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

The DX100, DX200, FS100 or YRC1000 operator’s manual above correspond to a specific usage. Be sure to use the appropriate manual.
DANGER

• This system manual provides an overview of the MotoSight™ 2D Global Edition system. It gives general information about the system, a description of its major components, and the procedures for installation, system operation, and preventive and repair maintenance. Be sure to read and understand this manual thoroughly before installing and operating the MotoSight™ 2D Global Edition system.

• General items related to safety are listed in chapter 1 of the Robot Controller Manual. To ensure correct and safe operation, carefully read the Robot Controller Manual before reading this manual.

CAUTION

• Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure that all covers and shields are replaced before operating this product.

• 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 a modification is made, the manual number will also be revised.

• If your copy of the manual is damaged or lost, contact a Yaskawa representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

• Yaskawa is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved Yaskawa training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the Motoman MotoSight™ 2D Global Edition system.

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

**DANGER**
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.

**WARNING**
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.

**CAUTION**
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**
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.

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

- Maintenance and inspection must be performed by specified personnel. Failure to observe this caution may result in electric shock or injury.
- For disassembly or repair, contact your Yaskawa representative.
- Do not remove the motor, and do not release the brake. Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.
YRC1000, DX200 and DX100

**WARNING**

- Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the controller and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

*Fig. : Emergency Stop Button*

- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

*Fig. : Release of Emergency Stop*

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  - Turning ON the power for the controller.
  - Moving the manipulator with the programming pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the controller and the programming pendant.
FS100

**WARNING**

- Before operating the manipulator, check that servo power is turned OFF when the emergency stop button on the programming pendant is pressed. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency.

*Fig. : Emergency Stop Button*

- In the case of not using the programming 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 5-6 pin and 16-17 pin of the robot system signal connector (CN2).

- Upon shipment of the FS100, this signal is connected by a jumper cable in the dummy 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.

- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

*Fig. : Release of Emergency Stop*

- Observe the following precautions when performing teaching operations within the manipulator’s operating range:
  - Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  - Always follow the predetermined operating procedure.
  - Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the manipulator’s operating range and that you are in a safe location before:
  - Turning ON the FS100 power.
  - Moving the manipulator with the programming pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

Injury may result if anyone enters the manipulator’s operating range during operation. Always press the emergency stop button immediately if there is a problem.

The emergency stop button is located on the right of the programming pendant.
Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is the Yaskawa industrial robot product. The manipulator usually consists of the controller, the Programming Pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX100, DX200, FS100 or YRC1000 controller</td>
<td>Controller</td>
</tr>
<tr>
<td>DX100, DX200, FS100 or YRC1000 Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
<tr>
<td>FS100 programming pendant dummy connector</td>
<td>Programming pendant dummy connector</td>
</tr>
</tbody>
</table>

Menu The menus displayed on Window are denoted with { }. ex. {TOOL}.

Button The buttons, check boxes, radio buttons displayed on Window are denoted with [ ]. ex. [Close]; [Sync] check box; [Fast] radio button.

CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the Programming Pendant to the hook on the cabinet of the controller after use.
- The Programming Pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.
- Read and understand the Explanation of Warning Labels in the Controller Manual before operating the MotoSight™ 2D Global Edition system.
Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • •" means the following operations:

• To move the cursor to the object item and left-click on it with the mouse.
• To pick out the object item by the tab key and press the [Enter] key.

(In case of selecting a menu, use arrow keys instead of the tab key to pick out the object item, then press the [Enter] key.)

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.
Explanation of Warning Labels

The following warning labels are attached to the manipulator.
Always follow the warnings on the labels.
Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Fig. : Warning Labels Location

WARNING Label A:

WARNING Label B:

Nameplate:

WARNING
Moving parts may cause injury

WARNING
Do not enter robot work area.
Safeguarding Tips

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

• Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this equipment, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this equipment.

• Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.

• The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.

• In accordance with ANSI/RIA R15.06-2012, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

Mechanical Safety Devices

The safe operation of this equipment is ultimately the users responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this equipment.

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

• Safety barriers
• Door interlocks
• Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the equipment to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.

- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.

- Check the E-Stop button on the operator station for proper operation before programming. The equipment must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.

- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.

- Any modifications to the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission from Yaskawa will void the warranty.

- Some operations require a standard passwords and some require special passwords.

- The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.

- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.

- Use proper replacement parts.

- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
Maintenance Safety

Turn the power OFF and disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by Yaskawa-trained, qualified personnel.

Summary of Warning Information

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notes.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by Yaskawa. Address any questions regarding the safe and proper operation of the equipment to Yaskawa Customer Support.
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1 Introduction

MotoSight™ 2D Global Edition is part of the Yaskawa family of standardized solutions. It is a fully integrated hardware/software 2D vision solution, supported by Yaskawa. MotoSight™ 2D Global Edition enables the robot controller to communicate with a MotoSight camera.

Included with MotoSight™ 2D Global Edition is a pendant application that is used to assign supported vision tool results directly to robot variables for use in robot programs. Image captures as well as vision tool graphics appear directly on the programming pendant display Window. Using the pendant application, EasyBuilder vision tool settings can also be modified directly from the programming pendant.

Fig. 1-1: MotoSight™ 2D Global Edition
1 Introduction
1.1 System Requirements

MotoSight™ 2D Global Edition only works with specific software versions. If you have questions regarding your system versions, contact Yaskawa Customer Support (see chapter 1.4 “Customer Support Information” at page 1-5). System requirements are shown below:

Table 1-1: DX100 System Requirements

<table>
<thead>
<tr>
<th>Function</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot Controller</td>
<td>DX100 (version 1.5x or higher)</td>
</tr>
<tr>
<td>Controller Software</td>
<td>DS1.XX.00A(JP/US)-14 (MotoPlus enabled)</td>
</tr>
<tr>
<td>DX100 Pendant</td>
<td>64 MB Pendant</td>
</tr>
<tr>
<td>Vision Device</td>
<td>Vision Device for each controller: Any MotoSight series camera. (Also compatible with Cognex In-Sight Series cameras)</td>
</tr>
<tr>
<td>MotoSight Version</td>
<td>5.0.0 or greater</td>
</tr>
</tbody>
</table>

Table 1-2: DX200 System Requirements

<table>
<thead>
<tr>
<th>Function</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot Controller</td>
<td>DX200</td>
</tr>
<tr>
<td>Controller Software</td>
<td>Any that works with DX200 controller</td>
</tr>
<tr>
<td>Vision Device</td>
<td>Vision Device for each controller: Any MotoSight series camera. (Also compatible with Cognex In-Sight Series cameras)</td>
</tr>
<tr>
<td>MotoSight Version</td>
<td>5.0.0 or greater</td>
</tr>
</tbody>
</table>

