart Pendant	Emergency Stop button	This button on the Smart Pendant will be denoted as Emergency Stop button
	Mode Switch	Three kinds of modes that can be selected by the mode switch are denoted as follows: REMOTE, PLAY (AUTOMATIC), or TEACH (MANUAL)
	Displays	The buttons and items displayed in the Smart Pendant is denoted with { }. ex. {Save}
	Status LED	These LED indicators will be denoted as: POWER LED, SERVO LED, or ERROR LED
	Membrane Key	The membrane keys are denoted with [ ]. ex. [JOG MODE]
	Jog Keys	“Jog Keys” is a generic names for the jog operation keys.
	Keys pressed simultaneously (for membrane key only)	When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [S+] + [L+].



Description of the Operation Procedure

<YRC1000/YRC1000micro>

In the explanation of the operation procedure, the expression “Select” means that the item is directly selected by touching the screen.

Registered Trademark

<YRC1000/YRC1000micro>

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1 Introduction

MotoSight™ 2D is part of the YASKAWA family of standardized solutions. It is a fully integrated hardware/software 2D vision solution, supported by YASKAWA. MotoSight™ 2D enables the YRC Controller to communicate with a camera.

The MotoSight™ 2D includes a Smart Pendant application that assigns supported vision tool results directly to robot variables for use in robot programs.

1.1 System Requirements

Table 1-1: System Requirements

Function	Details
Robot Controller	YRC1000 or YRC1000micro
Controller Software	Any that works with the YRC Controller
Vision Device	Cognex In-Sight series camera supporting EasyBuilder and Spreadsheet view.
MotoSight Version	Smart Pendant with software version 1.4 or later

1.2 About This Document

This manual provides a description of functionality, usage instructions, as well as application examples for the MotoSight™ 2D Smart Pendant Edition. For detailed information on specific system components in this document, refer to the documentation package included with the robot system.

NOTICE

This manual documents a standard Motoman system. If the system is custom or modified, use this manual in conjunction with the drawings, schematics, and parts listing (Bill of Material) for the specific system. The drawings, schematics, and parts listing are included in the documentation package supplied with the Motoman system.

1.2.1 Major Components

The MotoSight™ 2D Smart Pendant Edition includes the following major components:

- Cognex In-Sight Camera
- In-Sight Explorer Software (version 4.8.5 and higher)
- YASKAWA MotoSight (version 5.4.2 or higher)
- Smart Pendant with Software (version 1.4 or later)
- Manipulator
- One YRC Controller Assembly

1.3 Reference Documentation

For additional information on individual components of the MotoSight™ 2D, refer to *table 1-2* for various documentation that is included with your system:

Table 1-2: Reference Documentation

Manual Description	**YRC1000micro MANUAL NO.**	**YRC1000 MANUAL NO.**
YASKAWA Manipulator Manual	Based upon robot model	
YASKAWA Operator's Manual for your Application	Based upon application	
Vendor manuals not manufactured by YASKAWA	Not Available	
YASKAWA Controller Manual	RE-CTO-A222	RE-CTO-A221
YASKAWA YRC1000 Alarm Codes	RE-CER-A601	RE-CER-A600
YASKAWA Maintenance Manual	RE-CHO-A115	RE-CHO-A114
YASKAWA Smart Pendant Instructions	HW1485509	
YASKAWA Concurrent I/O Manual	RE-CKI-A469	RE-CKI-A467
YASKAWA Macro Command Function Manual	HW1484488	HW1483378
YASKAWA Smart Pendant *INFORM Language Supplement*	HW1485511	
YASKAWA Relative Job Function Manual	HW1484476	HW1483390

2 Installation and Setup

The customer is responsible for supplying and installing the PC, and camera if not supplied by YASKAWA. If using a non-MotoSight series camera refer to the Cognex In-Sight vendor documentation for complete installation instructions for your camera sensor and equipment.

The MotoSight 2D Pendant application hardware may vary depending on the robot controller model, the number of cameras and model of the cameras. MotoSight™ 2D can support up to four cameras. The Cognex cameras come in two versions:

- **Two-cable version** - power and Ethernet use two separate cables (like the MS-series, the IS7000 series).
- **POE (power over Ethernet) version** - single cable combining both the Power and Ethernet (like the IS8000-series).

Fig. 2-1 and *fig. 2-2* are a few examples of hardware combinations.

For further information refer to the system specific hardware configuration, refer to the system electric drawings or contact the local YASKAWA representative.

Fig. 2-1: Basic Equipment Connections using YRC1000micro Controller

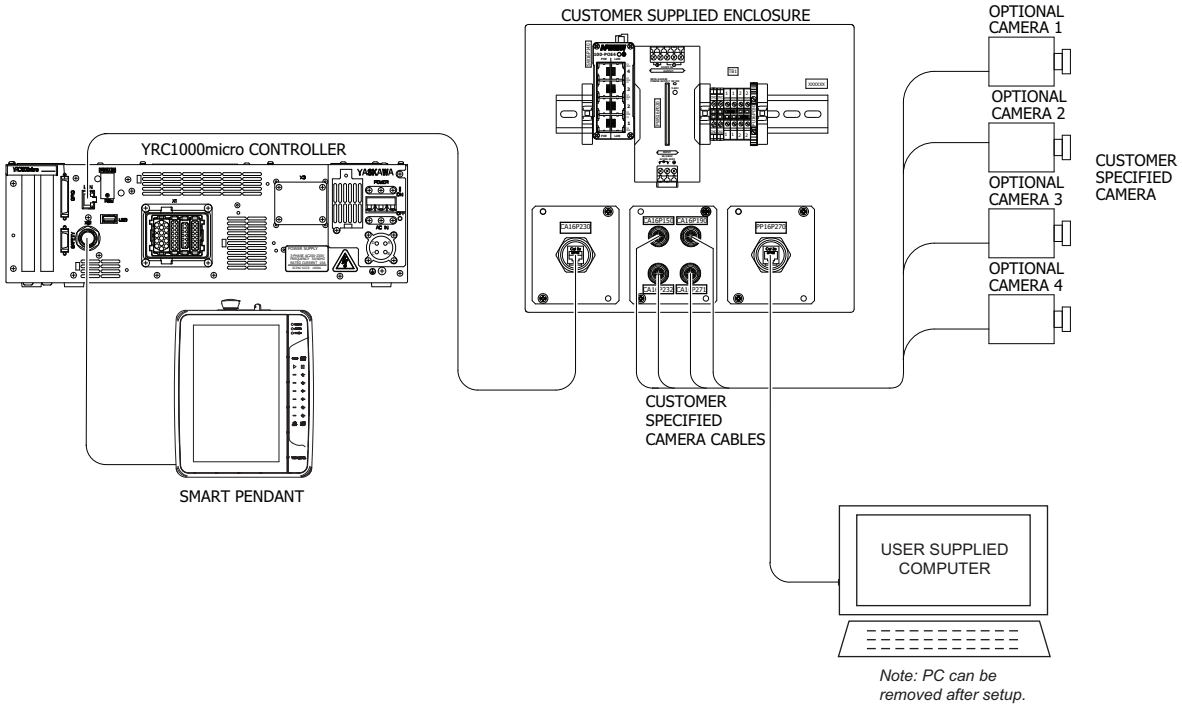
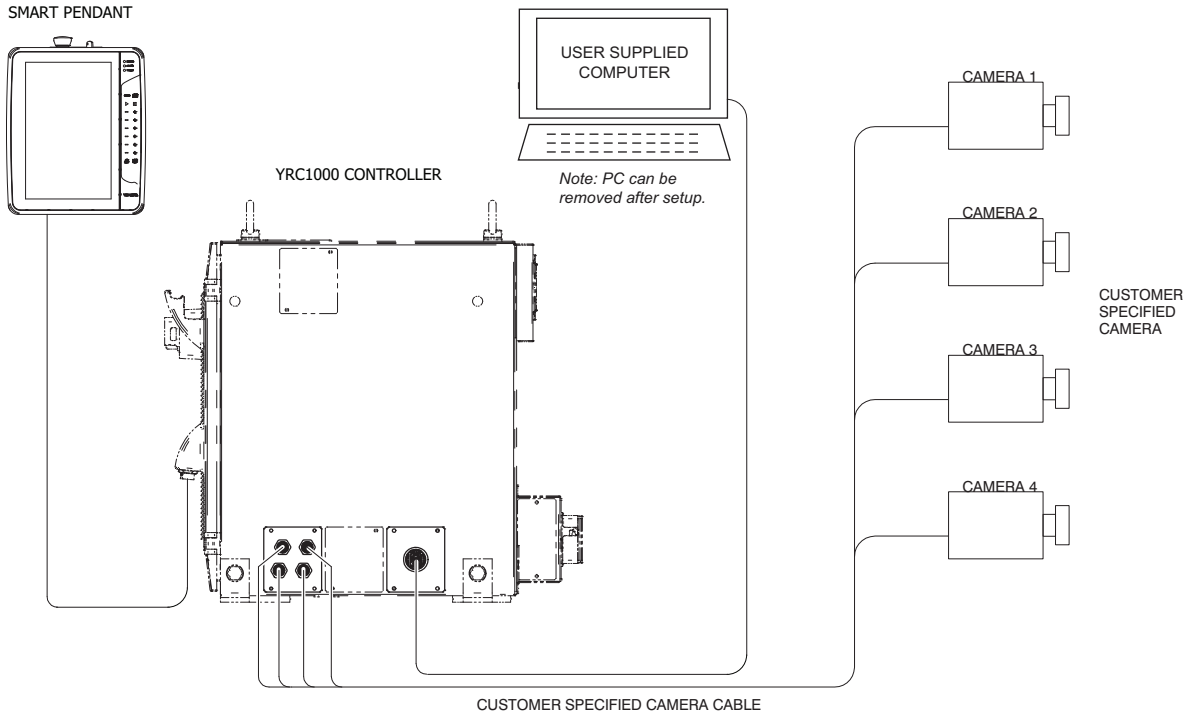


Fig. 2-2: Basic Equipment Connections using YRC1000 Controller



2.1 PC Setup

Refer to the pc vendor documentation for installation instructions.

2.1.1 Setting IP Addresses

The MotoSight™ 2D is configured with the following IP addresses from the factory. If there is a need to change the addresses then follow the instructions in *chapter 2.4 "TCP/IP Communication Setup"*.

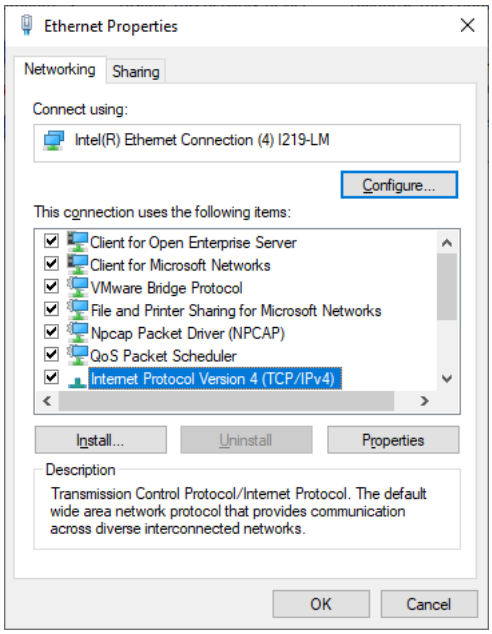
Table 2-3: YRC Controller IP Addresses

IP Address	Default Values	Allowable Range
Robot	192.168.1.31	Any valid IP address other than 10.0.0.x.
Camera1	192.168.1.41	Any IP address that puts the camera in the same subnet address space.
Camera2	192.168.1.42	
Camera3	192.168.1.43	
Camera4	192.168.1.44	
Computer	192.168.1.45	Any IP address that puts the computer in the same subnet address space.
Subnet Mask	255.255.255.0	Always set to 255.255.255.0.

2.1.2 Configure Network Settings

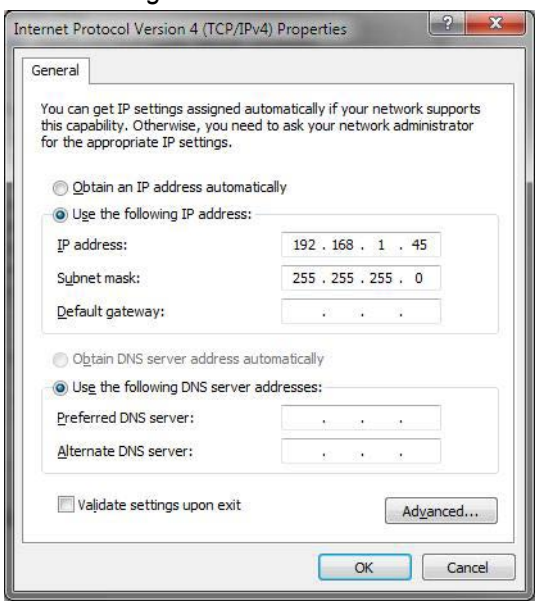
1. Open Network Connections in Control Panel.
   {Start} ⟶ {Settings} ⟶ In the "Find a setting" search bar, type in "Network Connections" and press enter.
2. From the Network Connections window, right-click on the desired connection (typically Ethernet) and select {Properties]. The Ethernet Properties window appears.

Fig. 2-3: Ethernet Properties Window



3. From the “Networking” tab, highlight “Internet Protocol Version 4 (TCP/IPv4)” from the “This connection uses the following items:” list and press {Properties}. The Internet Protocol (TCP/IP) Properties window appears.

Fig. 2-4: IP Address Settings



4. Select “Use the following IP address:”.
5. Set the IP address and subnet mask so that they are on the same network as the robot and camera(s).

NOTICE

The IP addresses for the PC, YRC Controller and In-Sight camera are all set on the same network.

6. Select the “Use the following DNS server addresses:”. Leave both addresses blank.
   - Preferred DNS server: Leave blank
   - Alternate DNS server: Leave blank
7. Click {OK} and close all open windows.

2.2 In-Sight Software Setup

The following instructions are based on In-Sight Explorer ver. 6.0.

2.2.1 Install Software

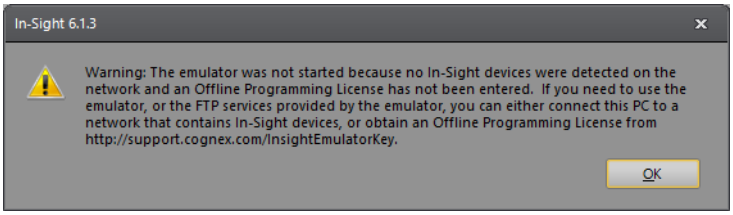
Install the Cognex In-Sight Explorer software. Refer to Cognex documentation for PC requirements and detailed instructions.

2.2.2 First Time Use

Start the In-Sight Explorer program from the PC.

When running the In-Sight Explorer 4.8.5 software for the first time, there may be the following warning:

Fig. 2-5: Warning! Camera Not Found



If you receive this warning, modify the IP address of the camera as described below. If no warnings appear and the camera is found, verify the IP address of the camera as described in *chapter 2.2.2.2" Verifying IP Address"*.

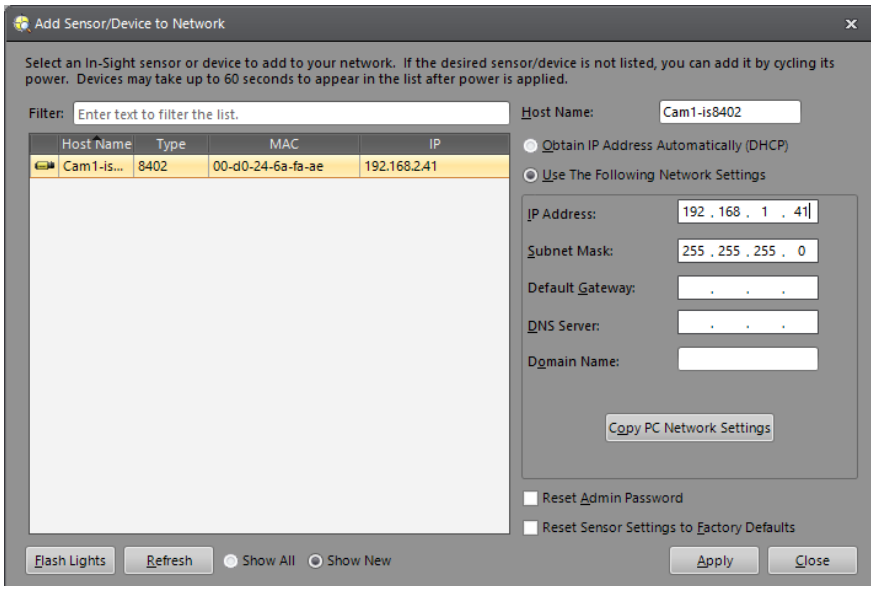
2.2.2.1 Modify Camera IP Address

1. Locate the camera, select {System} ⟶ {Add Sensor/Device to Network…} from the menu. The "Add Sensor/Device to Network" window appears.

NOTICE

If camera does not appear in the list, try selecting {Show All} and/or clicking the {Refresh} button.

Fig. 2-6: Add Sensor/Device to Network Window



2. Select a camera from the list and modify the network settings including IP address and Subnet Mask to match the settings in *fig. 2-6*.
3. Press {Apply}. A message box appears stating that network settings will be changed and existing communications with the device will be broken.
4. Press {OK}. A message box appears stating that the “Network settings are changed successfully.”
5. Press {OK}.
6. Press {Close} on the “Add Sensor/Device to Network” window.