Table 1-3: FS100 System Requirements

<table>
<thead>
<tr>
<th>Function</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot Controller</td>
<td>FS100</td>
</tr>
<tr>
<td>Controller Software</td>
<td>Any that works with FS100 controller</td>
</tr>
<tr>
<td>Vision Device</td>
<td>Vision Device for each controller: Any MotoSight series camera. (Also compatible with Cognex In-Sight Series cameras)</td>
</tr>
<tr>
<td>MotoSight Version</td>
<td>5.0.0 or greater</td>
</tr>
</tbody>
</table>

Table 1-4: YRC1000 System Requirements

<table>
<thead>
<tr>
<th>Function</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot Controller</td>
<td>YRC100</td>
</tr>
<tr>
<td>Controller Software</td>
<td>Any that works with YRC1000</td>
</tr>
<tr>
<td>Vision Device</td>
<td>Vision Device for each controller: Any MotoSight series camera.</td>
</tr>
<tr>
<td>MotoSight Version</td>
<td>5.0.0 or greater</td>
</tr>
</tbody>
</table>
1.2 About This Document

This User's Manual provides a description of functionality, usage instructions, as well as application examples for the MotoSight™ 2D Global Edition system. For detailed information on specific system components listed in this document, please refer to the documentation package included with your system.

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

This manual contains the following sections:

Chapter 1 “Introduction”
Provides general information about the MotoSight™ 2D Global Edition system, a list of reference documents, and customer support contact information.

Chapter 2 “Installation and Setup”
Provides installation procedures for the MotoSight™ 2D Global Edition system.

Chapter 3 “Understanding the Pendant Vision Interface”
Provides an overview of the MotoSight™ 2D Global Edition pendant interface.

Chapter 4 “Operation”
Provides an overview of MotoSight™ 2D Global Edition system operation, including start-up, loading, normal operations, fault recovery, and system shutdown.

Chapter 5 “Maintenance/Troubleshooting”
Provides preventive maintenance requirements for certain components of the MotoSight™ 2D Global Edition system.

Appendix A
Provides Tips for helping the user gain a better understanding of the of the Cognex InSight EasyBuilder documentation.

Appendix B
Provides Hardware Allocation for Network Inputs, TCP/IP Port Assignment, I/O, M-Register and MotoSight 2D Camera Comparison.

Appendix C
Provides supported tools when using the MotoSight 2D.
1.2.1 Major Components

The MotoSight™ 2D Global Edition system includes the following major components:

- Yaskawa MotoSight Image Sensor
- In-Sight Explorer Software (version 4.8.5 and higher)
- Yaskawa MotoSight (version 5.0.0 or higher)
- Yaskawa MotoSight™ 2D Global Edition pendant application
- Motoman manipulator
- One controller assembly
- One Programming Pendant (located on the controller)

1.2.2 Optional Equipment

The following optional equipment is available for use with the MotoSight™ 2D Global Edition system:

- MotoEIP
- Anybus
- ComArc™ (seam tracking)

1.3 Reference Documentation

For additional information on individual components of the MotoSight™ 2D Global Edition system, refer to Table 1-5 for various documentation that is included with your system:

<table>
<thead>
<tr>
<th>Manual Description</th>
<th>DX100 P/N</th>
<th>DX200 P/N</th>
<th>FS100 P/N</th>
<th>YRC1000 P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yaskawa Manipulator Manual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yaskawa Operator's Manual for your Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vendor manuals not manufactured by Motoman</td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Yaskawa Controller Manual</td>
<td>155494-1CD</td>
<td>165292-1CD</td>
<td>159550-1CD</td>
<td>178642-1CD</td>
</tr>
<tr>
<td>Yaskawa Maintenance Manual</td>
<td>155492-1CD</td>
<td>165293-1CD</td>
<td>159645-1CD</td>
<td>178643-1CD</td>
</tr>
<tr>
<td>Yaskawa Concurrent I/O Manual</td>
<td>155491-1CD</td>
<td>165294-1CD</td>
<td>160621-1CD</td>
<td>178648-1CD</td>
</tr>
<tr>
<td>Yaskawa Macro Command Function Manual</td>
<td>156439-1CD</td>
<td>166242-1CD</td>
<td>159656-1CD</td>
<td>178673-1CD</td>
</tr>
<tr>
<td>Yaskawa INFORM User's Manual</td>
<td>155493-1CD</td>
<td>165301-1CD</td>
<td>159549-1CD</td>
<td>178649-1CD</td>
</tr>
<tr>
<td>Yaskawa Relative Job Function Manual</td>
<td>156191-1CD</td>
<td>165306-1CD</td>
<td>159659-1CD</td>
<td>178659-1CD</td>
</tr>
</tbody>
</table>
1.4 Customer Support Information

If you need assistance with any aspect of your MotoSight™ 2D Global Edition system, please contact Yaskawa Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact Yaskawa Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact Yaskawa Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact Yaskawa Customer Support at the telephone number shown above.

Please have the following information ready before you call:

- **System**: MotoSight™ 2D Global Edition
- **Robots**: HP165, HP20, etc.
- **Primary Application**: Select {MAIN MENU} > {SYSTEM INFO} > (VERSION) - APPLI:
- **Controller**: DX100, DX200, FS100 or YRC1000
- **Software Version**: Select {MAIN MENU} > {SYSTEM INFO} > (VERSION) - SYSTEM:
- **Robot Serial Number**: Located on a data plate on the rear of each robot arm
- **Robot Sales Order Number**: Located on a data plate on the front door of the controller
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.

Table 2-1: Hardware Requirements for In-Sight Micro

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yaskawa MotoSight camera</td>
<td>1</td>
</tr>
<tr>
<td>Personal Computer</td>
<td>1</td>
</tr>
<tr>
<td>Ethernet Hub</td>
<td>1</td>
</tr>
<tr>
<td>Robot Controller</td>
<td>1</td>
</tr>
<tr>
<td>Ethernet Cable (straight)</td>
<td>1</td>
</tr>
<tr>
<td>EuroFast Ethernet Cable</td>
<td>1</td>
</tr>
<tr>
<td>EuroFast Power Cable</td>
<td>1</td>
</tr>
</tbody>
</table>

Fig. 2-1: Basic Equipment Connections

Note: PC can be removed after setup.

Fig. 2-1: Basic Equipment Connections

Note: PC can be removed after setup.
2.1 PC Setup

Refer to your pc vendor documentation for installation instructions.

2.1.1 Setting IP Addresses

The IP addresses for the DX100, DX200, FS100 and YRC1000 controllers are shown in Table 2-2 through Table 2-5.

Your Yaskawa MotoSight system is configured with the follow IP addresses from the factory. If you need to change the addresses then follow the instructions in section 2.1.1.1 “Setting IP Address in the Robot” on page 2-4

Table 2-2: DX100 Controller IP Addresses

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

Table 2-3: DX200 Controller IP Addresses

<table>
<thead>
<tr>
<th>IP Address</th>
<th>Default Values</th>
<th>Allowable Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot</td>
<td>192.168.1.31</td>
<td>Any valid IP address other than 10.0.0.x.</td>
</tr>
<tr>
<td>Camera1</td>
<td>192.168.1.41</td>
<td>Any IP address that puts the camera in the same subnet address space.</td>
</tr>
<tr>
<td>Camera2</td>
<td>192.168.1.42</td>
<td></td>
</tr>
<tr>
<td>Camera3</td>
<td>192.168.1.43</td>
<td></td>
</tr>
<tr>
<td>Camera4</td>
<td>192.168.1.44</td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td>192.168.1.45</td>
<td>Any IP address that puts the computer in the same subnet address space.</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>255.255.255.0</td>
<td>Always set to 255.255.255.0.</td>
</tr>
</tbody>
</table>
### Table 2-4: FS100 Controller IP Addresses

<table>
<thead>
<tr>
<th>IP Address</th>
<th>Default Values</th>
<th>Allowable Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot</td>
<td>10.0.0.2</td>
<td>Any valid IP address&lt;sup&gt;1&lt;/sup&gt;.</td>
</tr>
<tr>
<td>Camera1</td>
<td>10.0.0.41</td>
<td>Any IP address that puts the camera in the same subnet address space.</td>
</tr>
<tr>
<td>Camera2</td>
<td>10.0.0.42</td>
<td></td>
</tr>
<tr>
<td>Camera3</td>
<td>10.0.0.43</td>
<td></td>
</tr>
<tr>
<td>Camera4</td>
<td>10.0.0.44</td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td>10.0.0.45</td>
<td>Any IP address that puts the computer in the same subnet address space.</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>255.255.255.0</td>
<td>Always set to 255.255.255.0.</td>
</tr>
</tbody>
</table>

<sup>1</sup> Changing the IP address of the FS100 controller to an address outside the 10.0.0.x address range requires that the pendant address also be changed to stay within the subnet mask.

### Table 2-5: YRC1000 Controller IP Addresses

<table>
<thead>
<tr>
<th>IP Address</th>
<th>Default Values</th>
<th>Allowable Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot</td>
<td>192.168.1.31</td>
<td>Any valid IP address other than 10.0.0.x.</td>
</tr>
<tr>
<td>Camera1</td>
<td>192.168.1.41</td>
<td>Any IP address that puts the camera in the same subnet address space.</td>
</tr>
<tr>
<td>Camera2</td>
<td>192.168.1.42</td>
<td></td>
</tr>
<tr>
<td>Camera3</td>
<td>192.168.1.43</td>
<td></td>
</tr>
<tr>
<td>Camera4</td>
<td>192.168.1.44</td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td>192.168.1.45</td>
<td>Any IP address that puts the computer in the same subnet address space.</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>255.255.255.0</td>
<td>Always set to 255.255.255.0.</td>
</tr>
</tbody>
</table>
2.1.1.1 Setting IP Address in the Robot

The IP Addresses of the camera(s) must be entered into string variables within the robot control.

*Fig. 2-2: String Variable Window*

If you have loaded the IONAME.dat file the variables will be named. If not, the camera IP Addresses are as follows:

- S097 - Camera 1
- S096 - Camera 2
- S095 - Camera 3
- S094 - Camera 4
### 2.1.2 Configure Network Settings

1. Open Network Connections in Control Panel. {Start} > {Settings} > {Control Panel} > {Network Connections}.

2. From the Network Connections window, right-click on the desired connection (typically Local Area Connection) and select Properties. The Local Area Connection Properties window appears.

![Fig. 2-3: Local Area Connection Properties Window](image)

3. From the General tab, highlight Internet Protocol (TCP/IP) from the “This connection uses the following items:” list and click on the Properties button. The Internet Protocol (TCP/IP) Properties window appears.

![Fig. 2-4: IP Address Settings](image)
2 Installation and Setup
2.1 PC Setup

4. Select the [Use the following IP address] radio button. Set the IP address and subnet mask so that they are on the same network as the robot and camera(s).

5. Select the [Use the following DNS server addresses:] radio button. Leave both addresses blank.
   • Preferred DNS server: Leave blank
   • Alternate DNS server: Leave blank

6. Click [OK] and close all open windows.

**NOTE**

The IP addresses for the PC, robot controller and In-Sight camera are all set on the same network.
2 Installation and Setup

2.2 In-Sight Software Setup

The following instructions are based on In-Sight Explorer ver. 4.8.5.

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, you may receive the following warning:

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 section 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.

Fig. 2-5: Add Sensor/Device to Network Window

![Add Sensor/Device to Network Window Image]

2. Select a camera from the list and modify the network settings including IP address and Subnet Mask to match the settings shown.

3. Click [Apply]. A message box appears stating that network settings will be changed and existing communications with the device will be broken.

4. Click [OK]. A message box appears stating that the “Network settings are changed successfully.”

5. Click [OK].
2.2.2.2 Verifying IP Address

1. 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.

![Network Settings Window](image)

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

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

NOTE

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 back up and In-Sight Explorer restarted before the new IP address is correctly recognized.
### 2.2.2.3 Loading the Camera Job

1. Make sure In-Sight Explorer is in EasyBuilder mode. Select {Get Connected} from the menu. Select the camera job and click [Connect].

2. Select the {Open Job} menu icon and load the Motoman template supplied with your system.
2.3 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.

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

2.3.1 Create a TCP for Teaching the User Frame

A user frame must be defined for the calibration grid. If the calibration grid positions cannot be reached using the defined tool TCP, a modified TCP can be used to program the user frame. If required, a threaded pointer can be created and attached to the tool.

1. Create a threaded pointer of a known length and attach it to the End of Arm Tooling (EOAT).
2. From the programming pendant, select [ROBOT] under the main menu.
3. Select [TOOL]. The TOOL COORDINATE window appears.
4. Select the desired tool number using the arrow key and press [Select]. The TOOL window appears.
5. Calibrate the TCP by using the 5 point calibration method refer to the following manuals for detailed instructions:
   - DX100 Instructions, section 8.3.2 “Tool Calibration”  
     P/N: 162536-1CD
   - DX200 Instructions, section 8.3.2 “Tool Calibration”  
     P/N: 165292-1CD
   - FS100 Instructions, section 8.1.2 “Calibrating Operation”  
     P/N: 159644-1CD
   - YRC1000 Instructions, section 8.3.2 “Tool Calibration”  
     P/N: 178642-1CD
2.3.2 9-Point Calibration (MS100, MS200, and MS300 Models)

To calibrate the vision system proceed as follows:

1. Position the camera above the work area at the appropriate height to achieve the required field of view.
2. If the camera is mounted on the robot arm, teach the robot position/height above the work area using the teach pendant.
3. Print a copy of the 9-point calibration grid included in the MotoSight 2D package.
4. Click “Live Video”. Adjust the camera focus and aperture so the 9-point calibration grid is in sharp focus. Ensure the calibration grid is within the camera field of view and the text “Top of the Field of View” is located at the top of the window. Exit “Live Video” mode.
5. From In-Sight Explorer select “Set Up Image”.
6. Place the 9-point calibration grid in the work area.