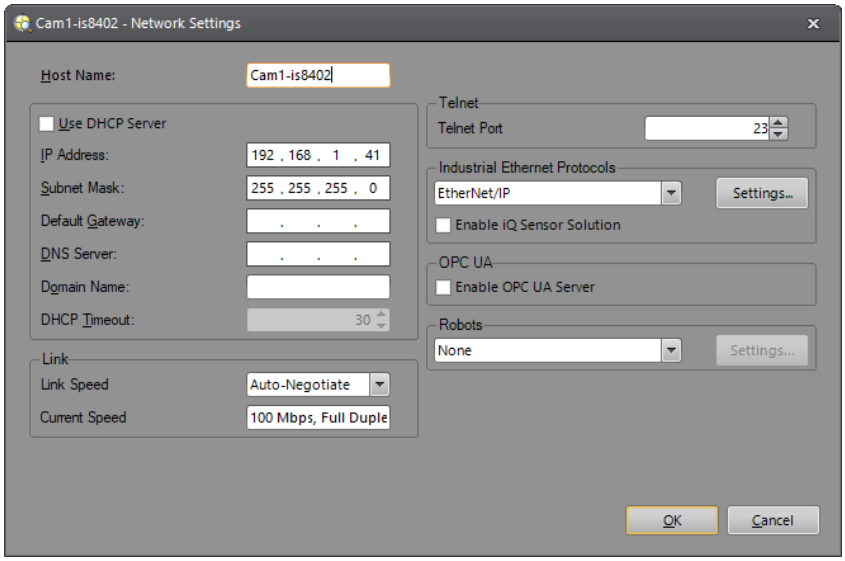
NOTICE

If the IP address is changed, In-Sight Explorer may need to be closed and the In-Sight Micro may need to be manually powered down and backed up and In-Sight Explorer restarted before the new IP address is correctly recognized.

2.2.2.2 Verifying IP Address

1. Put the camera Offline, select {Sensor} ⟶ {Online}.
2. To verify the IP address, select the camera host name from the In-Sight Network window and select {Sensor} ⟶ {Network Settings...} from the menu. The Network Settings window appears.

Fig. 2-7: Network Settings Window



3. Verify the IP address and Subnet Mask. If they need to be changed, type in the correct information and click [OK].

4. If necessary, click [Yes] in the message box that appears stating that the camera must be rebooted.

NOTICE

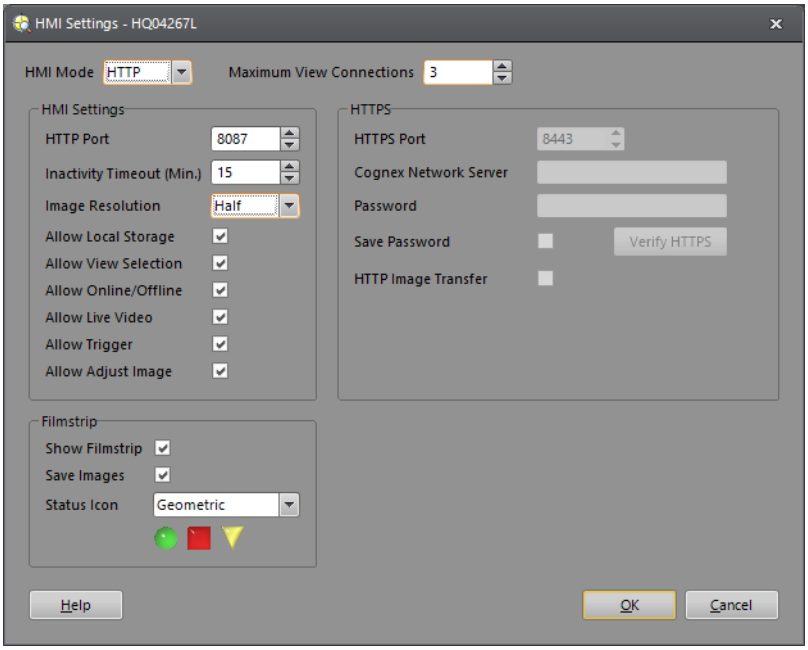
If the IP address is changed, In-Sight Explorer may need to be closed and the In-Sight Camera may need to be manually powered down and back up and In-Sight Explorer restarted before the new IP address is correctly recognized.

2.2.2.3 HMI Settings

Starting with MS2D 6.0.0, changes are made to use the In-Sight HMI protocol. In-Sight Camera Firmware 6.0.3 or later is required. For a proper connection to be established, the HMI settings must be properly set.

1. Double-click on the camera in the “In Sight Network” Window.
2. Select {Sensor} ⟶ {HMI Settings} to display the HMI Settings window.

Fig. 2-8: HMI Settings



3. Verify:
   - **HMI Mode:** is set to “HTTP”
   - **Maximum View Connections:** is set to “2” or more.
     - 3 connections are recommended for simultaneous connections from the Robot Controller, Programming Pendant, and PC browser.
   - **HTTP Port:** 8087
   - **Allow** options: All have a check-mark

4. Press {OK} to save the settings and close the window.

NOTICE

There may be a prompt to restart the camera for changes to take effect.

2.3 Loading the Camera Job

This operation loads the MotoSight2D job template to the In-Sight Sensors.

1. Double click on the camera in the “In Sight Network” Window.
2. Select {File} ⟶ {Open Job...}.
3. Select the folder containing the template supplied by YASKAWA.
4. Select and load the appropriate template job based on your camera firmware:
   – Template version 506 is for cameras containing firmware up to 4.10.5.
   – For cameras with firmware starting with 5.x try selecting the template that closely matches the firmware version of the camera.
     • For example, a camera with 5.5.0 uses MS2D-**-550.job template. A camera with 5.7.4 firmware uses MS2D-**-573.job template.
   – Starting with MS2D 5.4.2 changes were made to increase transfer speed. Templates are optimized for this change and are designated by ending with the digit '1'.
     • For example MS2D-**-5731.job is the optimized version of MS2D-**-573. MS2D 5.4.2 and up can work with non-optimized templates but for a maximum transfer speed use the optimized versions.

NOTICE

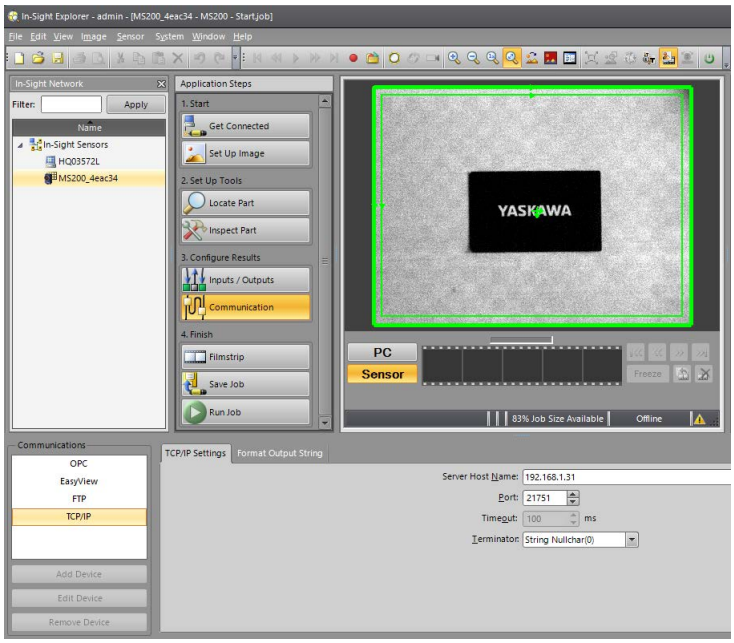
- “**” represents the abbreviated language on the Template job name.
- If you do not have the MS2D template or would like to check for updates, contact the local YASKAWA representative.

2.4 TCP/IP Communication Setup

Contained in the default template is a communications tool for signaling the robot when a new data acquisition (trigger) has occurred. The template is pre-configured to use the default IP Address selection. If the project requires the configuration of the IP Address to something different than the default IP Address, change the IP Address setting in the template to match the actual configuration.

1. Press {Communications} under “Application Steps, 3. Configure Results” *TCP/IP Settings*

Fig. 2-9: Communication Setup

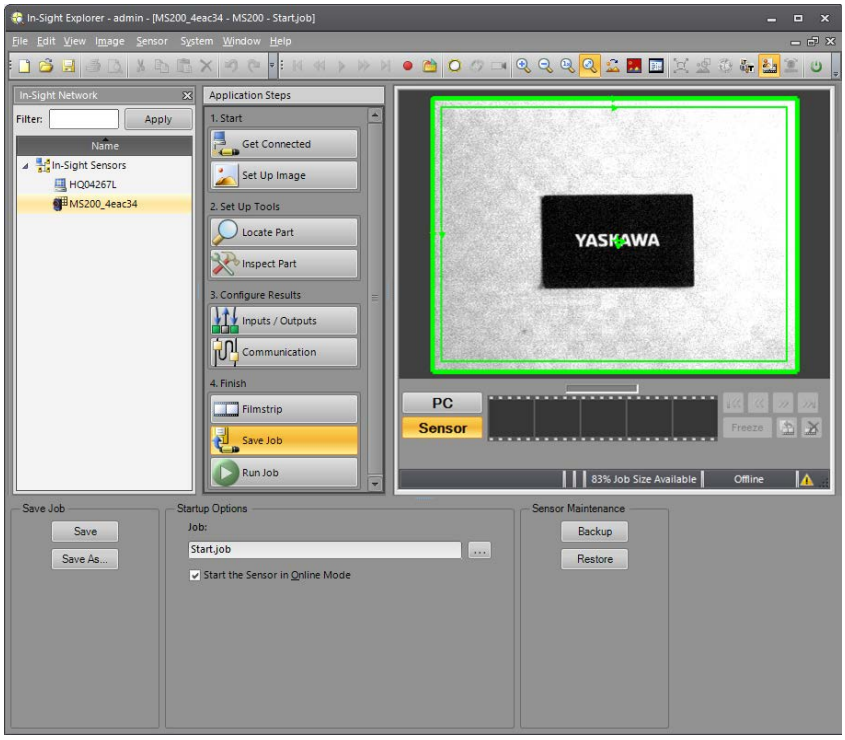


2. In the lower “Communications” selection box, select “TCP/IP” then (ADD Device/Edit Device/Remove Device).
3. Verify/modify the “Server Host Name” value to match the IP Address of the robot controller.
   – Example: YRC1000: 192.168.1.31
4. Verify the port # is set to the correct camera, if using multiple cameras.

- Camera 1 port - 21751
- Camera 2 port - 21752
- Camera 3 port - 21753
- Camera 4 port - 21754

5. Press {Save Job} under “Application Steps, 4. Finish.”

Fig. 2-10: Saving Job



6. Click on the drop down box and check “Start the sensor in Online mode” option box.
7. Press {Save As} on the bottom left of the Save Job area.
8. Select “In-sight Sensors” ⟶ “your camera” from the list.
9. Enter “Start” for the File Name then press {Save} to save the template as the Start.Job.

2.5 Setting Camera IP Address in the YRC Controller

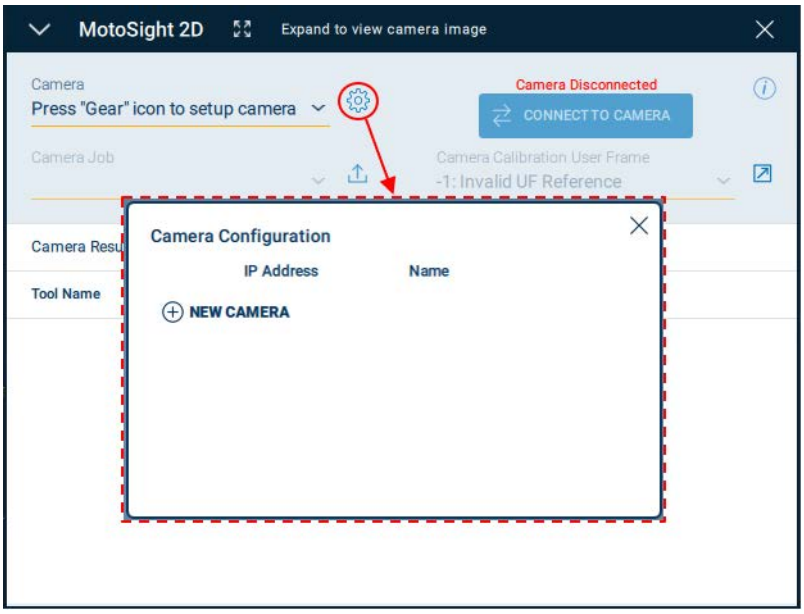
Use the MotoSight 2D screen to enter the camera(s) IP Addresses.

1. Select MENU → Utility → MotoSight 2D to display the MotoSight 2D screen on the Smart Pendant.

NOTICE

The MotoSight 2D menu only displays if the MotoSight 2D application is installed on the YRC Controller.

2. Switch to MANUAL mode using the key switch on top of the Smart Pendant.
3. Press (setting), to display the Camera Configuration screen.



CAUTION

- Do not use the following variables for any other purpose than:
  - S097 - Camera1
  - S096 - Camera2
  - S095 - Camera3
  - S094 - Camera4

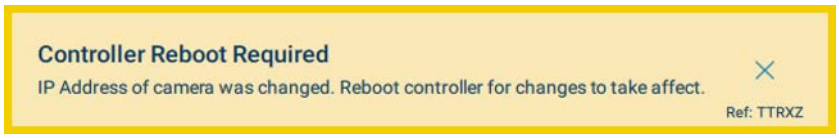
The MotoSight 2D screen uses the following string variables in the background to set IP addresses. Using these string variables for other purposes can cause unexpected results.

4. Press {NEW CAMERA} to add a camera with default values.

NOTICE

- The IP address and camera name are pre-populated with the default IP address and a generic camera name. If required the IP Address and Name of the camera may be edited by selecting the respective textbook.
- If using multiple cameras repeat *step 3* and *step 4*.
- MotoSight 2D supports up to four cameras.
- Pressing (trash can) at the end of the camera row deletes that camera.
- Only the last camera on the list can be deleted.

5. Press the {X} to close the dialog. A message appears to reboot the YRC Controller to apply changes.

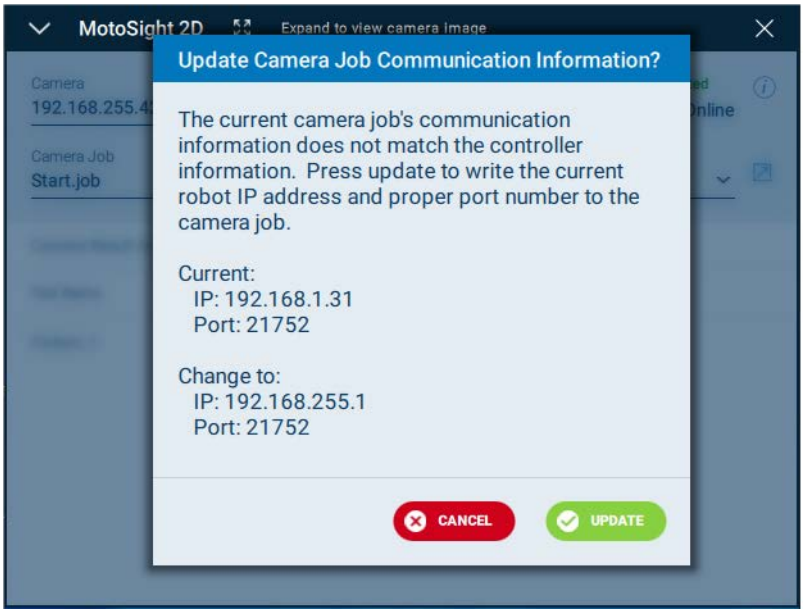


6. Reboot the YRC Controller.

2.6 TCP/IP Communications Setting Automatic Update

When connecting to the camera with the Smart Pendant MotoSight2D interface, the TCP/IP communication settings are verified and if the communication information in the camera job is incorrect the following message displays.

Fig. 2-11: Updating Camera Job Communication



Press {UPDATE} to update the communication settings.

3 Operation

This section provides a general outline of the operating procedures for the MotoSight 2D Smart Pendant Edition system.

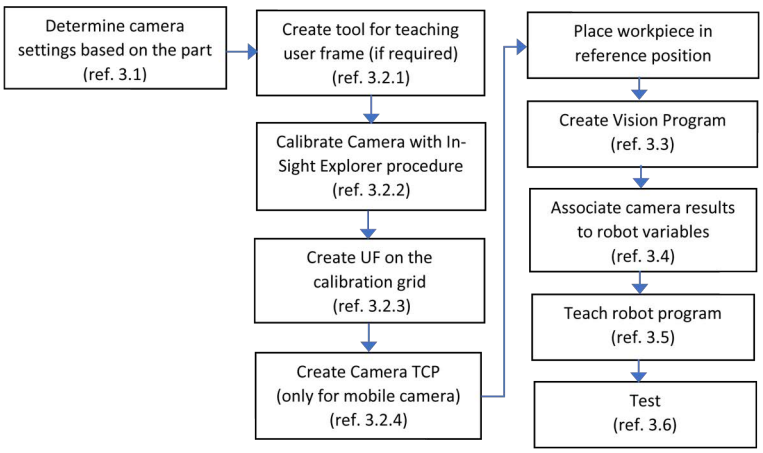
Vision systems process images using “tools” created in the vision program. These vision tools can perform a variety of functions, such as; counting the number of parts, locating a part in the field of view (FOV), measuring a part, counting specified features on a part, as well as many other functions. Once a vision program (referred to as a “job” by Cognex) processes an image, it creates a result value for each function in the job. Start each new vision job using the default MotoSight 2D template. The template allows the vision tool results to be available for assignment to the robot variables. If a new vision job is started from scratch without using the MotoSight 2D template, the robot will not interface with that camera job.

The programmer must designate where the camera job tool results are stored in robot memory. Using the MotoSight 2D screen, the camera results can be assigned to a compatible robot variable type (Byte/Real/ Robot Position) depending on the tool result type. Once assigned, the camera job tool result values are transferred to the robot variables each time the camera is triggered via the button on the MotoSight 2D screen, using the INSPECT macro in a robot job, or the In-Sight Explorer software.