![Fig. 2-7: 9-Point Field of View](image)

7. In the calibration area located at the bottom of the In-Sight Explorer window select [9-Point] from the {Calibration Type} drop down list.

![Fig. 2-8: Selecting Calibration Type](image)
8. Click the [Edit Model] button and train the target located near the center of the field of view by adjusting the “Model Region” around the target and clicking the [Train] button.

*Fig. 2-9: Centering Target*

9. Ensure all 9 targets were found. If the camera failed to find all 9 targets, ensure all targets are completely visible in the field of view.

10. Ensure [Millimeters] is selected. Also ensure the “X Dimension”, and “Y Dimension” are set properly. If using the 9-point grid included with MotoSight 2D set each dimension to 85 mm.

11. Click the [Calibrate] button. If the calibration is successful the calibrated image will be displayed. Save the vision program.

*Fig. 2-10: 9-Point Calibration Success*

*Fig. 2-11: 9-Point Target*

Teach a user frame as marked on the 9-point calibration grid.
2.3 Camera Calibration

12. If the camera is mounted to the EOAT of the robot, select the “TOOL” job to set the camera TCP as follows, otherwise skip step 14 and step 13.

   a) Select {JOB} under the Main Menu.
   b) Select {SELECT JOB}. The JOB LIST window appears.
   c) Select the “TOOL” job from the list.

The “TOOL” job appears in the “JOB CONTENT” window.

Modify the job as noted below.

*Fig. 2-12: Tool Job*

```
NOP

'***************************
' this job creates a TCP
' for a camera mounted
' to the T axis of the robot
' user must enter tool to
' create, user frame used,
' and teach the calibration
' position
'***************************

'1)
' set LB000 to the
tool number to create
SET LB000 10
'****************************

'2)
' set LB001 to the user frame
' number used for calibration
SET LB001 10
'***************************

'3)
' teach this position as the
camera calibration position
' with the same tool as LB000
MOVJ C00000 VJ=20.00 PL=0
'***************************
```

Enter the tool number to create for the camera here.

Enter the User Frame number created on the vision calibration grid.

Teach the calibration position here using the tool number for the camera specified at the top of this job.
13. Run the “TOOL” job.

14. Verify the Camera TCP.

   a) Press [COORD] button to select the tool coordinate.
   b) Press the [SHIFT] + [COORD] buttons (both should be held at the same time).
   c) Cursor to the tool number set in LB000 in the “TOOL” job.
   d) Go to live video mode on the EasyBuilder software (refer to the EasyBuilder instructions).
   e) Rotate the camera using the Rz, Rx, and Ry keys. The camera display should remain in focus and the display should rotate about the Origin point of the calibration grid.

For your reference, record values here:

Table 2-6: Calibration Values

<table>
<thead>
<tr>
<th>Camera TCP #</th>
<th>User Frame for Cal. Grid</th>
<th>EOAT TCP #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.3.3 **Advanced Camera Calibration** (MS200/MS300 Models)

1. Position the camera above the work area at the appropriate height to achieve the required field of view.

2. If the camera is mounted on the robot arm, teach the robot position/height above the work area using the teach pendant.

3. From In-Sight Explorer select {Set Up Image}

4. In the calibration area located at the bottom of the In-Sight Explorer window check the [Classic Orientation] check box.

*Fig. 2-13: In-Sight Explorer Window Classic Orientation Check Box*

5. Select [Grid] from the {Calibration Type} drop down list.

*Fig. 2-14: In-Sight Explorer Window Selecting Calibration Type*
2.3 Camera Calibration

6. Click the [Calibrate] button. The “CalibrateGrid” window appears.

*Fig. 2-15: Setup CalibrateGrid Window*

7. Select [Checkerboard, with Fiducial] from the {Grid Type} drop down list.

8. Set the Grid Spacing appropriately for the camera field of view.

9. Select [Millimeters] from the {Grid Units} list.

10. To print the calibration grid click the [Print Grid] button. Then click the [Print] button.

11. Place the calibration grid on the work area in the camera field of view.

12. Click {Pose} in the CalibrateGrid Window.

*Fig. 2-16: Pose CalibrateGrid Window*
13. Click [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.


15. Ensure all the feature points of the calibration grid are found.

Fig. 2-17: Feature Points of the Calibration Grid

16. From the “CalibrateGrid” window click the [Calibrate] button. The results are displayed. Click [OK] then save the program.

NOTE
For best results the calibration grid must be completely visible within the camera field of view.
17. Create a user coordinate system for the calibration grid. Refer to “User Coordinate Setting” of the Controller manual for more information.
   • Follow the axis orientation direction indicated on the calibration grid.
   • The origin, XX and XY must be located as illustrated in Fig. 2-18.

*Fig. 2-18: Calibration Grid*

18. Return the robot to calibration position recorded in step 2.

19. If the camera is mounted to the EOAT of the robot, select the job to set the camera TCP as follows, otherwise skip step 19 through step 21.
   a) Select [JOB] under the {Main Menu}.
   b) Select [SELECT JOB]. The JOB LIST window appears.
   c) Select the “TOOL” job from the list.

The “TOOL” job appears in the “JOB CONTENT” window.

Modify the job as noted in Fig. 2-19.
2.3 Camera Calibration

Fig. 2-19: Tool Job

NOP

'*******************************
' this job creates a TCP
' for a camera mounted
' to the T axis of the robot
' user must enter tool to
' create, user frame used,
' and teach the calibration
' position
'*******************************

'1)'
'set LB000 to the tool number to create
SET LB000 10

'*******************************

'2)'
'set LB001 to the user frame number used for calibration
SET LB001 10

'*******************************

'3)'
'teach this position as the camera calibration position
'these with the same tool as LB000
MOVJ C00000 VJ=20.00 PL=0

'*******************************

20. Run the “TOOL” job.

21. Verify the Camera TCP:

   a) Press [COORD] button to select the tool coordinate.
   b) Press the [SHIFT] + [COORD] buttons (both should be held at the same time).
   c) Cursor to the tool number set in LB000 in the “TOOL” job.
   d) Go to live video mode on the EasyBuilder software (refer to EasyBuilder instructions).
   e) 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.
For your reference, record values here:

**Table 2-7: Calibration Values**

<table>
<thead>
<tr>
<th>Camera TCP#</th>
<th>User Frame for Cal. Grid</th>
<th>EOAT TCP#</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.3.4 Pendant 9-Point Calibration (MS100, MS200, MS300)

1. Print a calibration target of the size that will fill the largest portion of your field of view, at your working height. It may be necessary to shrink or enlarge the calibration target to accomplish the best fit. Scroll to the “Calibration” VisionView tag heading into view on the bottom of the screen.
2. Click the Calibration [Active] check box to enable the calibration controls.

![Calibration Interface]

**NOTE** If you have re-sized the calibration target, input the new dimensions for the X and Y dimensions.

3. Press [Model].
4. Adjust the model region to encompass the center target as shown below. You may want to use the Pan/Zoom controls to ensure you can see the target with enough detail. When you are satisfied, press the [Check Mark].

5. Press the [Train] button. You should see all nine targets identified with a crosshair signifying that each target was found. If there are any targets that are not found, you will need to re-verify the model teaching step or perhaps adjust the size/position of the target grid. Repeat this process until you have all nine targets found.
2 Installation and Setup

2.4 TCP/IP Communications Setup

6. Scroll up until you can access the [Calibrate] button. Depress it to register the calibration.

2.4 TCP/IP Communications 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 your project requires you to configure the IP Addresses to something different than the default IP Address, you must change the IP Address setting in the template to match your actual configuration.

Fig. 2-20: TCP/IP Settings
3  Understanding the Pendant Vision Interface

MotoSight™ 2D Global Edition features an easy to use graphic interface. The various windows, fields, and buttons are described below.

3.1  Main Window

3.1.1  On Screen Mode Controls

Sensor Status: Displays information for the active sensor.

- The sensor's Display Name.
- The active job name (if available).
- Whether the sensor is Online, Offline, Forced Offline, if an image is being saved or if the filmstrip is frozen or paused (if available).
- The inspection pass, warning or fail status (if available).

If the MotoSight sensor is placed Offline using any method other than the user interface, the sensor status displays “Forced Offline”. When the sensor is in this state, no job changes are allowed and the sensor cannot be placed in Focus Mode. To allow job changes and enable Focus Mode, place the sensor Offline from the user interface.
Understanding the Pendant Vision Interface

3.1 Main Window

**Offline**: Places the sensor Offline.

**Online**: Places the sensor Online.

**Adjust Image**: Allows the operator to make adjustments to the image.

**Trigger**: Triggers an inspection on the sensor.

**NOTE**

The Trigger button is disabled in 'Online' mode

**Switch View**: Displays the next view available on the sensor

The following views are available in the following default order:

- **Image with Graphics and EasyView**: Displays the image, tool graphics and the EasyView. For Image with Graphics and EasyView to be displayed, EasyView tags must first be configured within In-Sight Explorer and saved to the sensor's job. (Shown Above)

- **Image Only**: Displays only the image.

*Fig. 3-2: Image Only Display*
3 Understanding the Pendant Vision Interface

3.1 Main Window

- **Image with Graphics**: Displays the image and tool graphics.

  **Fig. 3-3: Image with Graphics Display**

- **EasyView Only**: Displays only the EasyView. For EasyView Only to be displayed, EasyView tags must first be configured within In-Sight Explorer and saved to the sensor's job.

  **Fig. 3-4: EasyView Only Display**
3.2 Menus

**File Menu** - Selecting [Exit] from the File menu shuts down the MotoSight™ 2D pendant application.

**Connect Menu** - Selecting [Camera 1-4] will change the current connected camera

**Results Menu** - Selecting [Assign Results] will take you to the assign results window

**Options Menu** - Selecting [Language] will display a list of the available language selections. Changing language will require the application to be re-started for the new language selection to take effect.

**Help Menu** - Selecting [About] will display a dialog showing the current version of MotoSight2D.
3.3 Assign Results Window

*Fig. 3-5: Assign Results Window*

The Assign Results window is used to assign supported tool results to robot variables. Available tool results are listed in the left window. When a tool result is selected, the appropriate robot variables are listed in the 'Robot Variables' window. Once the desired robot variable is selected to store the vision tool results, pressing the [>>] button loads the vision tool name and variable information into the selected robot variable and is added to the Assignment List.

If the destination is a 'P' variable, the user can select the tool and user frame associated with that Pvar. The tool selection should match the tool number created for the end effector in use. Ensure the Pvar UF selection matches the user frame used for calibration.

Once assigned the robot variables will be updated automatically each time the camera is triggered.

*Fig. 3-6: Assignment Results Window*
You can remove individual variable assignments by highlighting a single assignment and pressing [Remove]. To remove all the assignments, press the [Remove All] button.

When all the assignments have been made, press [Save] to save the assignments to the vision job.

Pressing [Return] will take you back to the main window.

To make individual assignments from the camera spreadsheet, press [EasyBuilder]. This will display the row and column tools to allow you to make assignments from any camera spreadsheet location to robot variables.

**NOTE** The MotoSight 2D template must be used as a starting point for spreadsheet programming.

**Fig. 3-7: EasyBuilder Window**

To display the standard result tree press [Spreadsheet].
3.4 EasyView Tags

MotoSight2D gives you the ability to modify virtually any setting or tool through the power of EasyView tags.

The MS2D template contains a base collection of tools that allow the robot and camera to communicate. Specialized templates will allow some simple applications to be accomplished without any additional configuration.

However, some projects will require the addition of other vision processing tools. Once these tools are added to the camera job, the user can enable “EasyView” tags for these tools which will then allow those settings to be updated from the MotoSight 2D pendant application without the use of a computer.

By selecting [Communication] and then [EasyView] the user is presented with a list of tags that are currently enabled.

*Fig. 3-8: In-Sight Explorer Admin Window*
To add additional tags click [Add]

*Fig. 3-9: Select EasyView Items Window*

The user is then presented with a list of all the available tools. From this list the user can enable settings and values that they would like the ability to edit from the pendant app.

(It is recommended that the camera job contain no more than 70 “EasyView” enabled Items.)
This section provides a general outline of the operating procedures for your MotoSight™ 2D Global Edition system. For more detailed operating information, refer to the specific component manuals that are part of the MotoSight™ 2D Global Edition system documentation package (see chapter 1.3 “Reference Documentation” at page 1-4).

Fig. 4-1: Outline of Operations

- Determine camera setting based on the part
- Create user frame on calibration grid
- Calibrate camera with In-Sight procedure
- Remove calibration grid and place part
- Adjust robot height for working distance
- Create vision program
- Allocate robot variables using MotoSight 2D pendant application
- Teach robot program
- Convert robot path to relative job
- Test job
4.1 Overview

Vision systems process images using “tools” created within 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) has processed an image, it 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.

When setting up the robot program to use the camera job results, the programmer determines which result values the robot will use. The programmer must also designate where these result values are to be stored in robot memory. The result values can be stored in several different types of robot variables depending on the type and use. Refer to the Yaskawa Operator’s manual shipped with your system for more information on robot variable types. The MotoSight™ 2D Global Edition pendent application is used to assign the supported MotoSight result values to the selected robot variables. Once assigned, the camera result values are transferred to the robot variables and can now be used in various robot jobs for counting, part inspections, and path correction.