NOTICE

Refer to the YASKAWA Operator’s manual included with the system for more information on the robot variable types.

For more detailed operating information, refer to the specific component manuals that are part of the MotoSight 2D Smart Pendant Edition system documentation package (see *chapter 1.3 “Reference Documentation” on page 1-2*)



3.1 Determine Camera Settings

Based on the camera field of view, working distance, and workpiece type and size, determine the physical position of the camera and required lighting of the part. The camera can be in a fixed position or mounted on the robot (mobile camera).

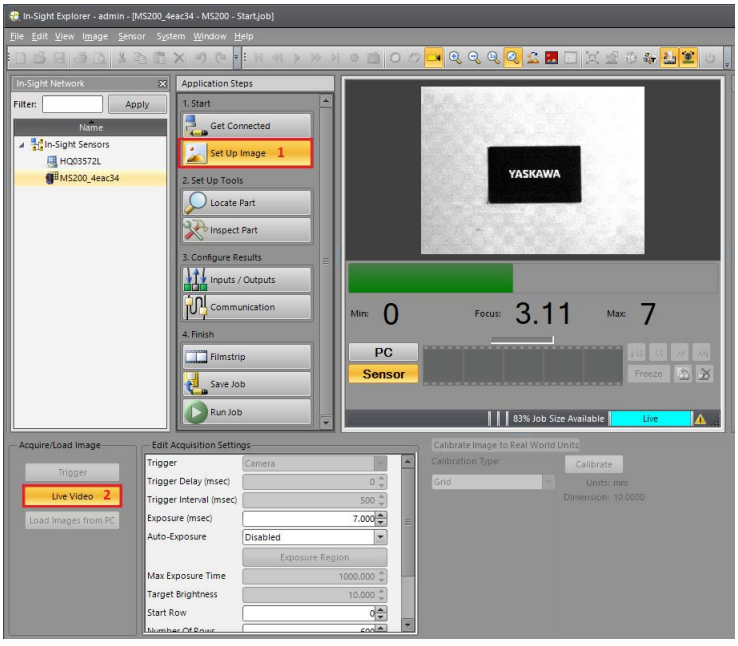
Fig. 3-1: Cameras

Fixed Camera

Mobile Camera

1. Connect the camera and select “Set Up Image” using the Cognex In-Sight Explorer application.
2. Switch camera to “Offline”
3. Press {Live Video}.
4. Adjust the camera focus and exposure to get a clear image and consistent illumination of the part.
5. Press {Live Video} to stop the image streaming and set back online, once complete.

Fig. 3-2: Cognex In-Sight Explorer



For more details on setting up an image in In-Sight Explorer refer to the Cognex In-Sight Explorer documentation.

3.2 Camera Calibration

To use the vision results for part correction, the camera and robot must have a common point of reference. The normal position result unit for a processed image is in “pixels”. The number of pixels within the field of view (FOV) is a fixed number based on the camera. As the field of view is expanded the amount of area each pixel represents also expands. The Cognex software includes a calibration command that allows the user to set the linear length for each pixel.

This calibration can also compensate for lens and perspective distortion.

NOTICE

Once this calibration is completed, if the distance between the camera and the part changes (working distance) the calibration changes and is no longer valid.

3.2.1 Create a Tool Center Point (TCP) for Teaching the User Frame

A user frame must be created that corresponds to the printed calibration grid. If the calibration grid positions cannot be reached using the current TCP, a modified TCP can be used to program the user frame. For example, a threaded pointer can be attached to the tool and the tip used as a pointer for teaching the user frame.

1. Create a threaded pointer of a known length and attach it to the End of Arm Tooling (EOAT).
2. Select [Robot Settings] ⟶ [Tool] from the “Main Menu”
   – “Tool” screen appears.
3. Select tool from the list by selecting the row associated with the desired tool number.
   – The Tool Detail panel of the selected tool number will appear.
   – Enter the Tool Information.

NOTICE

Refer to the YRC1000/YRC1000micro Instructions for Smart Pendant, chapter 6.1 “Tool Settings” (HW1485509) for detailed instructions.

3.2.2 Camera Calibration

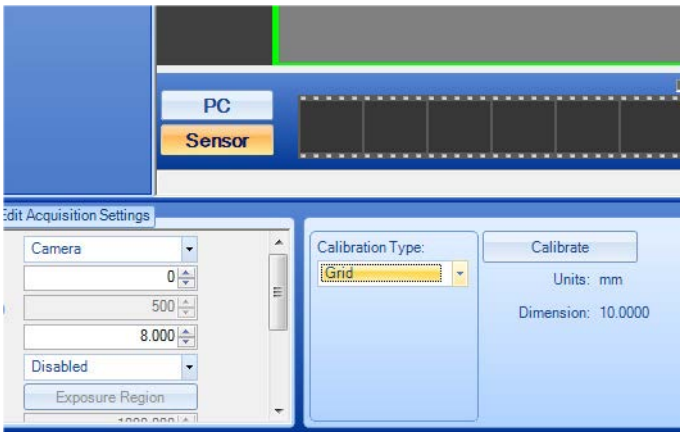
1. Position the camera above the work area to get the required field of view.

NOTICE

If the camera is mounted on the robot arm, teach the robots position using the Smart Pendant. Record this position to an unused P-variable as “CALIB POS” or to a new robot job for quick reference, so you can easily return to this exact position later in the process.

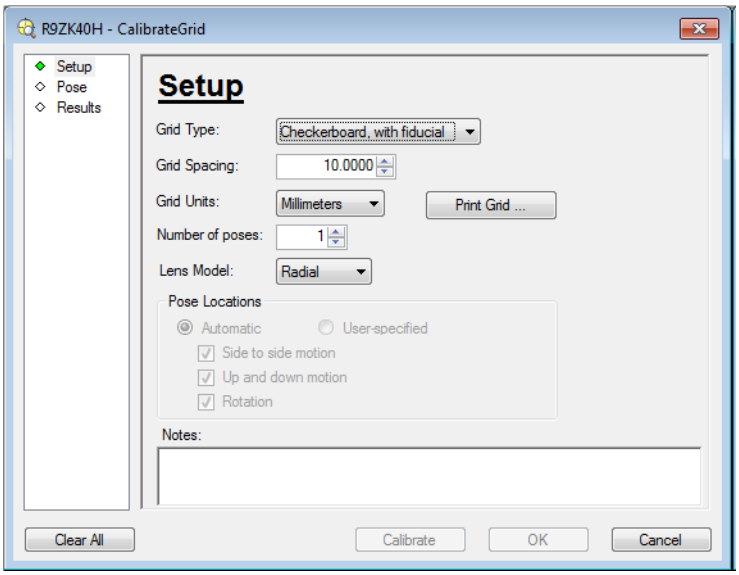
2. From In-Sight Explorer select {Set Up Image}
3. Select “Grid” from the {Calibration Type} drop down list.

Fig. 3-3: In-Sight Explorer Window Selecting Calibration Type



4. Press {Calibrate}
   – “CalibrateGrid” window appears

Fig. 3-4: Setup CalibrateGrid Window



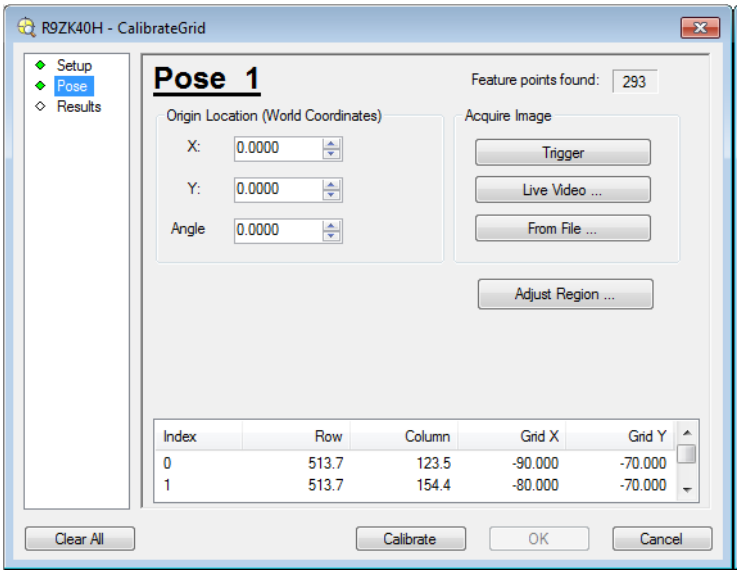
5. Select “Checkerboard, with Fiducial” from the “Grid Type” drop down list.
   – The default 10 mm grid spacing is usually appropriate for most applications.
6. Set the Grid Spacing appropriately for the camera field of view.
7. Select “Millimeters” from the “Grid Units” list.

NOTICE

To print the calibration grid, press {Print Grid} ⟶ {Print}

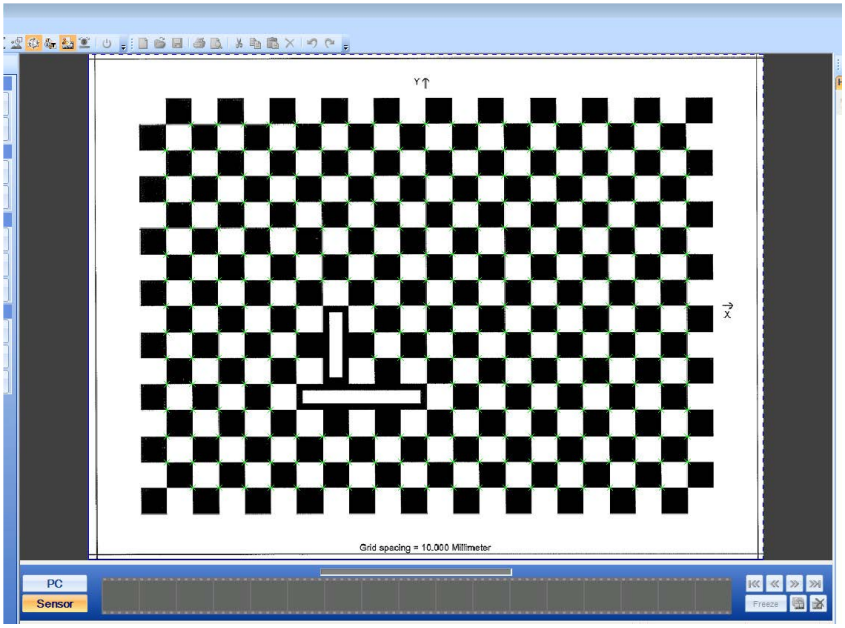
8. Place the calibration grid on the work area of the camera field of view.
   – Make sure the height of the calibration grid is at the height of the workpiece's features to be identified. This is probably different from the surface (table) where the workpiece's are placed.
9. Press {Pose} in the CalibrateGrid Window.

Fig. 3-5: Pose CalibrateGrid Window



10. Press [Live Video] to adjust the camera focus and aperture so the calibration grid is in sharp focus.
    – Ensure the calibration grid is within the camera field of view.
11. Press [Live Video] again to exit “Live Video” mode.
12. Ensure all the feature points of the calibration grid are found.

Fig. 3-6: Feature Points of the Calibration Grid



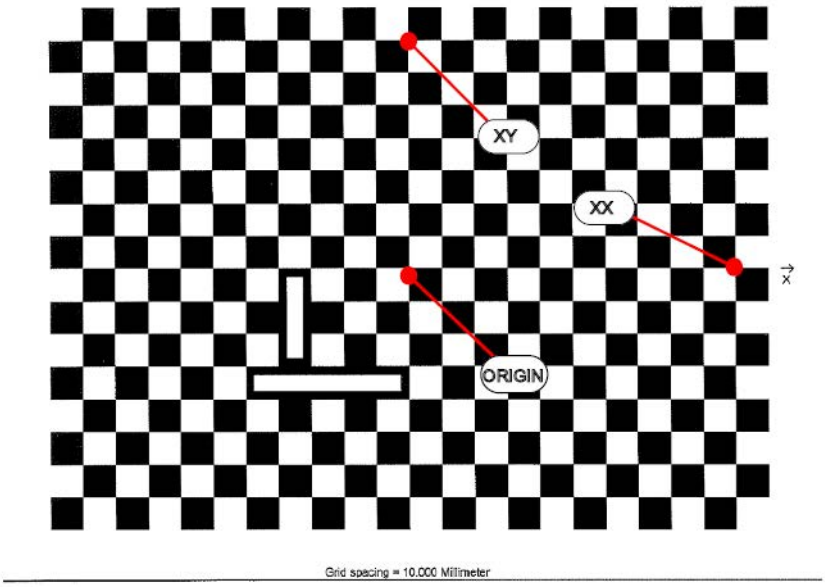
13. Press {Calibrate} from the “CalibrateGrid” window
    – The results display. Verify that Calibration score is below 0.5 pixels. If not, adjust grid and camera settings and recalibrate.
14. Press [OK] then save the program.

NOTICE
For best results the calibration grid must be completely visible within the camera field of view.

3.2.3 Teach a Calibration User Frame

1. Create a user coordinate system for the calibration grid. Refer to the YRC1000/YRC1000micro Instructions For Smart Pendant, section 6.3 User Frames for more information. (See *chapter 1.3 “Reference Documentation” on page 1-2*.)
   – Follow the axis orientation direction indicated on the calibration grid.
   – Locate The origin, XX and XY per *fig. 3-7*.

Fig. 3-7: Calibration Grid



2. Return the robot to calibration position recorded in *chapter 3.2 “Camera Calibration” step 1*.

3.2.4 Mobile Camera Tool

NOTICE

If the camera is a fixed camera, skip this step and proceed to *chapter 3.3 "Create a Vision Program"*.

If the camera is mounted to the EOAT of the robot, select the job to set the camera TCP:

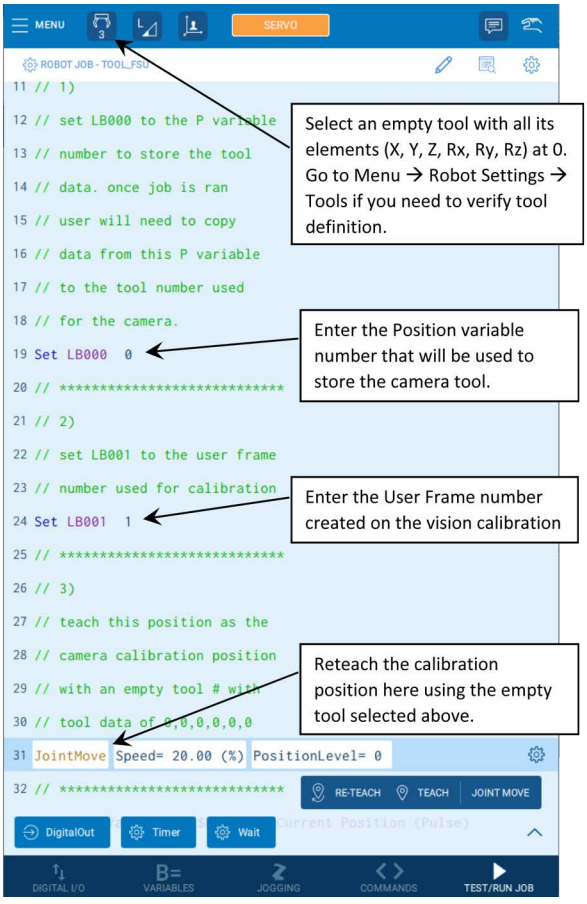
1. Select {MENU} ⟶ {Job List}.
   –The Job List screen appears.
2. Select the "TOOL_FSU" job from the list and press {EDIT}.
   –The "TOOL_FSU" job appears.

NOTICE

The TOOL_FSU job is included in the MotoSight 2D package. If the job is not available on the YRC Controller reinstall it from the MotoSight 2D package or contact your local YASKAWA representative.