4.2 Macro Commands

The macro command function registers a prepared job as a macro command and then carries out the job using the macro command instruction. Users can create macro commands using the INFORM programming language. Macro commands can be used in the same way as other instructions. For more information, refer to the instructions for Macro Command Function.

Yaskawa has provided several optional macro jobs to help set up and use the MotoSight™ 2D Global Edition function. These jobs can be added to a robot program to set up and use the data returned from the camera, provide a method of job change, and control different inspections in a particular camera job.

4.2.1 INSPECT Instruction

The INSPECT macro is used to trigger an inspection using the specified camera. The arguments for this macro allow the user to control the behavior of the system if the inspection fails to find an object.
4.2 Macro Commands

4.2.1.1 Format

**Fig. 4-2: Detail Edit View**

```
   INSPECT     CAM_=1     RETRIES=0      RT_DEL=0      DISABLE=0
```

1. Set the “CAMERA NUMBER” argument to the index of the camera to be used for this inspection. Setting range is 1 - 4.
2. Set the “# OF RETRIES” 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. Set the “RETRY DELAY” 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. Set the “DISABLE ALARM” argument to a zero to allow the macro to generate an alarm if an object is not found. This alarm will stop the robot. A setting of one will disable 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.

**NOTE**
To change argument values directly in the job, use the cursor to highlight the command on the instruction side and press the [SELECT] button. The command appears in the buffer section of the pendent window and the cursor can be used to select the argument to modify.
4.2 Macro Commands

4.2.1.2 Camera Trigger Methods

The INSPECT instruction triggers and processes an image capture during robot playback mode. However, there are several other ways that a camera image can be triggered. If the camera is in “offline” mode and the Cognex In-Sight Explorer software is active, the “trigger” button in the In-Sight Explorer software can be used. The operator can also initiate an image to be saved using the trigger button in the MotoSight™ 2D Global Edition pendant application.

NOTE
When using a moving camera to search for a part, adjusting the INSPECT instruction’s retry and retry delay settings can be helpful to prevent camera error for “no part present.”
4.2.2 ADJUST

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

4.2.2.1 Format

**Fig. 4-3: Adjust Setting Window**

(1) Set the “VISION RESULT(P)” 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 Assign Results window from the robot teach pendant. See chapter 3.4 “EasyView Tags” at page 3-7.

(2) If the camera is mounted to the 6th axis of the robot set the “CAMERA TCP #” argument to the TCP number used for the camera. This TCP is created during the calibration procedure. See chapter 2.3.3 “Advanced Camera Calibration (MS200/MS300 Models)” at page 2-15. If you are using a fixed mounted camera this argument is not used.

(3) If the camera is mounted to a stand or somewhere other than the 6th axis of the robot then set the “FIXED/MOBILE CAM” argument to zero. If the camera is mounted to the 6th axis of the robot then the setting should be a one.

(4) Set the “UF# TO CREATE” argument to the User Frame number you wish to create. Setting this argument to zero will disable User Frame creation.

(5) The Adjust macro will calculate the vision result location based upon the robot Base Frame. This location is the origin of the User Frame that is created. This is useful when inspecting larger objects with a mobile camera. The user can collect multiple locations and create a User Frame based upon those locations. Set the “VIS RESULTS BF” to the index of the Position variable you wish to contain this location. Setting
this argument to a value greater than 127 will disable this calculation.
(6) Set the “PAUSE” 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 or convert a pulse job to relative referencing the user frame that
was created. To resume normal operation set this argument to zero.

4.2.3 SETGROUP Instruction

Transmits the group integer number to the camera.

4.2.3.1 Format

Fig. 4-4: Set Group Window

(1) Set the “CAMERA NUMBER” argument to the index of the camera to
receive the group data. Setting range is 1 - 4.
(2) Set the “GROUP VALUE” argument to the integer value to be sent to
the camera. Setting Range is 0 - 32767. See chapter A.1 “Tips & Tricks”
at page A-1 for more information regarding groups.
4.2.4 SET_JOB Instruction

Changes the active vision job.

4.2.4.1 Format

**Fig. 4-5: Set Job Edit Window**

![Set Job Edit Window](image)

```
SET_JOB CAM_#=1 CAM_JOB=0 FORCE=1
```

1. Set the “CAMERA NUMBER” argument to the index of the camera to perform the job change. Setting range is 1 - 4.
2. Set the “CAMERA JOB #” argument to the ID number of the job to set as the active camera job.
3. If the “CHANGE IF ACTIVE” argument is set to a zero 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 one in order to force a job change if the active camera job equals the requested job.
5 Maintenance/Troubleshooting

This section includes a parameter list for the MotoSight™ 2D Global Edition system.

5.1 Parameter List

5.1.1 Parameters

Table 5-1: Parameter List

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial Settings</th>
<th>New Setting</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C211</td>
<td>0</td>
<td>2</td>
<td>Language Level (expanded)</td>
</tr>
<tr>
<td>S2C231</td>
<td>0</td>
<td>1</td>
<td>Motion in FWD/BWD/TEST Operation</td>
</tr>
<tr>
<td>S2C400</td>
<td>0</td>
<td>1</td>
<td>Enable User Alarms</td>
</tr>
<tr>
<td>S2C431</td>
<td>0</td>
<td>1</td>
<td>Multiple Tool</td>
</tr>
<tr>
<td>S2C541</td>
<td>1</td>
<td>0</td>
<td>Read/Write in Play Mode</td>
</tr>
<tr>
<td>S2C542</td>
<td>1</td>
<td>0</td>
<td>Read Write in Prohibit-Edit Mode</td>
</tr>
<tr>
<td>S2C688</td>
<td>2</td>
<td>3</td>
<td>BWD Motion</td>
</tr>
<tr>
<td>S3C1192</td>
<td>0</td>
<td>2000000</td>
<td>Max Set Tool Correction Amount</td>
</tr>
<tr>
<td>S1D229</td>
<td>1</td>
<td>0</td>
<td>User Variable Access Control</td>
</tr>
<tr>
<td>S1D233</td>
<td>1</td>
<td>0</td>
<td>Instruction Quick Execution</td>
</tr>
<tr>
<td>S1D305</td>
<td>0</td>
<td>20</td>
<td>Standard Priority MotoPlus Tasks</td>
</tr>
<tr>
<td>S1D306</td>
<td>0</td>
<td>10</td>
<td>High Priority MotoPlus Tasks</td>
</tr>
<tr>
<td>S1D307</td>
<td>3</td>
<td>30</td>
<td>Concurrent MotoPlus Tasks</td>
</tr>
</tbody>
</table>
Appendix A

A.1 Tips & Tricks

The following chapter is intended to supplement the Cognex InSight EasyBuilder documentation. The following instructions are provided as supplemental guidelines and tips to help the user gain a better understanding of the system.