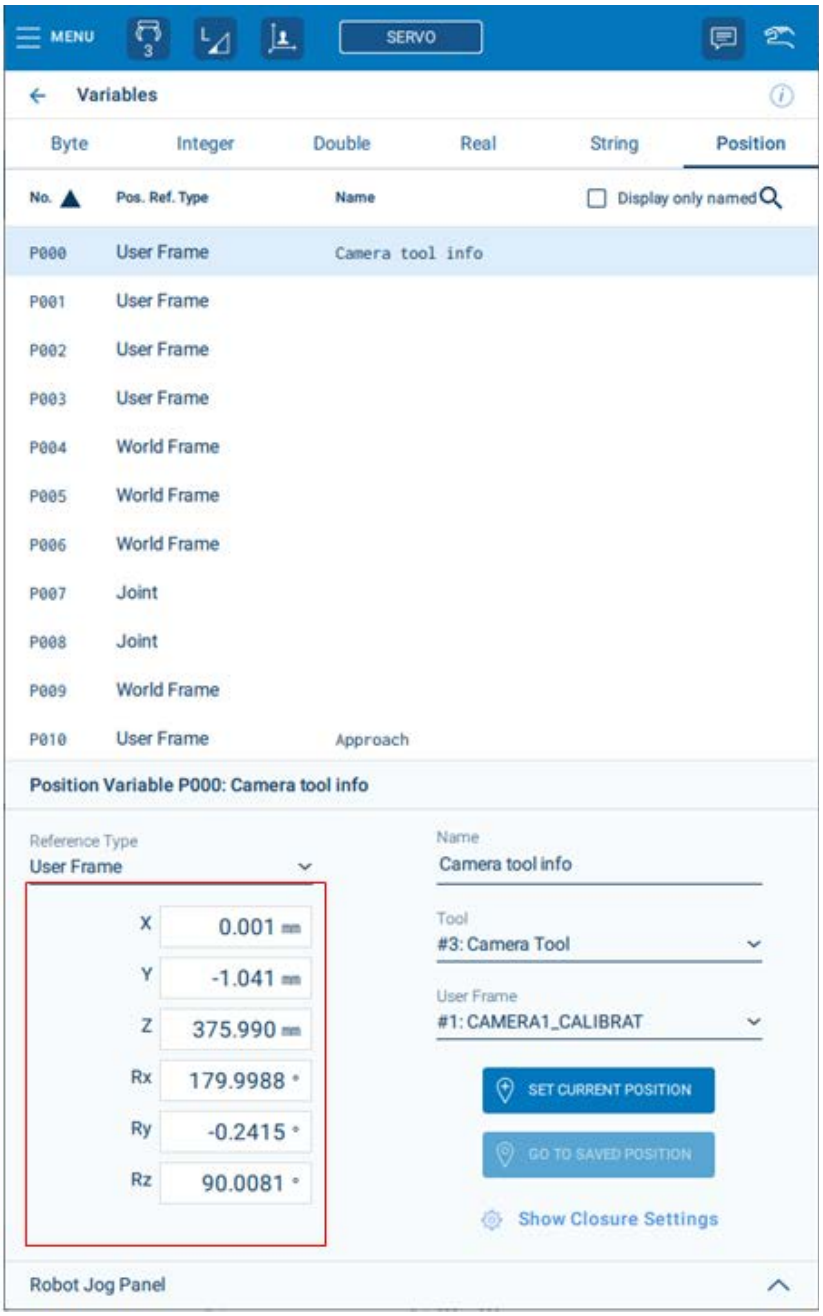
3. Modify the job per *fig. 3-8*

Fig. 3-8: Tool Job



4. Run the “TOOL_FSU” job.
    a) Select the 1st line of the job (Start Job).
    b) Press {TEST/RUN JOB}.
    c) Press {SERVO} then press the enabling switch to turn on servos.
    d) Press and hold the {TEST START} button.
5. Copy the tool information from the variable to the tool definition.
    a) Select “MENU” ⟶ “Program/Operate” ⟶ “Variables” to display the Variables screen.
    b) Select the “Position” tab and select from the list position variable that was entered in the job (step 19).
    c) Write down the Position Variable values X, Y, Z, Rx, Ry, Rz

Fig. 3-9: Position Variables

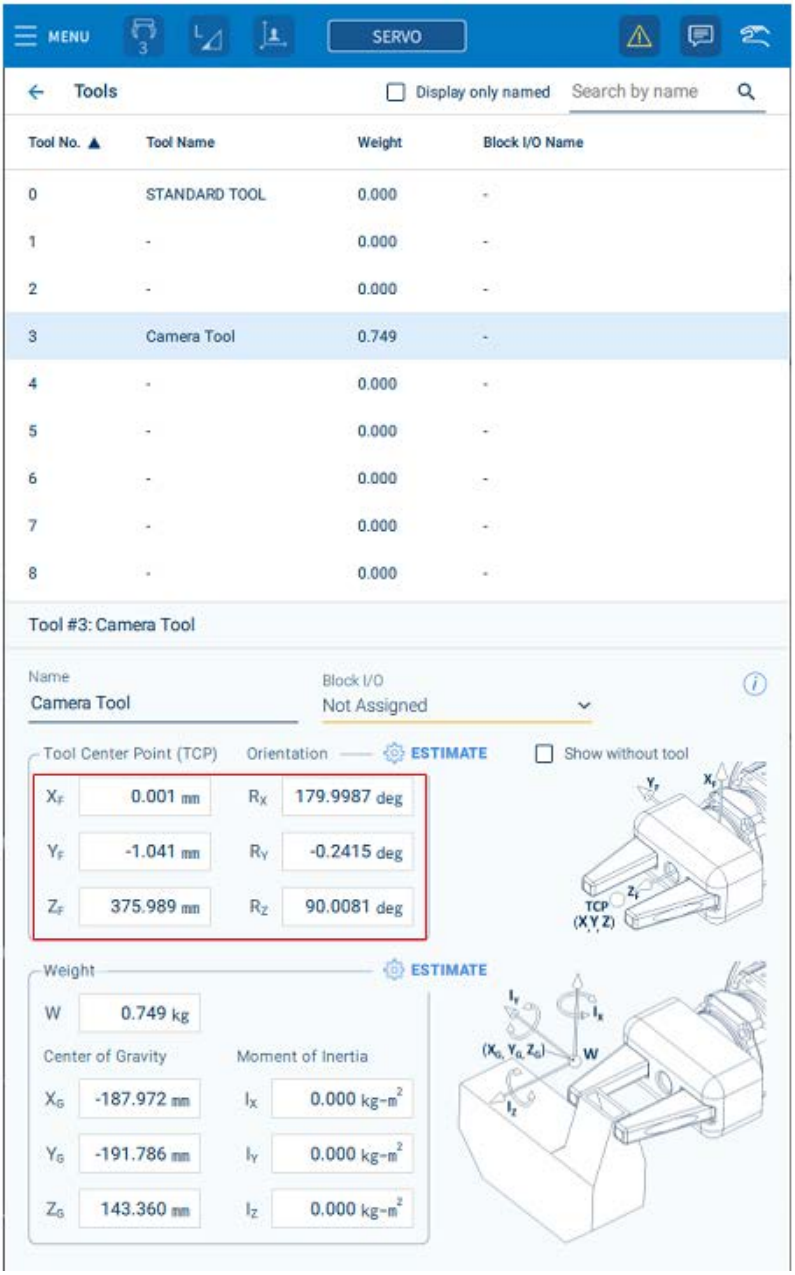


d) Select “MENU” ⟶ “Robot Settings” ⟶ “Tools” to display the tool list.

e) Select the tool for the camera from the list.

f) Enter the values previously written down from the variable into the corresponding X, Y, Z, Rx, Ry, Rz fields.

Fig. 3-10: Entering Tool Center Point (TCP)



g) Press {READBACK}, then {WRITE}.

h) When asked “Do you want to update tool data?” press {Yes}.

6. Verify the Camera TCP.
    a) Select the camera, place the camera offline in Cognex In-Sight Explorer.
    b) Press {Set Up Image} in the “Application Steps” panel.
    c) Press {Live Video} to start acquiring video feed
    d) Select “MENU” → “Current Job” and press {JOGGING}.
    e) Select the Mode as “XYZ - Tool” and the Tool as camera tool previously defined.
    f) Rotate the camera using the Rz, Rx, and Ry keys.
        • The camera display should remain in focus and the window should rotate about the origin point.
    g) Stop the video feed by pressing {Live Video}
    h) Switch the camera to Online mode

3.3 Create a Vision Program

Vision systems process images using “tools” created in the vision program. These vision tools perform a variety of functions, such as; counting the number of parts, locating a part in the field of view (FOV), measuring a part, counting specified features on a part, as well as many other functions. Once processing an image a camera job creates a result value for each function in the job.

Start each new vision job using the default MS2D template. The template allows the vision tool results to be available for assignment to the robot variables. If a new vision job is started from scratch without using the MS2D template, the robot will not be able to interface with that camera job.

The MS2D template should be loaded in the camera as the Start.job. If that is not the case, refer to *chapter 2.3 “Loading the Camera Job” on page 2-9*.

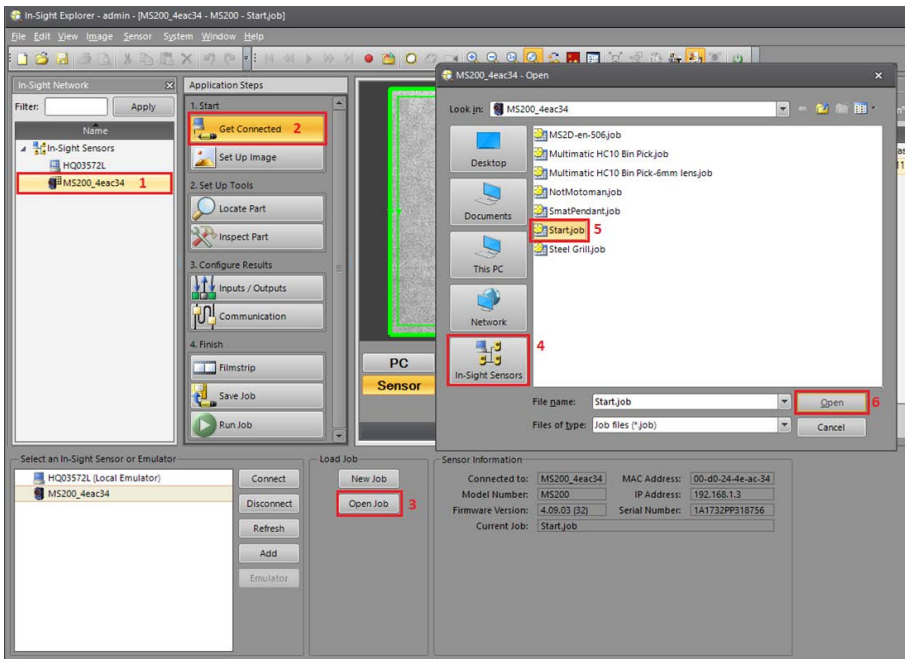
3.3.1 Simple Vision Job Example

This section will illustrate the procedures to create a simple vision job. For more advanced vision job and descriptions of the various tools available, refer to the Cognex In-Sight Explorer documentation.

3.3.1.1 Open “Start Job”

1. Double click on the appropriate camera in the In-Sight network / In-Sight Sensors.
2. Put the camera in Offline mode by selecting “Sensor” ⟶ “Online” from the menu.
3. Select the “Get Connected” tab under application steps.
4. Press {Open Job} under the “Load Job” section.
5. Select “In-Sight-Sensors” and then select the correct Camera directory.
6. Load the camera template job “Start.Job”

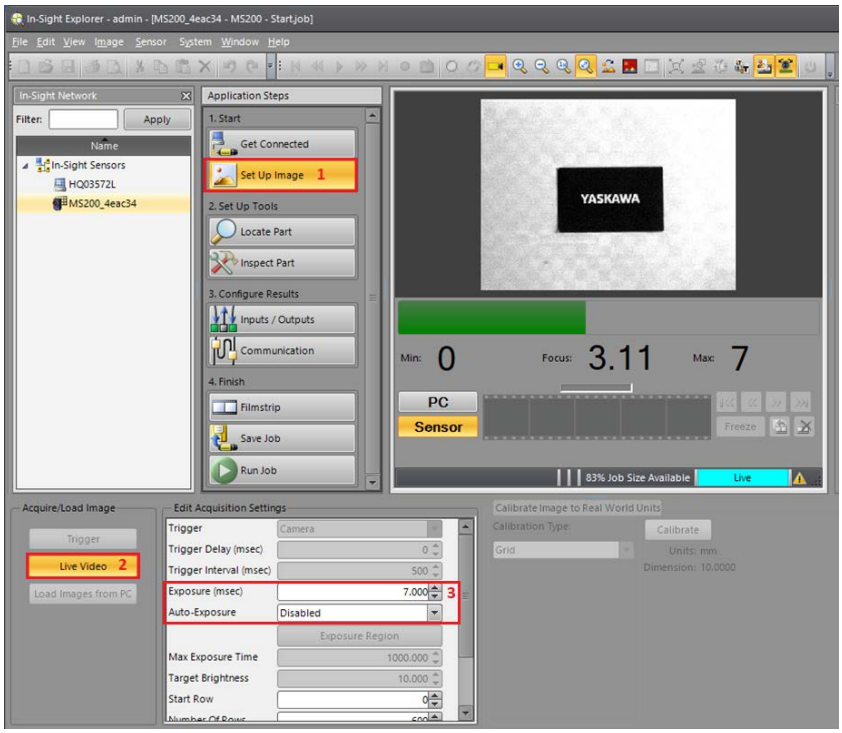
Fig. 3-11: Open “Start.Job”



3.3.1.2 Setting Up Image

1. Press “Set Up Image” then select “Live Video” on the Insight software.
2. Place an item of your choosing under the camera and adjust the focus and brightness.
   – Focus is normally adjusted on the camera lens.
   – The brightness can be adjusted by changing the lighting or adjusting the “Exposure” setting in the “Edit Acquisition Settings” section.
3. For a mobile camera, jog the robot in the Z-direction until the camera is at the correct working distance from your part (needs to be the same working distance as the calibration grid to the camera). Record this position as your inspection position either in an unused P-Variable or to a new robot job for quick reference.
4. Press “Live Video” to turn off live feed.

Fig. 3-12: Turning On Live Feed



3.3.1.3 Adding a Tool

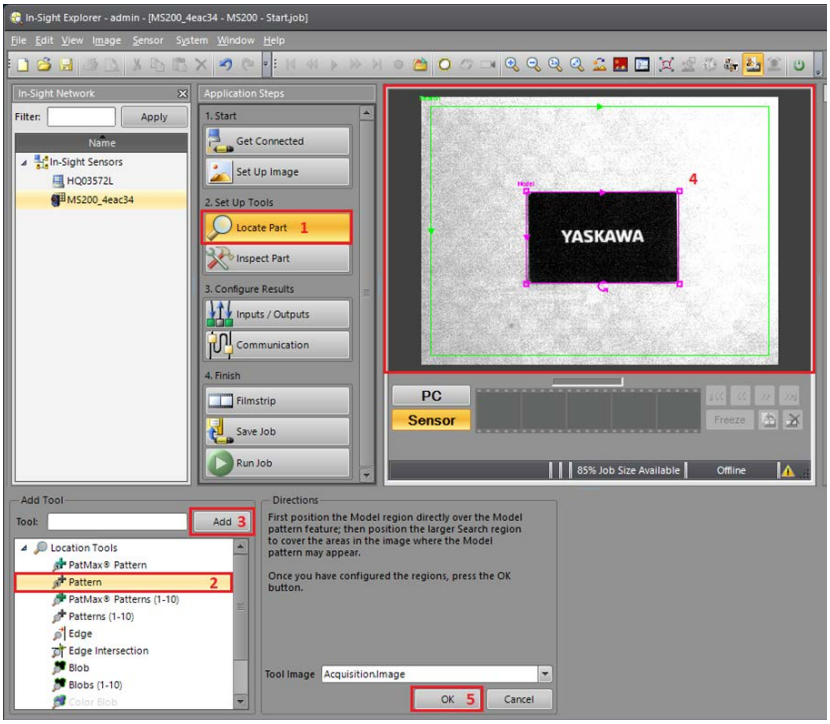
1. Select the “Locate Part” tab and select “Pattern” from the “Application Steps”.

NOTICE

If a pattern that has been created needs to be removed or edited, select Application Steps → 2. Set up Tools → Locate Part → Palette section, right click on the pattern that needs edited or deleted.

2. Double click on the selected tool or press {Add}.
3. Position the model (Pink Box) region on some feature of the part and press {OK}.
   – Make sure the image pattern created appears in the model region.

Fig. 3-13: Adding Tool



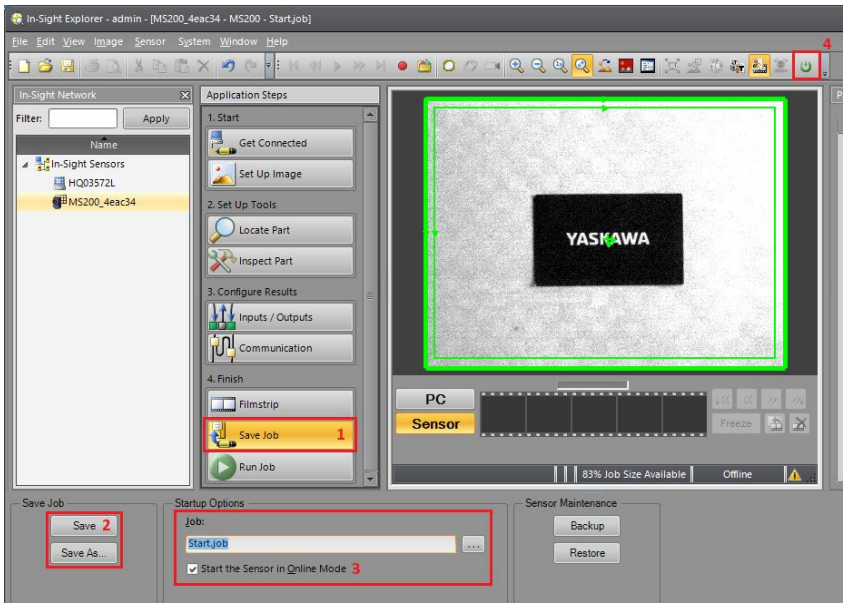
3.3.1.4 Saving a Job

1. Press “{Save Job} under Application Steps.

NOTICE
• Press {Save} to save a job under the current name. • Press {Save As} to save the job under a different name.

2. Select the job to automatically load when the camera is powered on and check the “Start the sensor in Online Mode” box in “Startup Options”.
3. Place the camera in “Online mode”. (Using Sensor Menu or {Online}.

Fig. 3-14: Saving Job



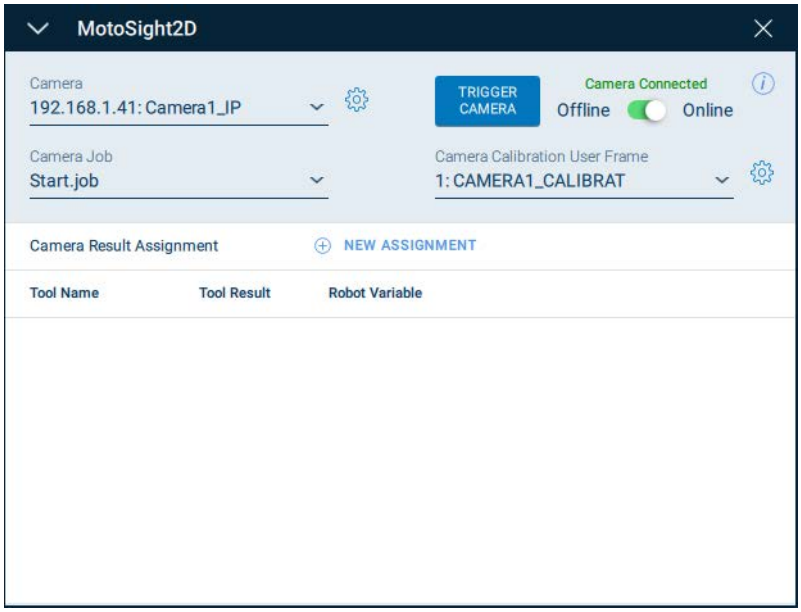
3.4 Associate Camera Results to Robot Variables

To use the vision results in a robot job, the camera tool result can be assigned to robot variables. Every time the camera is triggered, the associated robot variables will be updated with the new results. The result assignment is done using the Smart Pendant MotoSight 2D screen. For further details about the Smart Pendant MotoSight 2D screen, refer to *chapter 4 "Smart Pendant MotoSight 2D Interface"*.

3.4.1 Select Camera and Camera Job

1. Select "Utility" → "MotoSight 2D" from the Smart Pendant menu.
   – Application starts with camera 1 selected and its current job.

Fig. 3-15: Camera Assignment List



2. Select the camera and job by selecting a different item from the dropdown list, if desired.

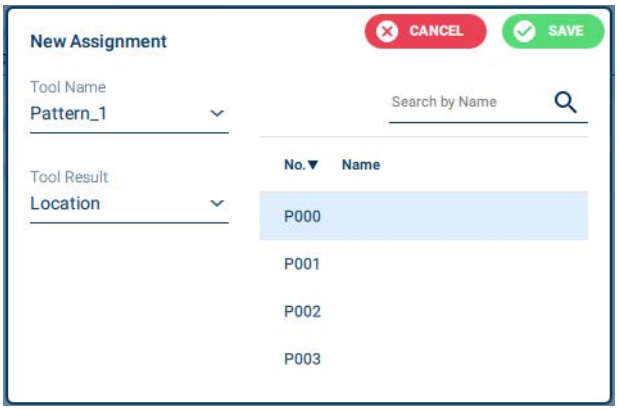
3.4.2 Select the Camera Calibration User Frame

1. Select the user frame defined for the camera calibration (*chapter 3.2.2 "Camera Calibration"*) from the dropdown list.

3.4.3 Add New Assignments

1. Press {NEW ASSIGNMENT}, to display the New Assignment dialog.

Fig. 3-16: New Assignment



2. Select the desired tool from the “Tool Name” dropdown list.
3. Select the desired result available for that tool from the “Tool Result” dropdown list.
4. Select the robot variable to store the selected result on the YRC Controller and press {SAVE} to save the assignment and add it to the list.

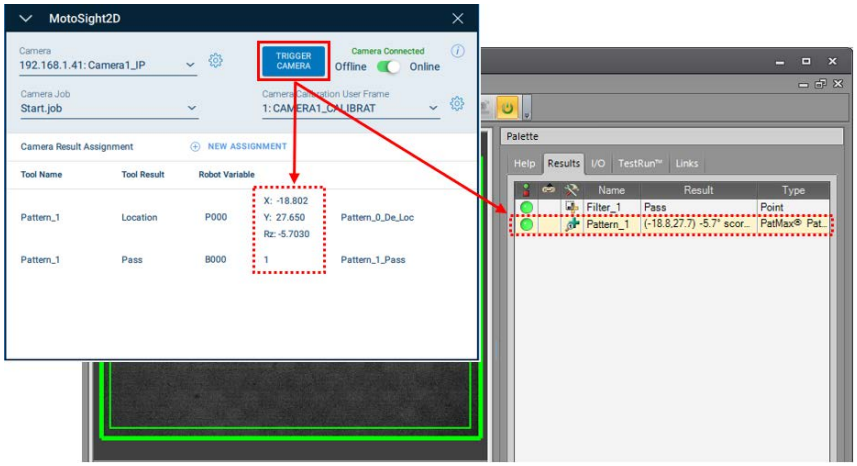
NOTICE

- If more results are to be assigned, repeat *chapter 3.4.3 “Add New Assignments”*.
- The same results cannot be assigned multiple times. Already assigned results and tools will not appear in the dropdown list.

3.4.4 Test Assignment

1. Press {Trigger Camera}.
   – Verify the values in the robot variables section are updated.
   • The Location values (X, Y, Rz) should change to match the values from In-Sight Explorer. For the Pass values, a value of 1 corresponds to “Passed” and a value of 0 to “Failed”.

Fig. 3-17: Trigger Testing



3.5 Teach Robot Program

Create a new job on the Smart Pendant (ex: VISION-MASTER). This job will do the following steps:

- Position the robot
- Trigger the camera
- Calculate an adjusted frame
- Call a job to process part

3.5.1 Position the Robot

Program the robot start position. In the case of a mobile camera mounted on the robot, this would be the home position taught in *chapter 3.3.1.2*. Otherwise, any position where the robot is not obstructing the fixed camera field of view.

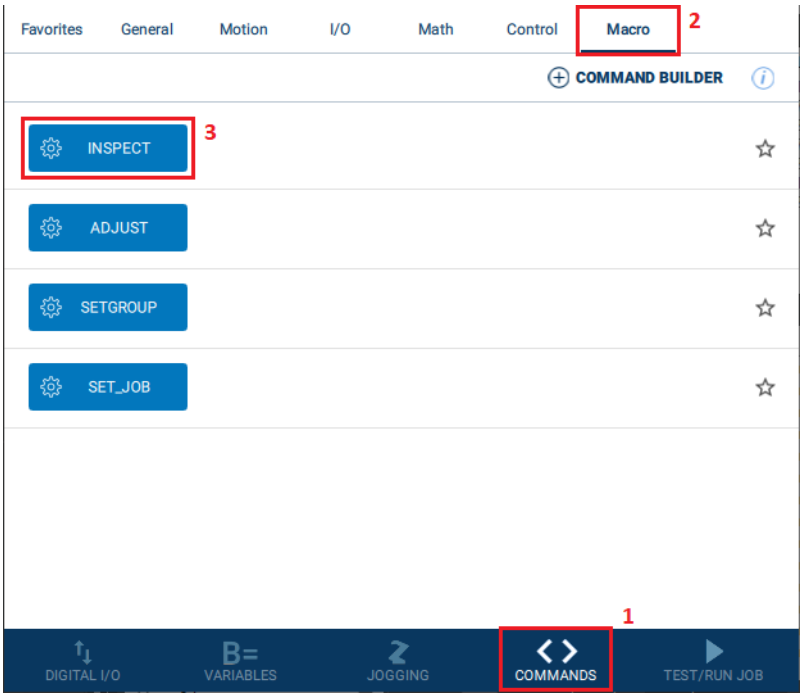
3.5.2 Trigger the Camera (INSPECT macro)

To trigger the camera, the INSPECT macro (included with MotoSight 2D) triggers the specified camera and waits for the image analysis result to be stored into the robot variables as per the Camera Result Assignment defined in *chapter 3.4 "Associate Camera Results to Robot Variables"*. The arguments for this job allow the user to control the behavior of the system if the inspection fails to find an object.

To add the INSPECT macro to the job:

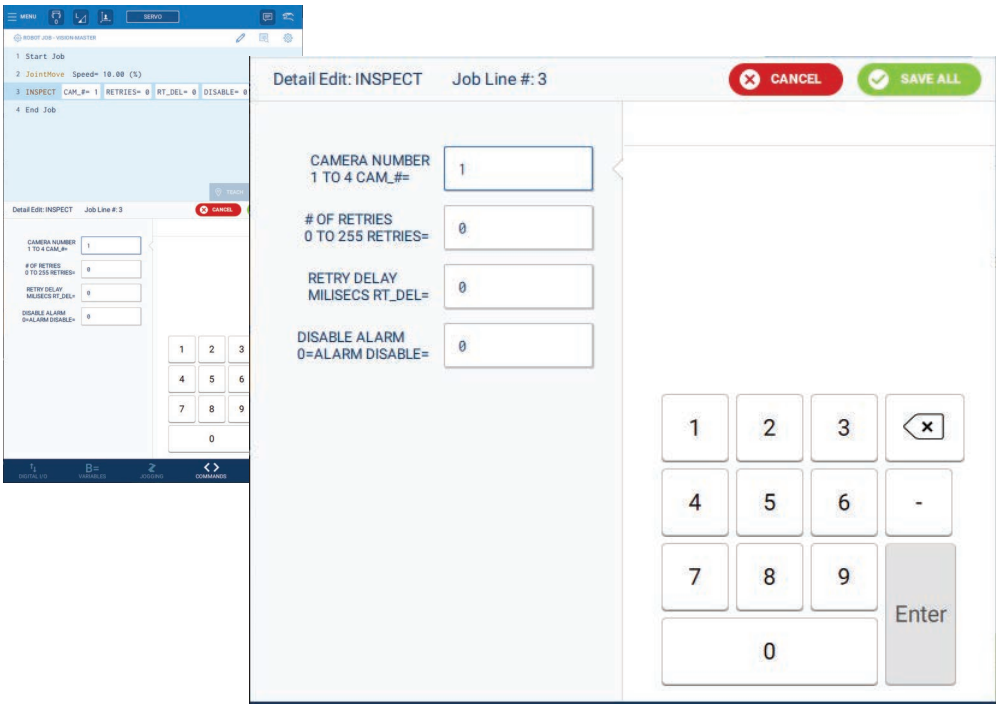
1. Press {COMMANDS} → {Macro} → {INSPECT}
   - The INSPECT instruction is added to the job

Fig. 3-18: Macro Inspect Add



2. Press “Gear” at the end of the newly inserted line to edit the instruction.
3. Set values for the macro arguments.

Fig. 3-19: Inspect Detail Macro



NOTICE

This example assumes using camera #1, there are no retries and alarms are not enabled. So, the arguments are set to:

CAMERA NUMBER = 1

OF RETRIES = 0

RETRY DELAY = 0

DISABLE ALARM = 0

For more details about the argument, refer to *chapter 5.1 “INSPECT Macro” on page 5-1*.

4. Press {SAVE ALL} to save the changes to the job.

3.5.3 Calculate the Adjustment Frame (ADJUST macro)

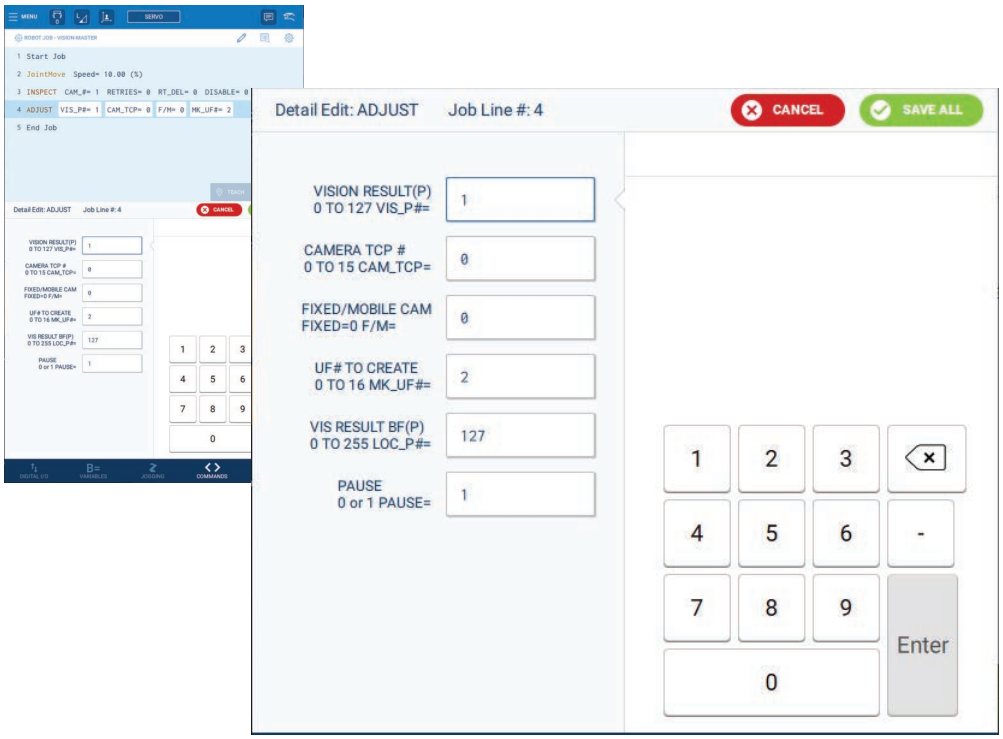
To adjust the robot path based on the location of a part or feature, the ADJUST macro (included with MotoSight 2D) creates a user-defined coordinate system (User Frame) based on vision inspection results.

The argument for this job allows the user to control which inspection results to use and what user frame to create.

To add the ADJUST instruction to the job:

1. Press {COMMANDS} → {Macro} → {ADJUST}.
   – The ADJUST instruction is added to the job.
2. Press {Gear} at the end of the newly inserted line to edit the instruction.
3. Set values for the macro arguments.

Fig. 3-20: Add Macro Adjust



NOTICE

This example assumes the camera inspection result for the part location is stored to variable P001, the camera is fixed and therefore the CAMERA TCP# is irrelevant. The user frame #2 is used to create a reference frame on the part. The vision result relative to the base frame is not needed, so the value is set to 127 to disable the calculation. Finally, PAUSE is enabled to allow programming of the part. The arguments are set to:

VISION RESULT(P) = 1 (P001 result from camera)

CAMERA TCP # = 0(Unused)

FIXED/MOBILE CAM = 0(Fixed camera = 0, Mobile Camera = 1)

UF# TO CREATE = 2(UF#2)

VIS RESULT BF(P) = 127 (disabled)

PAUSE = 1 (enabled)

For further details about the argument, refer to *chapter 5.2 “ADJUST Macro” on page 5-3*.

4. Press {SAVE ALL} to save the changes to the job.
   – The MASTER-VISION job should look like *fig. 3-21*

Fig. 3-21: Job Master Vision

3.5.4 Program the Process

This step consists of programming the process of a reference workpiece.

1. Place the workpiece in the desired reference position and run the MASTER-VISION job.
   – When the MASTER-VISION stops, reference the user frame for the part being created.
2. Create a new job to program the process to be executed on the workpiece. For this example, the job will be called “PROCESS-PART”.
   a) From “Menu” select “Job List”
   b) Press {New Job}
   –The “NEWJOB1” job is added to the list and the job details display in the bottom section of the screen.
   c) Edit the job name to something more meaningful. For example: PROCESS-PART.
   d) Press {EDIT} to create the program.
3. Start creating the process program relative to the workpiece.
   a) Move the robot into position and teach the points along the process path.
   b) Insert other commands as needed (DigitalOut, Timer…)

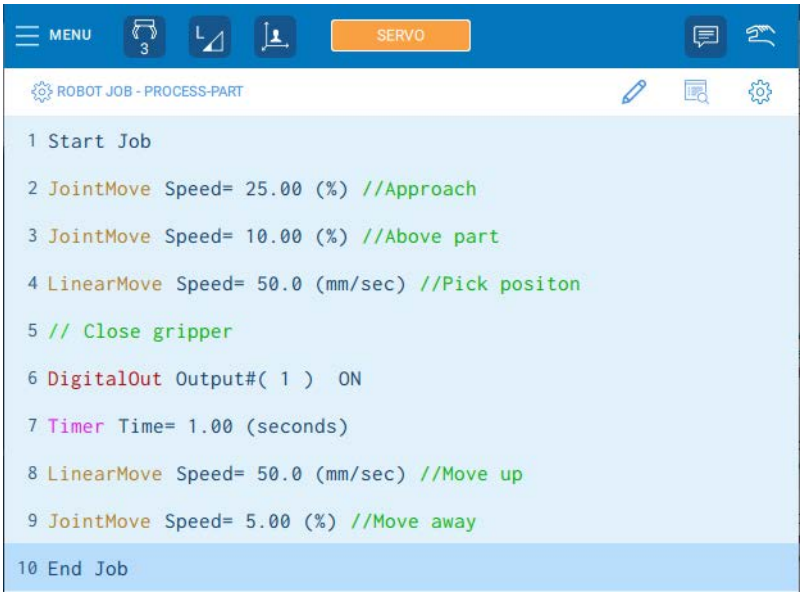
NOTICE

- Do not move the workpiece while creating the program.

Moving the workpiece while creating the program may cause damage to workpieces due to the program not being set correctly.

A finalize job might look like the following:

Fig. 3-22: Figure: Job Process Part Program

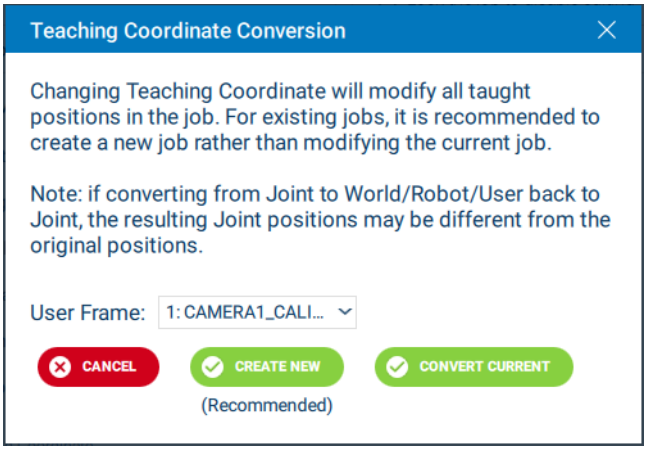


4. Convert job relative to workpiece user frame.

   a) Press the ROBOT JOB to display the job detail.

   b) Select “User” from the dropdown list to display the “Teaching Coordinate Conversion” on the job detail screen, in the “Teaching Coordinate” section

Fig. 3-23: Teaching Coordinate Conversion



   c) Select the same User Frame as the one selected in the ADJUST macro job from the dropdown list.

   d) Select either “CREATE NEW” or “CONVERT CURRENT”. If you choose to create a new job, make sure to call the converted job in the next step.