A.1.1 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.

![Application Steps Diagram]

Inspect Part

The Add Tool box changes.

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

![Add Tool Diagram]


![Edit Tool Diagram]
4. Select the Tool Enable window and set to Expression.

5. Select the Enable Expressions tab.


7. Expand the Logic set.

8. Double click IF. "Appearers 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 “=1,1,0” 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. Now 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 active.
Now 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.
A.2 SET GROUP Macro

From the Groups Setup section, we entered an expression... =1,1,0

So the Camera job is looking for the Integer passed to =1 in order to enable that particular group.

Therefore, we need to use the SET GROUP macro to set the Integer to a "1" before we trigger an inspection. This is shown as the group # in the following screenshot.

Now we have group 1 enabled in the camera job.
A.3 SET_JOB macro

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 we will use “7”.

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

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

2. Then, from the Macro on the teach pendant, simply match the Integer setting.
A.4 INSPECT Macro

The INSPECT macro is used to trigger a camera inspection.

The macro arguments give us several configuration choices. The simplest use of the macro is shown in the following screenshot. In this case, we set the camera # to 1.

![Screenshot of the INSPECT macro settings](image)

The remaining arguments can be used to set up automatic retries for failed inspections, and to set alarms for camera errors.
A.5 Adjust Macro

As described previously in this manual the ADJUST macro creates a user defined coordinate system (User Frame) based upon vision inspection results. In order for the robot to correct its path the command positions must be relative to the User Frame that is created. The robot path to be adjusted should be contained within a separate job. This way the job can be easily converted to relative. Please refer to the Relative Job Function Manual for more information.

Once the vision inspection is configured, program the robot path in a separate job. See the image below. The robot motion to be corrected by the vision data is contained in the job named “PATH”.

![Image of job content]

```plaintext
JOB

J: EXAMPLE
CONTROL GROUP: R1

00001 NCP
00002 MOVJ UJ=100.00
00003 INSPECT CAM_U:1 RETRIES:0 RT:DEL:0 DISABLE:0
00004 ADJUST VIS_PW=10 CAM_TCP=5 F/M=1 MK_PF=1 LOC_PF=20 PAUSE=
00005 CALL JOB: PATH UF#(1)
00006 MOVJ UJ=100.00
00007 END

MOVJ UJ=0.78
```
Once the robot path is programmed do not move the object to be inspected. We need to locate the object with the vision system in the same position that the robot path was programmed. To do this, return to the job that contains the “ADJUST” macro, and move the robot to the inspection position. Now change the ADJUST macro PAUSE argument to a “1”. See figure below.

Enabling the PAUSE will stop robot execution once the User Frame is created. This will allow the user to convert the robot path to a relative job or check vision results. Execute the program. Make sure to trigger a new inspection. Program execution will stop once the User Frame is created. Convert the job to a relative job referencing the same User Frame that was created by the ADJUST macro (UF# TO CREATE argument). Refer to the Relative Job Function Manual for more information. Now the robot path is relative to the User Frame created by the vision inspection results. Each time a new inspection occurs the ADJUST macro will create the User Frame for the new object location thus “shifting” the robot path. Set the ADJUST macro PAUSE argument to “0” in order to disable the pause option.

If modifications to the robot path need to occur there is no need to convert the job. Set the ADJUST macro PAUSE argument to “1” in order to enable the pause option. Execute the program ensuring that a new vision inspection is performed. Program execution will stop once the User Frame is created. Now the user can step through the robot path and adjust/modify the path as needed. Set the ADJUST macro PAUSE argument to “0” when finished.
Appendix A
A.6 Additional Tips

- The Pendant Application is stored on the Pendant. If you swap 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 pendant swap.

- Do not delete the Group Select tool from the Default camera job.

- Motosight 2D is designed to work with EasyBuilder. You can use the spreadsheet to make edits, but be forewarned that you must be careful with the spreadsheet side or you may break some of the communications.

- Be careful with 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.
Appendix B

B.1 Hardware Allocation

B.1.1 Network Inputs

<table>
<thead>
<tr>
<th></th>
<th>FS100</th>
<th>DX100</th>
<th>DX200</th>
<th>YRC1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS2D Heartbeat</td>
<td>25240</td>
<td></td>
<td>27240</td>
<td></td>
</tr>
<tr>
<td>MS2D License Valid</td>
<td>25241</td>
<td></td>
<td>27241</td>
<td></td>
</tr>
<tr>
<td>Camera 1 Active</td>
<td>25244</td>
<td></td>
<td>27244</td>
<td></td>
</tr>
<tr>
<td>Camera 2 Active</td>
<td>25245</td>
<td></td>
<td>27245</td>
<td></td>
</tr>
<tr>
<td>Camera 3 Active</td>
<td>25246</td>
<td></td>
<td>27246</td>
<td></td>
</tr>
<tr>
<td>Camera 4 Active</td>
<td>25247</td>
<td></td>
<td>27247</td>
<td></td>
</tr>
</tbody>
</table>

B.1.2 TCP/IP Port Assignment

<table>
<thead>
<tr>
<th></th>
<th>FS100</th>
<th>DX100</th>
<th>DX200</th>
<th>YRC1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORT_TELNET</td>
<td></td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PORT_COGNEX</td>
<td></td>
<td>1069</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PORT_TCP_1 (NA)</td>
<td></td>
<td></td>
<td>21751</td>
<td></td>
</tr>
<tr>
<td>PORT_TCP_2 (NA)</td>
<td></td>
<td></td>
<td>21752</td>
<td></td>
</tr>
<tr>
<td>PORT_TCP_3 (NA)</td>
<td></td>
<td></td>
<td>21753</td>
<td></td>
</tr>
<tr>
<td>PORT_TCP_4 (NA)</td>
<td></td>
<td></td>
<td>21754</td>
<td></td>
</tr>
</tbody>
</table>

B.1.3 I/O

B.1.3.1 Universal Outputs Commands

- Universal Output 11210; //OUT#961 OG#121 CAM#1 Command
- Universal Output 11220; //OUT#969 OG#122 CAM#2 Command
- Universal Output 11230; //OUT#977 OG#123 CAM#3 Command
- Universal Output 11240; //OUT#985 OG#124 CAM#4 Command

B.1.3.2 Within Each Camera Command Word

0 - TRIGGER
1 - GO_ONLINE
2 - GO_OFFLINE
3 - SET_JOB
4 - GET_JOB
5 - SET_GROUP

Universal Output Results

- Universal Output 11250; //OUT#993 OG#125 CAM#1 Results
- Universal Output 11260; //OUT#1001 OG#126 CAM#2 Results
- Universal Output 11270; //OUT#1009 OG#127 CAM#3 Results
- Universal Output 11280; //OUT#1017 OG#128 CAM#4 Results
### Within Each Camera Result Word