NOTICE

If creating a new job make sure to call the converted job in *chapter 3.6 “Finalizing and Testing”*

3.6 Finalizing and Testing

In the MASTER-VISION, modify the Call Job:ADJUST to change the PAUSE argument to 0, so that the program execution does not stop during normal operation.

1. Add a Call job to the PROCESS-PART:

    a) Select “COMMANDS” → Control → Call.

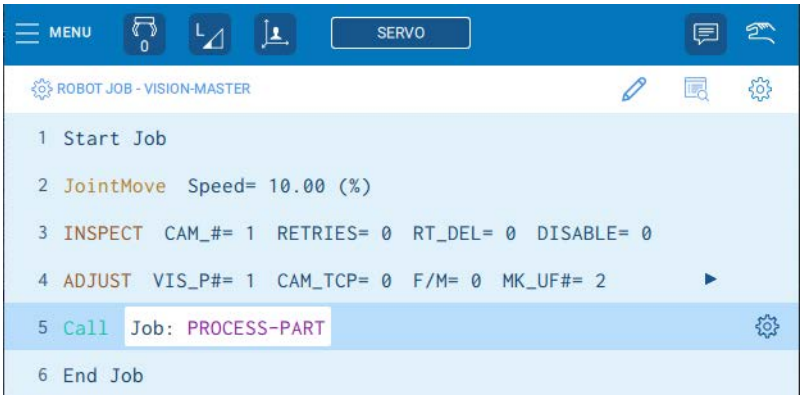
NOTICE

The “Show advanced commands” needs to be checked for the “Call” command to display.

    b) Select the PROCESS-PART job from the job list.

    c) Press {SAVE ALL} to save the changes to the job.

Fig. 3-24: PROCESS-PART Job



Programming is complete. At this point the part can be moved or a new part placed in position to run the program. The process should adjust itself for the new part location.

4 Smart Pendant MotoSight 2D Interface

4.1 Display the MotoSight 2D interface

From the Smart Pendant menu, select “Utility” ⟶ “MotoSight 2D” to display the MotoSight 2D screen. For any operation other than selecting the active camera, the Smart Pendant must be in Manual mode.

Fig. 4-1: MotoSight 2D Screen

NOTICE

The MotoSight 2D menu will only be displayed if the MotoSight 2D application is installed on the YRC Controller.

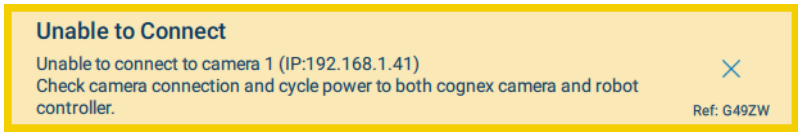
4.2 Camera Selection

When displaying the MotoSight 2D screen, Camera 1, if defined, will be selected. To select a different camera, select the Camera control and select a different camera from the dropdown list. If no cameras are configured the list will be empty. Refer to *chapter 4.9 “Camera Configuration”* to add cameras.

4.3 Camera Connection

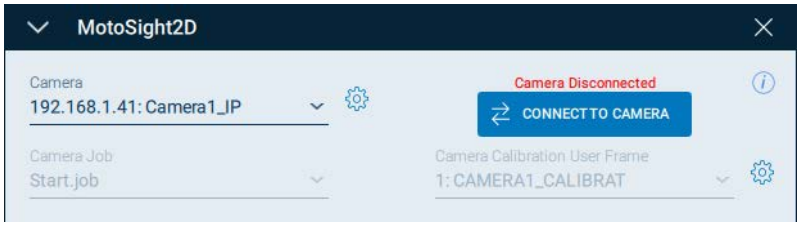
When a camera is selected, a connection attempt will automatically be made. If the connection is established, the camera current data is displayed. If the connection cannot be established a notification will be displayed.

Fig. 4-2: Unable to Connect Display



While no connection is established to the camera, the button “CONNECT TO CAMERA” displays to the right of the camera selection control. Press {CONNECT TO CAMERA} to try to connect to the camera.

Fig. 4-3: {CONNECT TO CAMERA}



4.4 Trigger Camera

While connected to the camera, the {Trigger Camera} signals the camera to take a new picture and assigned camera job results values to update. (Refer to *chapter 4.8 "Camera Result Assignment List"* for details.)

The MotoSight 2D screen can be used to display the camera view by pressing {Expand} at the top of the screen. Pressing "Expand" again hides the camera view.

Fig. 4-4: MotoSight 2D Camera View

NOTICE

- YASKAWA recommends using Smart Pendant version 2.1.0 or higher with a Cognex camera having firmware supporting HMI protocol (version 5.7.3 or higher).
- If the Smart Pendant version is lower than 2.1.0 or the HMI protocol on the Cognex camera is not available:
  - The camera image may take several seconds before displaying for higher resolution cameras.
  - The camera job graphical results do not display.
  - The camera image is not available while the robot job is running.

4.5 Offline/Online Switch

The Offline/Online switch reflex the current online state of the camera. For normal operation, the camera should be set to Online. During edition with the MotoSight 2D screen, the camera status may temporarily switch to offline and then back to online, this occurs to enable the MotoSight 2D to save changes to the camera job; it is normal behavior.

If the camera was set to offline using In-Sight Explorer or from digital I/O, the MotoSight2D screen on the pendant will not be able to set the camera online. The camera must be set back to online from In-Sight Explorer or from the digital I/O signals. In the same manner, if the camera is set to offline using the MotoSight2D interface, In-Sight Explorer will not be able to set the camera online. It is always good practice to set the camera back to online whenever you are done making changes.

4.6 Camera Job Selection

Each camera can have multiple vision programs referred to as camera jobs. The currently selected camera job name is displayed in the “Camera Job” control. That job's Camera Calibration User Frame and Result Assignment will display in the respective controls.

The currently selected job can be changed by selecting the “Camera Job” control and picking a different job from the dropdown list.

NOTICE

Upon rebooting the camera, the Start-up job set with In-Sight Explorer is automatically selected. To change the Start-up job, refer to the Cognex In-Sight Explorer documentation.

4.7 Camera Calibration User Frame

The Camera Calibration User Frame control displays the user frame number used for the calibration of the camera for the currently selected camera job. Selecting the control displays a list of all the defined user frame in the YRC Controller. Pick the appropriate user frame from the list.

If the user frame number defined in the camera job doesn't exist, the message “Undefined! Create UF…” displays. Selecting {setting} (gear icon) to the right of the Camera Calibration User Frame control displays the “User Frames” screen. For more detail about the Camera Calibration refer to *chapter 3.2.2 “Camera Calibration”* and the “YRC Controller Instructions for Smart Pendant” manual, chapter 6.3 “User Frames”.

4.8 Camera Result Assignment List

The Camera Result Assignment list displays the current camera job results that have already been assigned to a robot variable. For each assignment, the information about the Tool Name, Tool Result and Robot Variable. Next to the robot variable address, the current variable value and name is displayed.

4.8.1 New Assignment

New assignments can be added to the list by using the New Assignment dialog. There are two types of assignments, explicit tool name references and spreadsheet references.

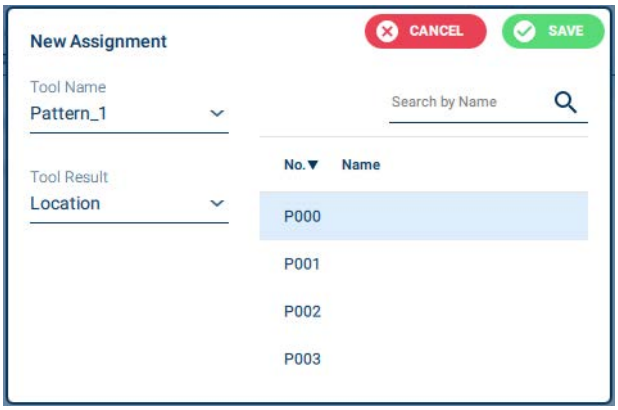
The explicit tool name references make direct reference to the names of camera tool that are available in the current camera job. The most common tools and their associated results are supported (refer to *Appendix C* for the complete list). In the case of an unsupported tool, it is possible to define a direct reference to a spreadsheet cell. The user will need to use the In-Sight Explorer and display the camera job in “Spreadsheet” mode and locate the data that needs to be transferred to a robot variable.

1. Press “NEW ASSIGNMENT”, to display the New Assignment dialog.
2. Select the desired tool name or “Spreadsheet” from the “Tool Name” dropdown list.

4.8.1.1 Allocating non-spreadsheet camera tool data

1. Select one of the results available for that tool from the “Tool Result” dropdown list.
2. Select where the robot variables results will be stored.

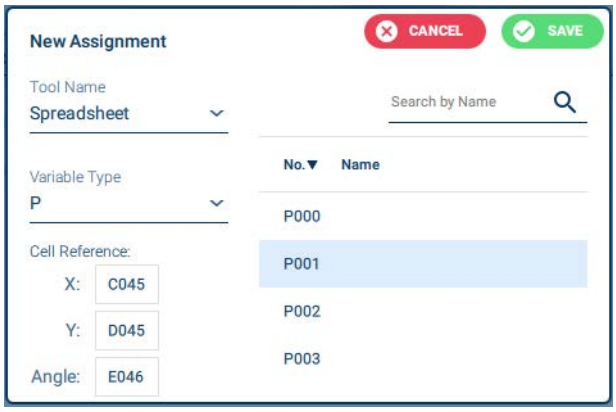
Fig. 4-5: Robot Variable Store Location



4.8.1.2 Allocating “Spreadsheet” Data

1. Select the variable type from the dropdown list:
   - **B** for byte values (0 to 255),
   - **R** for floating point values, or
   - **P** for position values (X, Y, Angle).

Fig. 4-6: Selecting Variable Type



2. Enter the spreadsheet cell references.
3. Select the robot variable to use for storing the results on the YRC Controller.

NOTICE

The same results cannot be assigned multiple times. Already assigned results and tools will not appear in the dropdown list.

4.8.2 Inline Edition

An assignment can be edited by selecting it from the assignment list. The result destination variable can be changed by clicking on it. The variable list will display, and a different variable can be selected from the list. The name of the variable can also be edited by clicking in the name and then entering a new name for the variable.

4.8.3 Delete Assignment

An existing assignment can be deleted by pressing the “Trash can” icon at the far right of the selected assignment line.

4.9 Camera Configuration

MotoSight 2D supports up to four cameras. For each camera, the camera IP address is specified using the camera configuration dialog.

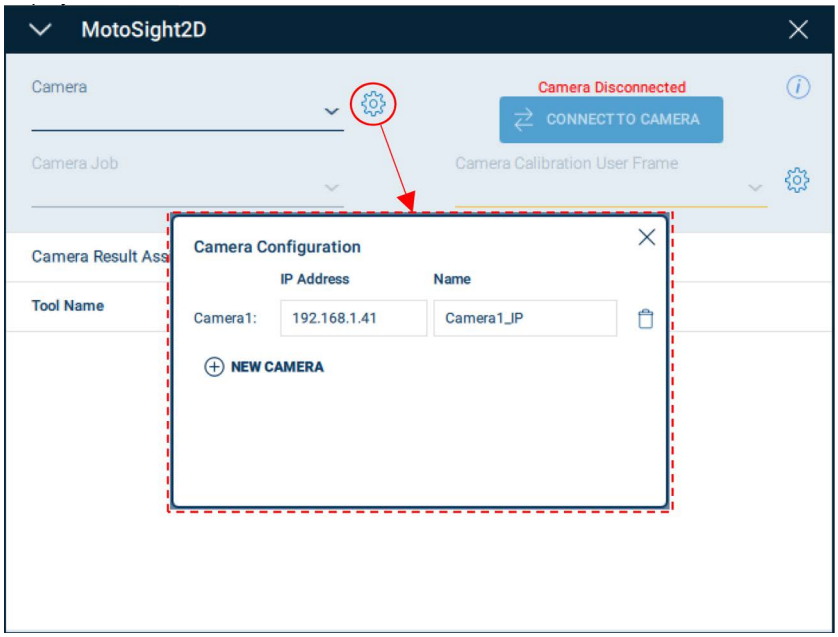
CAUTION

- Do not use the following variables for any other purpose than:
  - S097 - Camera1
  - S096 - Camera2
  - S095 - Camera3
  - S094 - Camera4

The MotoSight 2D screen uses these string variables in the background to set IP addresses. Using these string variables for other purposes can cause unexpected results.

The IP Addresses of the camera(s) can be entered using the MotoSight 2D screen by pressing , next to the Camera selection control, to display the Camera Configuration screen. If cameras are configured, their information displays.

Fig. 4-7: Camera Configuration dialog



The Camera Configuration dialog, allows:

- **Editing the “IP Address” and “Name”** by selecting the corresponding textbox and entering the new value.
- **Adding a new camera**, by pressing {NEW CAMERA}, adds a camera with the default values.
- **Deleting a camera**, by pressing the at the end of the last camera row.

NOTICE

- If a new camera was added or a camera IP was edited, a message displays to reboot the YRC Controller to apply the changes.
- Only the last camera on the list can be deleted.
- The {X} closes the dialog.

These IP Address’ are stored as variable values and the Name as the variable name. Do not use these variables for any other purpose.

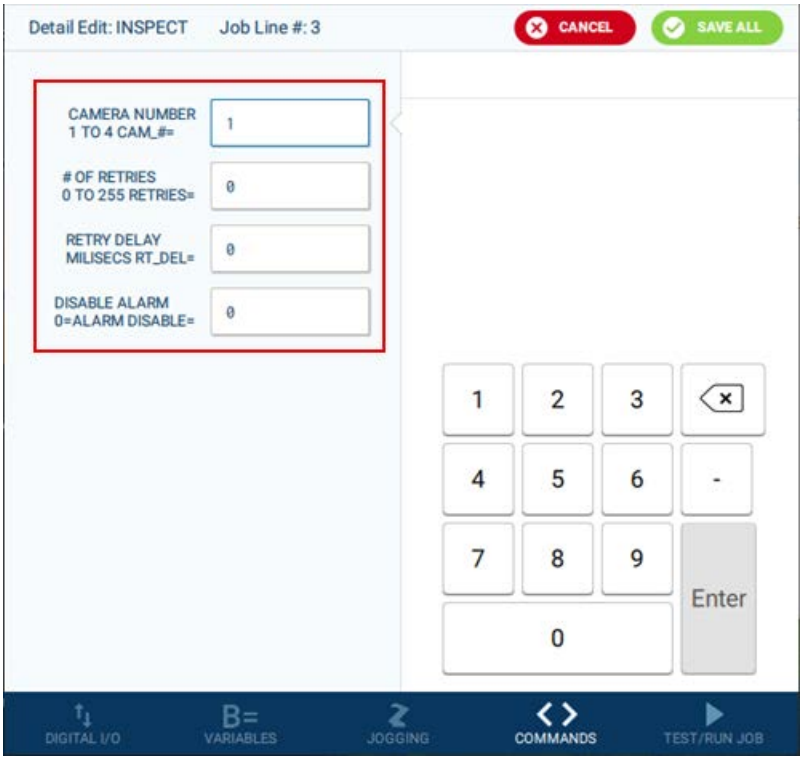
5 MotoSight 2D Standard Macros

YASKAWA supplies several optional macro jobs to help set-up and use the MotoSight™ 2D function. These jobs are available to add to a robot program to set up and use the data returned from the camera, supplying a method for changing jobs, and controlling different inspections for a particular camera job.

5.1 INSPECT Macro

Use the INSPECT macro to trigger an inspection using a specific camera. The argument for this macro allows the user to control the behavior of the system if the inspection does not find an object.

Fig. 5-1: INSPECT Macro Screen



① CAMERA NUMBER
Set the argument to the index of the camera to be used for this inspection. Setting range is 1 - 4

② # OF RETRIES
Set the argument to number of times to trigger another inspection if the previous inspection failed to find an object. Setting range is 0 to 255.

③ RETRY DELAY
Set the argument to the time in milliseconds the robot should wait before executing a retry. This time is only used if a retry is specified. Setting range is 0 to 32767. (32.767 seconds)

④ DISABLE ALARM

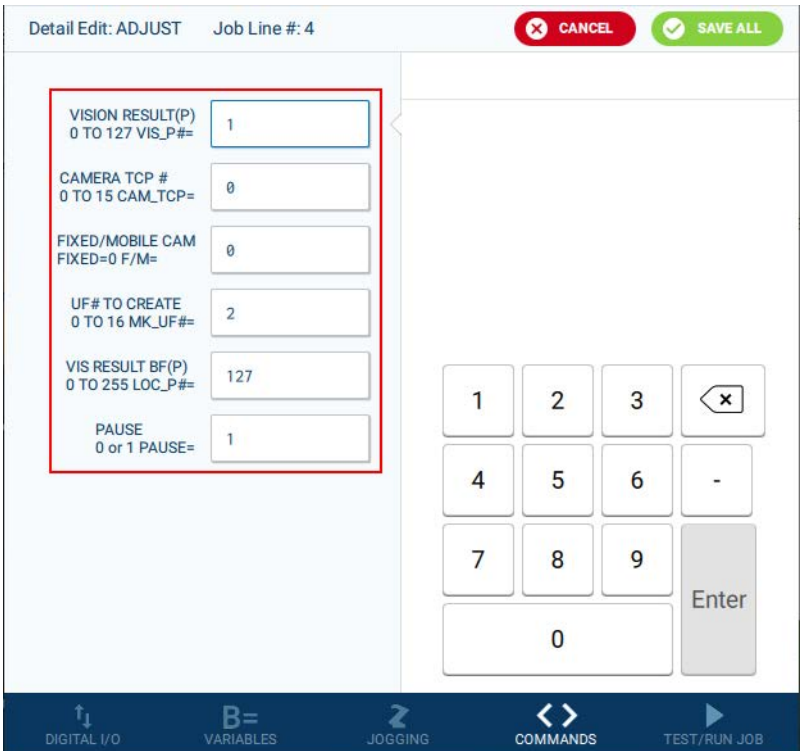
Set the argument to a 0 to allow the macro to generate an alarm if an object is not found. This alarm will stop the robot. Setting the argument to 1 disables the alarm in the macro. If the alarm is disabled, then the programmer must handle the vision alarm after the macro call. Disable the alarm when you want the robot program to continue when an object is not found. This argument will only disable object not found alarms. Camera communication alarms will be handled by the macro.