0 - DATA_VALID
1 - ONLINE
2 - PART_GOOD
3 - PART_BAD
4 - ERROR
5 - JOB_VALID

### B.1.4 M-Register

<table>
<thead>
<tr>
<th>M Register</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>CAM#1 Current Job Register</td>
</tr>
<tr>
<td>251</td>
<td>CAM#2 Current Job Register</td>
</tr>
<tr>
<td>252</td>
<td>CAM#3 Current Job Register</td>
</tr>
<tr>
<td>253</td>
<td>CAM#4 Current Job Register</td>
</tr>
<tr>
<td>254</td>
<td>CAM#1 Job Load Register</td>
</tr>
<tr>
<td>255</td>
<td>CAM#2 Job Load Register</td>
</tr>
<tr>
<td>256</td>
<td>CAM#3 Job Load Register</td>
</tr>
<tr>
<td>257</td>
<td>CAM#4 Job Load Register</td>
</tr>
<tr>
<td>260</td>
<td>CAM#1 Group Set Register</td>
</tr>
<tr>
<td>261</td>
<td>CAM#2 Group Set Register</td>
</tr>
<tr>
<td>262</td>
<td>CAM#3 Group Set Register</td>
</tr>
<tr>
<td>263</td>
<td>CAM#4 Group Set Register</td>
</tr>
<tr>
<td>264</td>
<td>CAM#1 Error Register</td>
</tr>
<tr>
<td>265</td>
<td>CAM#2 Error Register</td>
</tr>
<tr>
<td>266</td>
<td>CAM#3 Error Register</td>
</tr>
<tr>
<td>267</td>
<td>CAM#4 Error Register</td>
</tr>
</tbody>
</table>

#### B.1.4.1 M-Register Error Code Values

If MS2D detects an error it will set the MotoPlus error bit, (bit 5 within each cameras result word) and place the appropriate error code value in the error M-Register.

<table>
<thead>
<tr>
<th>M Register Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Failed to set robot output</td>
</tr>
<tr>
<td>102</td>
<td>Failed to set robot variable</td>
</tr>
<tr>
<td>103</td>
<td>Good Part - Bad Part set simultaneously</td>
</tr>
<tr>
<td>104</td>
<td>Failed to set Online</td>
</tr>
<tr>
<td>105</td>
<td>Failed to set Offline</td>
</tr>
<tr>
<td>106</td>
<td>Failed to set group select</td>
</tr>
<tr>
<td>107</td>
<td>Failed to read current user frame</td>
</tr>
<tr>
<td>108</td>
<td>Failed to read a value from the spreadsheet</td>
</tr>
<tr>
<td>109</td>
<td>Camera contains no variable assignments</td>
</tr>
<tr>
<td>110</td>
<td>Failed to read a string from the spreadsheet</td>
</tr>
<tr>
<td>111</td>
<td>Failed to change camera job</td>
</tr>
</tbody>
</table>
### B.1 Hardware Allocation

#### B.1.5 MotoSight 2D Camera Comparison

<table>
<thead>
<tr>
<th>Model</th>
<th>Resolution</th>
<th>Processor Speed</th>
<th>Frames/Second</th>
<th>Vision Tools</th>
<th>When to Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS100</td>
<td>800 X 600</td>
<td>1x(^1)</td>
<td>102</td>
<td>Pattern, Edge, Blob, Circle, Curve, Histogram, Geometry, Image Filters, and Standard Calibration</td>
<td>Clean background (object to find is on a solid surface and the object has simple features). Camera inspection angle is normal to object.</td>
</tr>
<tr>
<td>MS200</td>
<td>800 X 600</td>
<td>3x</td>
<td>102</td>
<td>MS100 Tools + PatMax, non-linear calibration, and caliper tool, OCR, OCV, 2D Matrix, and Barcode reading</td>
<td>Cluttered background (object to find is on a conveyor or the object has complex features). Non-linear calibration is required due to inspection angle, wide angle lens, or high accuracy requirements.</td>
</tr>
<tr>
<td>MS300</td>
<td>1280 X 1024</td>
<td>6x</td>
<td>60</td>
<td>MS100 Tools + PatMax, non-linear calibration, and caliper tool, OCR, OCV, 2D Matrix, and Barcode reading</td>
<td>Large camera Field Of View or high image detail is required. Cluttered background (object to find is on a conveyor or the object has complex features). Non-linear calibration is required due to inspection angle, wide angle lens, or high accuracy requirements.</td>
</tr>
</tbody>
</table>

\(^1\) Base model for speed comparison.
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-VAR.

C.1.1 Location Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Assignable Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern</td>
<td>X, Y, Angle (Two Tools)</td>
</tr>
<tr>
<td></td>
<td>Qty Found (1 or 10 found items)</td>
</tr>
<tr>
<td></td>
<td>Pass/Fail Status</td>
</tr>
<tr>
<td>PatMax Pattern</td>
<td>X, Y, Angle (Two tools)</td>
</tr>
<tr>
<td></td>
<td>Qty Found (1 or 10 found items)</td>
</tr>
<tr>
<td></td>
<td>Pass/Fail Status</td>
</tr>
<tr>
<td>Blob</td>
<td>X, Y, Angle</td>
</tr>
<tr>
<td></td>
<td>Pass/Fail Status</td>
</tr>
<tr>
<td>Circle</td>
<td>X, Y</td>
</tr>
<tr>
<td></td>
<td>Diameter</td>
</tr>
<tr>
<td></td>
<td>Pass/Fail Status</td>
</tr>
<tr>
<td>Edge</td>
<td>X, Y, Angle</td>
</tr>
<tr>
<td></td>
<td>Pass/Fail Status</td>
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</tbody>
</table>

C.1.2 Inspection Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Assignable Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern</td>
<td>Pass/Fail Status</td>
</tr>
<tr>
<td>PatMax Pattern</td>
<td>Pass/Fail Status</td>
</tr>
<tr>
<td>Blob</td>
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<td>Edge</td>
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C.1.3 Measurement Tools

<table>
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<tbody>
<tr>
<td>Blob Area</td>
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<tr>
<td>Diameter</td>
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<td>Distance</td>
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<td></td>
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</tr>
<tr>
<td>Angle</td>
<td>Angle</td>
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<td></td>
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<td>Math</td>
<td>Results</td>
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<td>Pass/Fail Status</td>
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### C.1.4 Geometry Tools

<table>
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<tr>
<td>Point-to-Point:</td>
<td>X, Y, Angle</td>
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<td>MidPoint</td>
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<tr>
<td>Line Intersection</td>
<td>X, Y</td>
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### C.1.5 Counting Tools

<table>
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<tr>
<td>Blob</td>
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</tbody>
</table>
MOTOSIGHT™ 2D INSTRUCTIONS
Global Edition

Specifications are subject to change without notice for ongoing product modifications and improvements.

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