5.2 ADJUST Macro

Creates a user-defined coordinate system (User Frame) based upon vision inspection results. The user frame created can adjust the robot path.

For the robot to correct its path, the command positions must be relative to the User Frame created. The robot path to adjust, should be within a separate job. This way the job converts easily to relative. Refer to *chapter 3.5 "Teach Robot Program" on page 3-18* for a step-by-step example.

Fig. 5-2: ADJUST Macro Screen



① VISION RESULT(P)
Set the argument to the index of the robot position variable that contains the vision inspection results. This is the same position variable that was assigned using the MotoSight 2D Smart Pendant screen (*chapter 3.4 "Associate Camera Results to Robot Variables" on page 3-16*.)

② CAMERA TCP #
If the camera is mounted to the 6th axis of the robot set the argument to the TCP number used for the camera. This TCP is created during the calibration procedure. Refer to *chapter 3.2.4 "Mobile Camera Tool" on page 3-8*. If using a fixed mounted camera, this argument is not used, set value to 0.

③ FIXED/MOBILE CAM
If the camera is mounted to a stand or somewhere other than the 6th axis of the robot, then set the argument to 0. If the camera is mounted to the 6th axis of the robot, then set the argument to 1.

④ UF# TO CREATE
Set the argument to the User Frame number wishing to create. Setting this argument to 0 will disable User Frame creation.

⑤ VIS RESULTS BF

Adjust macro calculates the vision result location based upon the robot Base Frame. This location is the origin of the User Frame being created. The user can collect multiple locations and create a User Frame based upon those locations. Set this argument to the index of the Position variable to be used. Setting this argument to a value greater than 127 will disable this calculation.

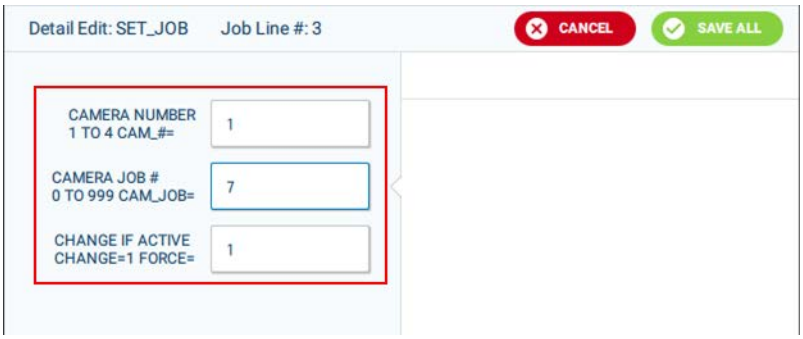
⑥ PAUSE

Set the argument to a one in order to interrupt execution of the macro after the User Frame is calculated. This is useful for set-up and debug. Once execution is paused the user can manually check the results and proceed with the teaching of the part relative to the created user frame. To resume normal operation set this argument to zero.

5.3 SET_JOB Macro

Changes the active vision job.

Fig. 5-3: SET_JOB Macro Screen



① **CAMERA NUMBER**
Set the argument to the index of the camera to perform the job change. Setting range is 1 - 4.

② **CAMERA JOB #**
Set the argument to the ID number of the job to set as the active camera job.

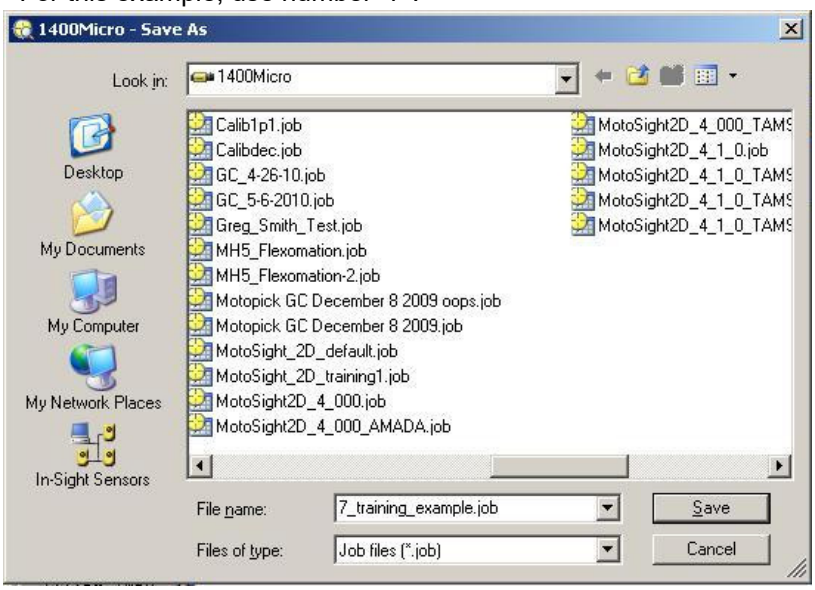
③ **CHANGE IF ACTIVE**
If the argument is set to a 0 then the vision job will change will only occur if the requested job is different from the active camera job. If the requested job is the same as the active camera job, no action will be taken. Set the “CHANGE IF ACTIVE” argument to a 1 in order to force a job change if the active camera job equals the requested job.

5.3.1 SET_JOB Example

The SET_JOB macro performs a job change on the Cognex camera.

To use SET_JOB, first we will need to save the job on the camera in the correct naming format. The vision job must begin with a number. This Job ID number is used to select that job. For this example, use “7”.

1. Modify the job name on the camera so that it begins with a number. For this example, use number “7”.



2. Then, from the Macro on the Programming Pendant, simply match the integer setting.

5.4 SETGROUP Macro

Transmits the group integer number to the camera.

Fig. 5-4: SETGROUP Screen

① **CAMERA NUMBER**
Set the argument to the index of the camera to receive the group data. Setting range is 1 - 4.

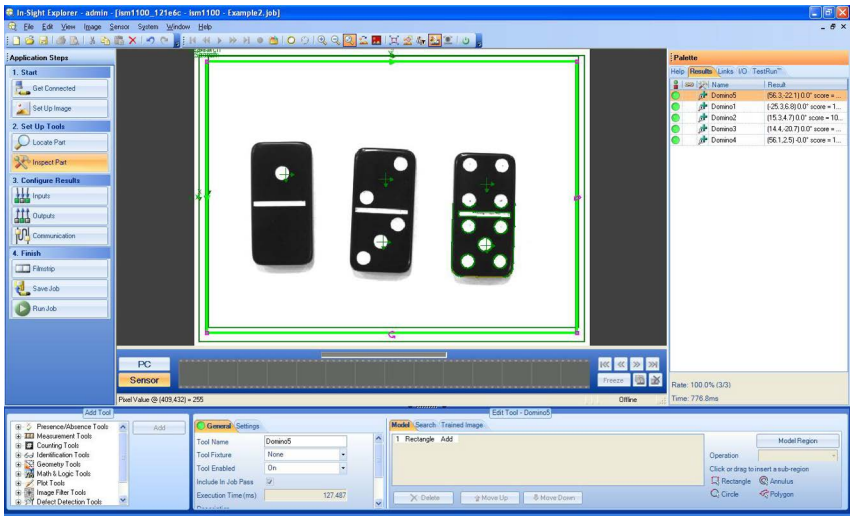
② **GROUP VALUE**
Set the argument to the integer value to be sent to the camera. Setting Range is 0 - 32767.

5.4.1 Group Tool Example

Using the Group tool can help reduce process time when performing a single inspection out of multiple inspections loaded in the vision job.

For this example, let's assume our vision job contains five different inspections. Each inspection is for a different part. If we only want to find part one, the camera executes all five inspections. However, if we put the five inspections into five separate groups, we can enable and execute only one inspection. This will eliminate the time needed to process the other five inspections.

We'll start by setting up five inspections using tools from the Locate parts tab of EasyBuilder.

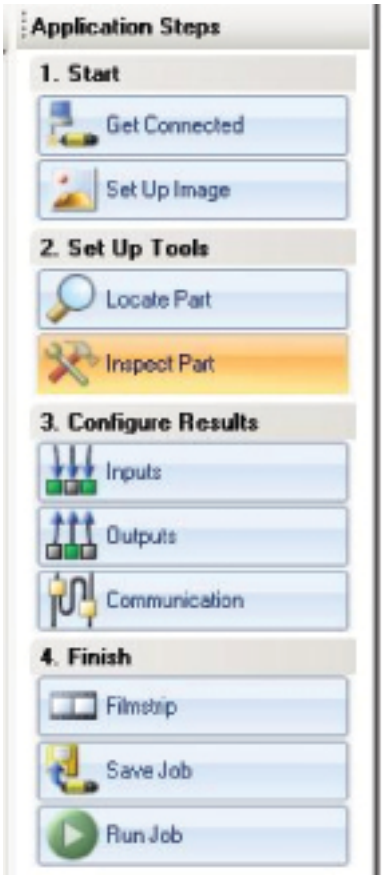


- Domino1
- Domino2
- Domino3
- Domino4
- Domino5

If we click the [Trigger] button, we can look at the lower-right corner of the displayed camera image to see that the processing time of the camera for all of these inspections is approximately 770 to 780 ms.

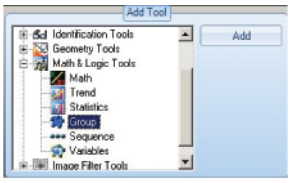
Now, let's add groups to see the difference.

1. From the Application Steps area, select Inspect Part.

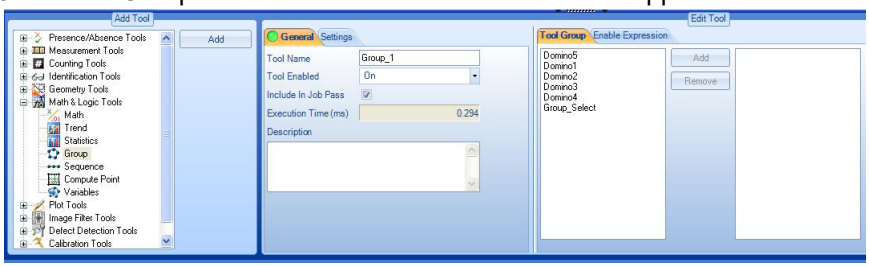


The Add Tool box changes.

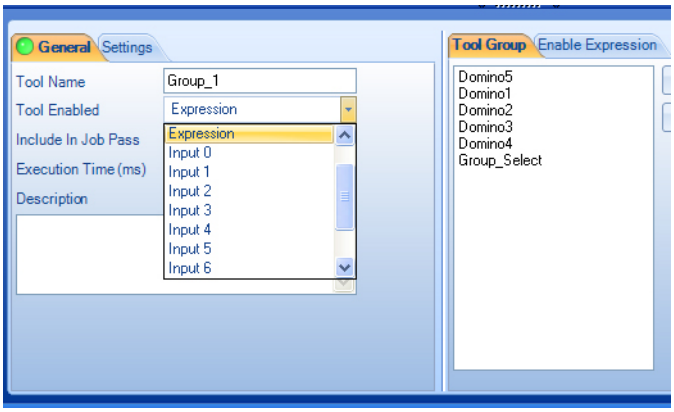
2. Click the [+] sign next to Geometry Tools to expand the set of vision tools.



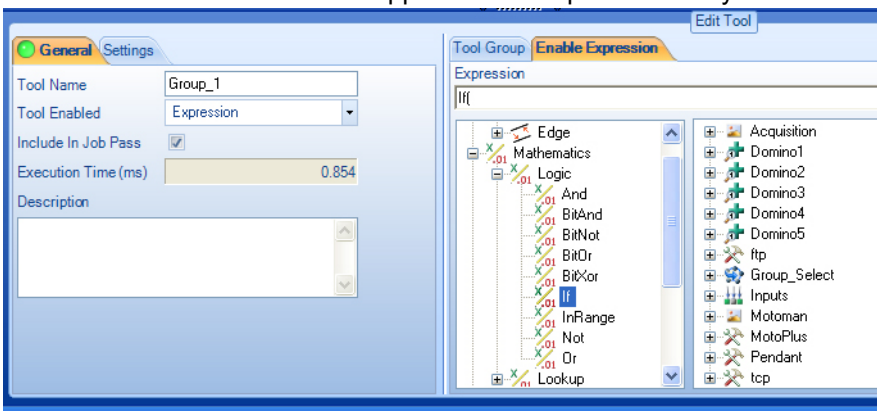
3. Select Group and click Add. The Edit Tool window appears.



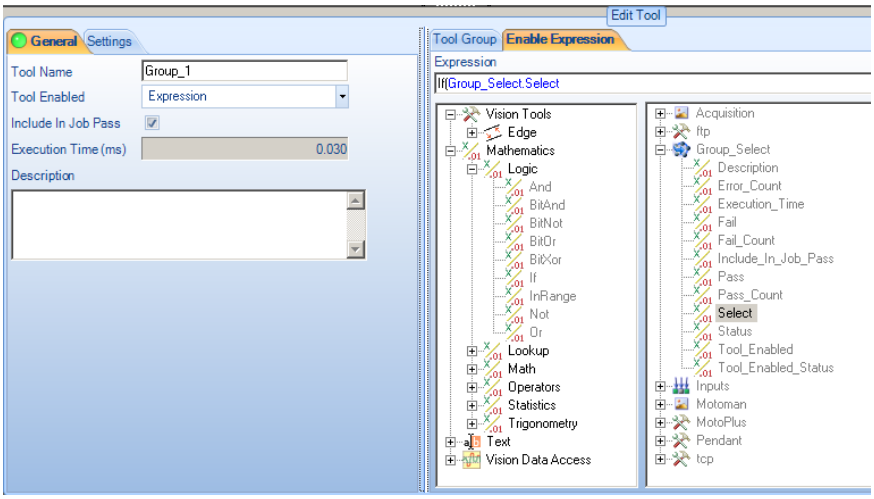
4. Select the Tool Enable window and set to Expression.



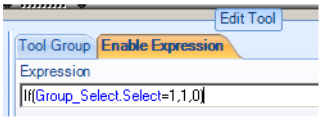
5. Select the Enable Expressions tab.
6. Expand the Mathematics set.
7. Expand the Logic set.
8. Double-click “IF” to make it appear in the Expression entry line.



9. Double-click [Select]. “If(GROUP_SELECT.Select” appears in the Expression entry line.



10. In the Expression entry line, manually type “=1,0” at the end of the expression and press Enter.

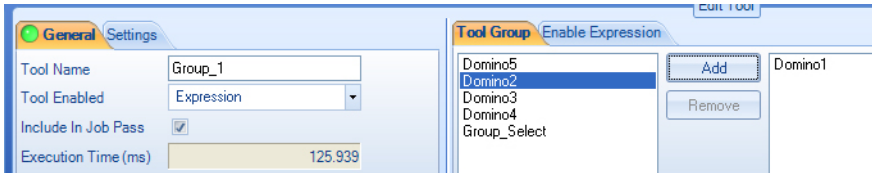


=1 means that if the integer set by the GROUP macro is 1 then….

,1,0 means enable if true, disable if false.

Now we will set one of the inspections to be in this group.

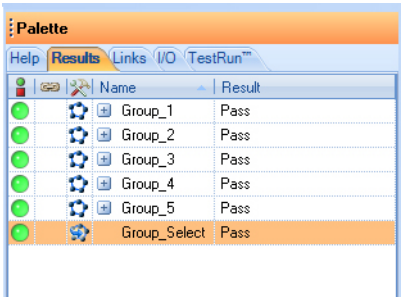
1. Select the Tool Group Tab.
2. Select the Inspection(s) you want to add to this group and click Add. The desired inspection moves from the left window list of available items to the right window list of added items.



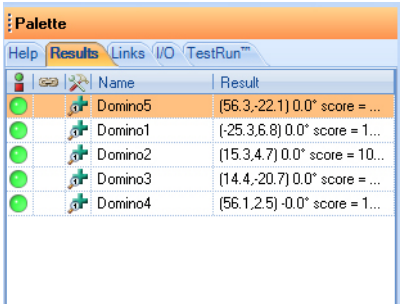
3. Repeat the process four more times to create Groups 2,3,4, and 5.

Make sure when entering the Enabling Expression to use different values after the = sign while keeping the last portion the same “,1,0”.

Once all five Groups are created, your Palette should show:

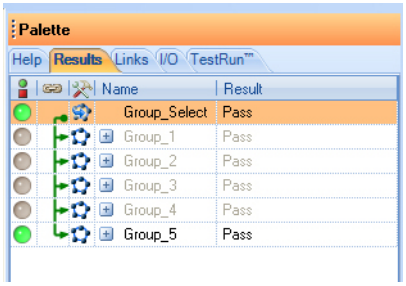


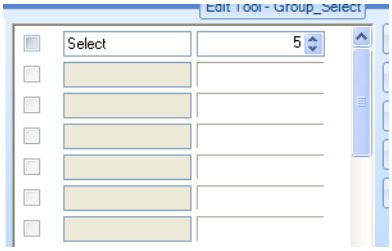
Where before any groups were created it showed.



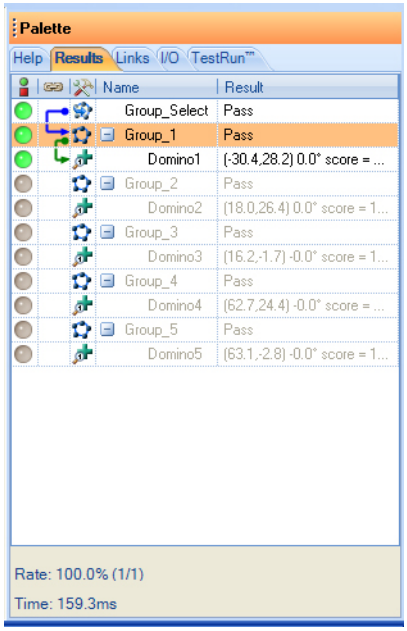
Click on the + signs to expand the groups to be able to see and edit your original five inspections.

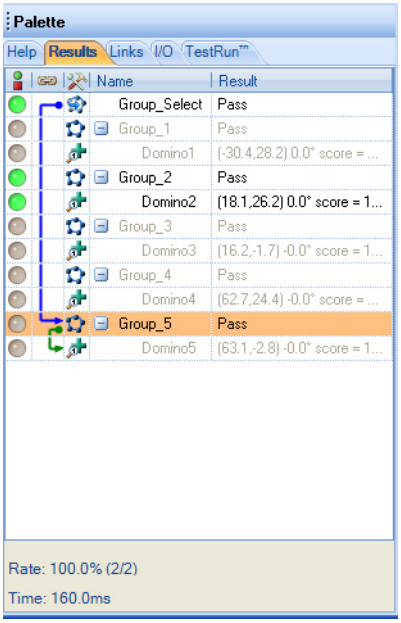
If you double-click the GROUP_SELECT tool in the Palette, an edit tool opens that allows you to force the selection integer to desired values so that you do not have to use the GROUP macro to enable Camera items during setup. As you change the Select Integer value, you should see the Palette display highlight the items you forced to be active.

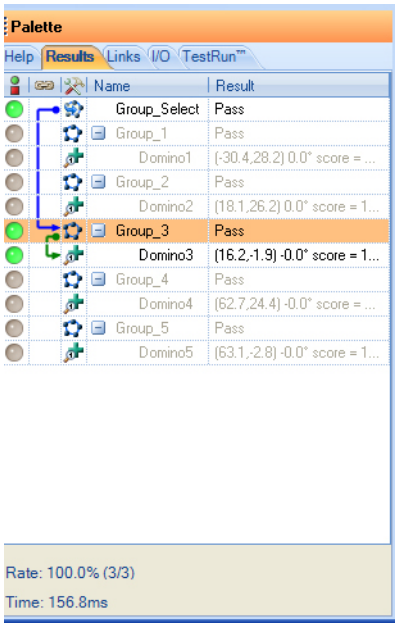


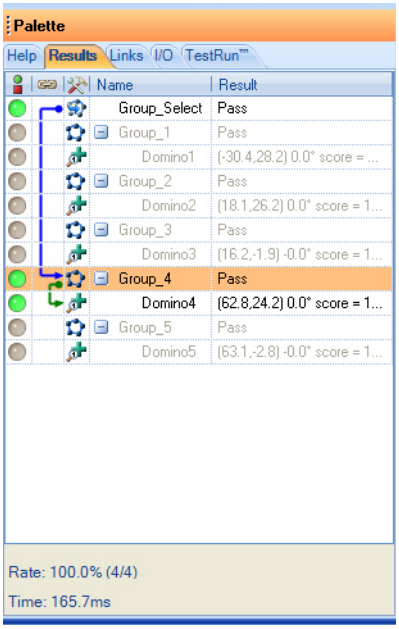


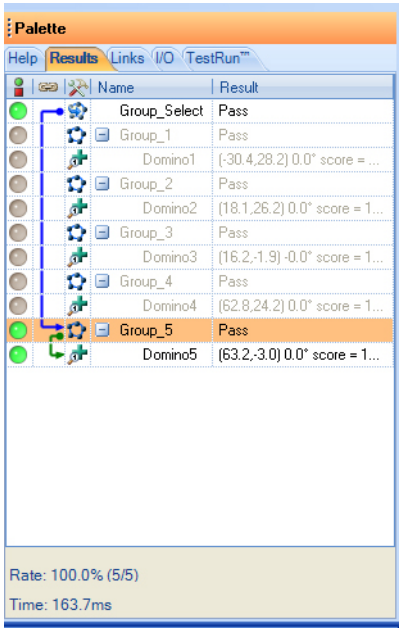
Let's see the camera's inspection times for each of the five inspections when it only has to perform one at a time. Triggering with the Selection Integer set at each of the five values yields.











So individually the inspections run at 159 ms, 160 ms, 156 ms, 165 ms and 163 ms. All significant reductions from the 776 ms when it had to run all the inspections every time.

Appendix A

A.1 Tips & Tricks

– The Pendant Application is stored on the Programming Pendant. If you swap Programming Pendants, you will have to reload the Pendant Application.
The robot job communication is handled by MotoSight and will still be functional. Only the Pendant application is lost with a Programming Pendant swap.

– Do not delete the Group Select tool or the Filter tool from the Default camera job.

– MotoSight 2D Pendant application is designed to work with EasyBuilder. You can use the spreadsheet to make edits, but be careful with the spreadsheet side or you may break some of the communications.

– Be careful with the job setup, especially if using groups. If you enable Group1, all of the other groups, variables are set with the last active values, not the current inspection data.

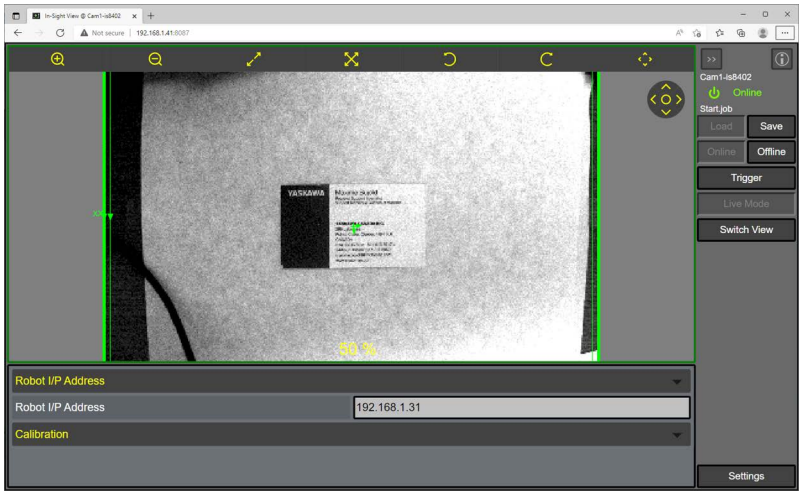
A.2 Web Browser View

For Cognex cameras with In-Sight firmware 5.6.0 and later, the Web HMI application is available. This application can be use to monitor the camera view from a PC during MS2D operation.

Open a web browser on a PC connected to the camera network, and enter the IP address of the camera followed by the port number ":8087" in the browser navigation bar. For example: http://192.168.1.41:8087. For further information about the Web Browser View requirements and operation, please refer to the Cognex In-Sight Documentation.

NOTICE

Review *chapter 2.1.2 "Configure Network Settings" on page 2-3* if there are problems connecting the camera.



Appendix B

B.1 Hardware Allocation

B.1.1 Network Inputs

	YRC Controller
MS2D Heartbeat	27240
MS2D License Valid	27241
Camera 1 Active	27244
Camera 2 Active	27245
Camera 3 Active	27246
Camera 4 Active	27247

B.1.2 TCP/IP Port Assignment

	YRC Controller
PORT_TELNET	23
PORT_COGNEX	1069
PORT_CAMERA_1	21751
PORT_CAMERA_2	21752
PORT_CAMERA_3	21753
PORT_CAMERA_4	21754
PORT_UDP_DEBUG	21760

B.1.3 Alarms

If MS2D detects an error it will generate the corresponding alarm.

Alarm	Description
8101	Failed to set robot output
8102	Failed to set robot variable
8103	Good Part - Bad Part set simultaneously
8104	Failed to set Online
8105	Failed to set Offline
8106	Failed to set group select
8107	Failed to read current user frame
8108	Failed to read a value from the spreadsheet
8109	Camera contains no variable assignments
8110	Failed to read a string from the spreadsheet
8111	Failed to change camera job
8112	Failed to retrieve camera job
8113	Attempt to set invalid job number
8114	Failed to read tool number

B.1.4 MotoSight 2D Camera Comparison

Model	Resolution	Performance Factor	Frames/ Second	Connection	Vision Tools[a)]
In-Sight 7050	800 X 600	0.1X	102	Two cables (separate Power and Ethernet)	Pattern, Edge, Blob, Circle, Curve, Histogram, Geometry, Image Filters, and Standard Calibration
In-Sight 7200	800 X 600	0.3X	102	Two cables (separate Power and Ethernet)	MS100 Tools + PatMax, non-linear calibration, and caliper tool, OCR, OCV, 2D Matrix, and Barcode reading
In-Sight 7402	1280 X1024	0.6X	60	Two cables (separate Power and Ethernet)	MS100 Tools + PatMax, non-linear calibration, and caliper tool, OCR, OCV, 2D Matrix, and Barcode reading
In-Sight 8101	1280 X1024	1X[b)]	54	POE cable (Power Over Ethernet)	MS100 Tools + PatMax, non-linear calibration, and caliper tool, OCR, OCV, 2D Matrix, and Barcode reading
In-Sight 8401	1280 X1024	3.9X	76	POE cable (Power Over Ethernet)	MS100 Tools + PatMax, non-linear calibration, and caliper tool, OCR, OCV, 2D Matrix, and Barcode reading
In-Sight 8402	1600 X1200	3.9X	53	POE cable (Power Over Ethernet)	MS100 Tools + PatMax, non-linear calibration, and caliper tool, OCR, OCV, 2D Matrix, and Barcode reading

a These are the vision tools available on the camera. Some of these tools may not be directly supported by MotoSight 2D software. Refer to *Appendix C* for the supported tools. Some unsupported tools may be mapped using the Math tool or a direct reference to a spreadsheet cell.
  – MotoSight 2D software supports PatMax Redline, but the option must be purchased separately for the camera.

b Base model for speed comparison.

B.2 Optional Configuration

With MotoSight 2D version 6.0.0 or higher, some of the MotoSight 2D default configurations can change by creating a robot job with the name MS2D_CONFIG. A setting can be defined in a job comment with the setting key word followed by its value. *Appendix B-1* lists the available keyword and the possible values for it.

Table B-1: Keywords and Values

Keyword	Value
DEBUG	0=Not debug info (default); 1=Debug Info; 2=Detailed Info
BROADCAST	0=Debug info displayed to terminal; 1=Debug info broadcast UDP port 21760 (default)
COMMAND_TIMEOUT	1000 (default; min=100) Time [msec] to get a reply to a normal command
TRIGGER_TIMEOUT	7500 (default; min=500) Time [msec] to get the result changed event after “camera trigger”
JOBCHANGE_TIMEOUT	7500 (default; min=1000) Time [msec] to get the job changed event after “set job”
OUTPUT_SCANTIME	4 (default; min=1) Interval [msec] at which the outputs are scanned.
SET_ACQUISITION_MODE	FALSE or 0 (default: TRUE) Prevents MS2D from changing the acquisition mode to Manual Trigger (which is normally needed to trigger while being Online)
CAMERA[a)]	# of camera (1-4; default: 1) sets the camera ID for the following settings:
OUTPUT_ADDR:	11210 (camera 1 default) Starting output address for the outputs to the camera
INPUT_ADDR:	11250 (camera 1 default) Starting input address for the inputs from the camera
MREG_CUR_JOB:	250 (camera 1 default) M-register to store the camera current job
MREG_LOAD_JOB:	254 (camera 1 default) M-register to store the camera job # to load
MREG_GROUP_SET	260 (camera 1 default) M-register to store the camera group # to select
MREG_ERROR	264 (camera 1 default) M-register to store the error code when the input error bit turns on.

a See *Appendix B.1.3* and *Appendix B.1.4* for default values of all cameras

B.3 Debugging Information

The MotoSight 2D MotoPlus can broadcast debugging information in case of an issue on the network. If needed to troubleshoot, these messages are retrievable by connecting a PC to the network and listening for UDP messages on port 21760 using a network packet analyzer or sniffer (such as WireShark).

The amount of data generation and enabling of the broadcast are configurable using MotoSight 2D version 6.0.0 or higher and *Appendix B.2*. For older versions, information is limited to error reporting, unless using a special debugging version from YASKAWA.

B.4 Parameter List

Table B-1: Parameter List

Parameter	Setting	Content
S2C211	2	Language Level (expanded)
S2C231	1	Motion in FWD/BWD/TEST Operation
S2C400	1	Enable User Alarms
S2C431	1	Multiple Tool
S2C541	0	Read/Write in Play Mode
S2C542	0	Read Write in Prohibit-Edit Mode
S2C688	3	BWD Motion
S2C1402	3	Allow File Save/Load During Alarms and Errors
S3C1192	2000000	Max Set Tool Correction Amount
S4C1057	0	Send Message Timeout. 0 = Disable

Appendix C

C.1 MotoSight 2D Supported Tools

When using MotoSight 2D tools, the X, Y, and Angle results can be assigned as a single entity to a P-variable.

C.1.1 Location Tools

Tool	Assignable Values
Pattern	X, Y, Angle (Two Tools)
	Qty Found (1 or 10 found items)
	Pass/Fail Status
PatMax Pattern	X, Y, Angle (Two tools)
	Qty Found (1 or 10 found items)
	Pass/Fail Status
PatMax Pattern Redline[a)]	X, Y, Angle (Two tools)
	Qty Found (1 or 10 found items)
	Pass/Fail Status
Blob	X, Y, Angle
	Pass/Fail Status
Circle	X, Y
	Diameter
	Pass/Fail Status
Edge	X, Y, Angle
	Pass/Fail Status

a MotoSight 2D software supports PatMax Redline, but the option must be purchased for the camera.

C.1.2 Inspection Tools

Tool	Assignable Values
Pattern	Pass/Fail Status
PatMax Pattern	Pass/Fail Status
PatMax Pattern Redline[a)]	Pass/Fail Status
Blob	Pass/Fail Status
Circle	Pass/Fail Status
Edge	Pass/Fail Status

a MotoSight 2D software supports PatMax Redline, but the option must be purchased for the camera.

C.1.3 Measurement Tools

Tool	Assignable Values
Blob Area	Area
	Pass/Fail Status
Diameter	Diameter
	Pass/Fail Status
Distance	Distance
	Pass/Fail Status
Angle	Angle
	Pass/Fail Status
Math	Results
	Pass/Fail Status

C.1.4 Geometry Tools

Tool	Assignable Values
Point-to-Point: MidPoint	X,Y, Angle
	Pass/Fail Status
Line Intersection	X, Y
	Pass/Fail Status

C.1.5 Counting Tools

Tool	Assignable Values
Blob	Qty
	Pass/Fail Status

Appendix D

D.1 Troubleshooting

Alarm	Error Codes	Description	Remedy
8101	101	Failed to clear robot outputs for camera #	Unable to set controller output. Check controller state for active alarm. Restart the controller.
		Failed to set data valid for camera #	
8103	103	Good Part - Bad Part set simultaneously for camera #	Check camera job. Inspection is report both pass and fail state at the same time.
8104	104	Setting Online failed for camera # (with source indication) - softOnline is Off - nativeOnline is Off - discreteOnline is Off	The indicated source is forcing the mode to stay Offline. Change the setting from the indicated source to Online.
		Setting Online failed for camera # (with no precision)	For ver.6.x, make sure that Insight Explorer is not connected to the camera during operation, it will prevent switching offline/ online mode from the robot controller. If monitoring is required during operation, use the Web Browser View (refer to *section A.2 "Web Browser View" on page A-1*)
8105	105	Setting Offline failed for camera #	
8106	106	Failed to change group on camera #	Check that the selected group is defined in the camera job.
8111	111	Failed to change job on camera #	Check that the selected job is defined in the camera, or same as alarm 105.
8112	112	Failed to retrieve job for camera #	Check that the selected job is defined in the camera, or same as alarm 105.
8113	113	Attempt to load invalid job on camera	Check camera job: incompatible job version, corrupted file…
8113	113	Communication Timeout	- Make sure to logout of the camera before exiting Insight Explorer to prevent leaving unnecessary connection opened. - Make sure that the camera is not being triggered a second time before the previous trigger has been processed. - Make sure that there isn't multiple versions of the MS2D Motoplus application installed on the controller. - If the camera job is very large and slow, the timeout may occur before the inspection is completed. Increase the INSPECT macro timeout time. *' wait for Motoplus or timeout* *WAIT OT#(LI012)=ON T=5.00* - If the camera and robot is on a large network with a lot of network traffic, packet might have been lost.
8200	200	Failed to retrieve 'cells' information	Contact a YASKAWA representative

Alarm	Error Codes	Description	Remedy
8201	201	Failed to retrieve 'Inspection_Completed' cell value	Check that the correct Motoman camera job template was used and that the indicated cell Symbolic tag is defined.
8202	202	Failed to retrieve 'Job.Pass' cell value	
8203	203	Failed to retrieve 'Job.Fail' cell value	
8204	204	Failed to retrieve 'Motoman.UF' cell value	
8205	205	Failed to retrieve 'Motoman.Tool' cell value	
8210	210	Trigger Camera Failed - Camera busy	Check connection between camera and robot controller.
8211	211	Trigger Camera Failed - Camera not responding	
8213	213	Trigger Camera Failed - Timeout	Check the trigger mode in the camera job (cell A3). It needs to be set to Manual to be able to trigger the camera from the robot controller output.

MOTOSIGHT™ 2D
INSTRUCTIONS

FOR: SMART PENDANT

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