XRC Controller

Basic Integrated Vision Instruction Manual

Part Number 144963-1

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SECTION 1
INTRODUCTION

The Motoman Basic Integrated Vision system provides a high-speed vision solution for use with the Motoman UP6 robot. This state-of-the-art vision system features the DVT, Series 600, SmartImage sensor, and DVT FrameWork™ software. DVT's patented image acquisition technology provides optimum image stability and repeatability, while high speed ethernet connections provide vital control data to the XRC, including: P-variables, inspection results, and SPC data. The DVT Framework software package provides an intuitive yet powerful user interface featuring: Ethernet communications, ActiveX controls, scripting, and OCR.

1.1   About this Document

This document is intended to provide a system integration overview for personnel familiar with the operation of Motoman UP6 robot, and the Windows PC operating environment. For more detailed instructions, you will be refered to the manuals listed in Section 1.3. This manual contains the following sections:

SECTION 1 - INTRODUCTION
Provides general information about the Basic Integrated Vision system and its components, a list of reference documents, and customer service information.

SECTION 2 - SAFETY
Provides information regarding safe use and operation of the Basic Integrated Vision system.

SECTION 3 - INSTALLATION
Provides overview instructions for setup and installation of the Basic Integrated Vision system.

1.2   System Overview

The Basic Integrated Vision system is designed around the DVT, Series 600, SmartImage sensor, and includes: 12 digital Inputs/Outputs, Ethernet communications, serial communications, 640 x 480 resolution, Windows based point and click toolbox, and multi-setup storage with user frame data conversion.

1.2.1   System Layout

The DVT image sensor is mounted at the customer work station. A programming cable is run to a PC to provide ethernet communication for system setup. The serial converter and cable connect the image sensor to the XRC controller, drawing power directly from the XCP01 board. An I/O breakout card and isolation relays are mounted inside the controller for connection to the XRC I/O or additional devices. The DVT FrameWork™ software allows all I/O to be configured, including combining inspection tasks into subset pass, fail, or warn outputs.

XRC CONTROLLER

RJ11 SERIAL CABLE
(144087)

PROGRAMMING
CABLE (144084)
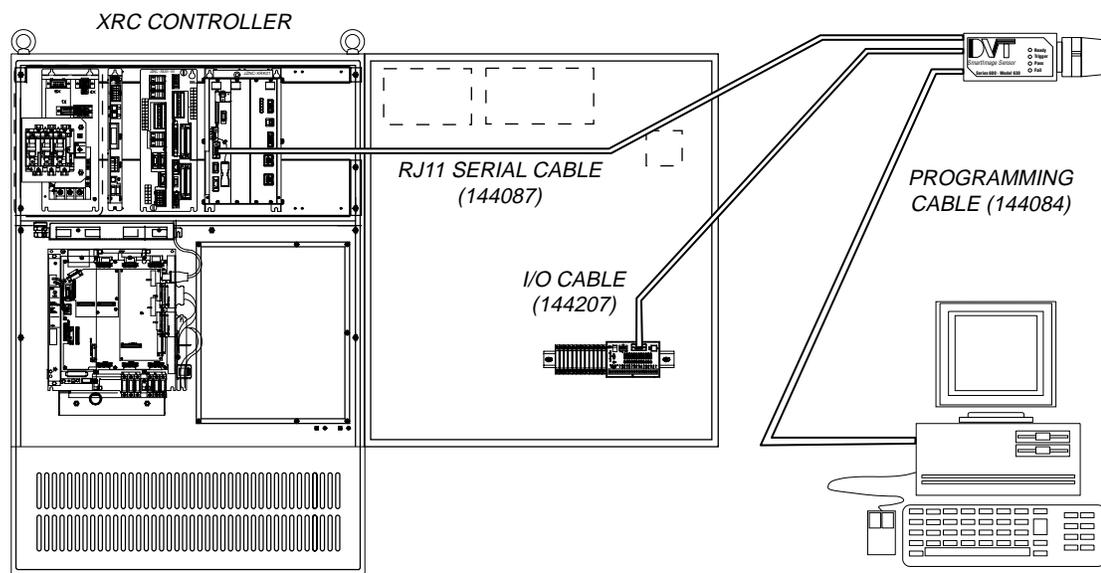
I/O CABLE
(144207)

Figure 1-1   System Layout

The Basic Integrated Vision system includes the following major components:

- DVT, Series 600, SmartImage sensor
- Camera mount
- I/O breakout card and relay assembly
- Serial convertor
- Serial communications cables
- I/O cables
- Panel mounted cable couplers
- DVT FrameWork™ software
- DVT Series 600 SmartImage Sensor Installation Guide
- DVT FrameWork™ 1.3 User Guide.
- Motoman Basic Integrated Vision System manual

1.2.2   System Requirements

The following minimum software and hardware requirements are needed to use the Basic Integrated Vision system:

Computer	IBM PC or compatible
Processor	486, 66 MHz minimum (Pentium, 75 MHz recommended)
Memory	16 MB minimum (32 MB recommended)
Hard Disk	20 MB minimum
CD ROM Drive	For installation
Monitor	Color Graphics
Input Device	Mouse
COM Port	One serial port available
Operating System	Microsoft Windows 95/98 or Windows NT 4.0 Service Pack 3 or higher
Controller Software	Controller software must have DCI Communications option installed

1.3   Reference to Other Documentation

For additional information refer to the following:

- Manipulator Manual for your robot model
- DVT Series 600 SmartImage Sensor Installation Guide (P/N 144095-1)
- DVT FrameWork™ 1.3 User Guide. (P/N 144096-1)
- Motoman Concurrent I/O Parameter Manual (P/N 142102-1)
- Vendor manuals for system components not manufactured by Motoman

1.4   Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

- Robot Type (UP6)
- Application Type (General, Handling)
- System Type (Basic Integrated Vision)
- XRC Controller Software Version (5.101A)
- Robot Serial Number (located on the back side of the robot arm)
- Robot Sales Order Number (located on back side of XRC controller)
- FrameWork™ software version
- PC specifications
- Description of difficulty (make a note of any error messages)

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SECTION 2
SAFETY

2.1   Introduction

> **It is the purchaser's responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.**

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06. The address is as follows:

<div align="center">

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

</div>

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. **The robot must not be operated by personnel who have not been trained!**

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming Safety (Section 2.6)
- Operation Safety (Section 2.7)
- Maintenance Safety (Section 2.8)

2.2   *Standard Conventions*

This manual includes information essential to the safety of personnel and equipment. As you read through this manual, be alert to the four signal words:

- DANGER
- WARNING
- CAUTION
- NOTE

Pay particular attention to the information provided under these headings which are defined below (in descending order of severity).

DANGER!
Information appearing under the DANGER caption concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.

WARNING!
Information appearing under the WARNING caption concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.

CAUTION!
Information appearing under the CAUTION caption concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

NOTE: *Information appearing in a NOTE caption provides additional information which is helpful in understanding the item being explained.*

2.3   *General Safeguarding Tips*

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot 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 robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.

- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.

- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

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

- In accordance with ANSI/RIA R15.06, section 6.13.4 and 6.13.5, 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).

2.4   *Mechanical Safety Devices*

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's 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 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety measures are available:

- Safety fences and barriers
- Light curtains
- Door interlocks
- Safety mats
- Floor markings
- Warning lights

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

2.5 *Installation Safety*

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 *Programming Safety*

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Programming tips are as follows:

- Any modifications to PART 1 of the controller PLC can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1. Making any changes without the written permission of Motoman will **VOID YOUR WARRANTY!**
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. **YOUR WARRANTY WILL BE VOID** if you use these special passwords.
- Back up all programs and jobs onto a floppy disk whenever 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.
- The concurrent I/O (Input and Output) function allows the customer to modify the internal ladder inputs and outputs for maximum robot performance. Great care must be taken when making these modifications. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations that may damage the robot or other parts of the system.
- 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 robot should be permitted to operate the system.

- Inspect the robot and work envelope 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 the E-STOP button on the teach pendant for proper operation before programming.
- Carry the teach pendant with you when you enter the workcell.
- Be sure that only the person holding the teach pendant enters the workcell.
- Test any new or modified program at low speed for at least one full cycle.

2.7 *Operation Safety*

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Operation tips are as follows:

- Be sure that only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories are permitted to operate this robot system.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Inspect the robot and work envelope to ensure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Ensure that all safeguards are in place.
- 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 robot should be permitted to operate the system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.

2.8   Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Maintenance tips are as follows:

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

- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.

- 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 robot should be permitted to operate the system.

- Back up all your programs and jobs onto a floppy disk whenever program changes are made. A backup must always be made before any servicing or changes are made to options, accessories, or equipment to avoid loss of information, programs, or jobs.

- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.

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

- Be sure all safeguards are in place.

- Use proper replacement parts.

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

- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.

- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

SECTION 3
INSTALLATION

The Basic Integrated Vision system can be installed easily in just a short time. Follow established safety procedures **at all times** throughout the installation process. Failure to use safe work practices can result in damage to equipment and injury to workers.

CAUTION!
Installation of the Basic Integrated Vision System is not a task for the novice. The Basic Integrated Vision System is not fragile, but it is a highly sophisticated vision system. Handle components with care. Rough handling can damage system electronic components.

3.1 Hardware Installation

3.1.1 Mounting the Image Sensor

1. Carefully mount DVT Image Sensor in desired location using hardware provided (refer to Dimensions of the DVT Series 600 SmartImage Sensor Installation Guide, Section 2.4 for mounting specifications).

3.1.2 Connecting the Cables

1. Locate RJ-11 serial communication cable assembly (144087-1), I/O cable assembly (144088-1), and Ethernet crossover cable (144084-1).
2. Plug serial cable into RJ-11 jack on back of DVT Image Sensor.
3. Plug I/O cable into 15-pin connector on rear of DVT Image Sensor.
4. Plug Ethernet crossover cable into RJ-45 jack on rear of DVT Image Sensor.

CAUTION!
Route wires and cables away from hazardous work areas to avoid wire breakage and unnecessary interruption of system operation.

5. Route Ethernet crossover cable to PC and connect directly to the RJ-45 jack on the Ethernet card.

NOTE: *The Ethernet crossover cable is designed to communicate between the Series 600 Image Sensor and the PC running FrameWork. To do this, the PC must have an Ethernet network card running TCP/IP protocol. Refer to Configuration of the DVT Series 600 SmartImage Sensor Installation Guide, Section 2.7.2 for detailed instructions on TCP/IP setup.*

6. Locate the gland-plate mounted RJ-11 coupler (144208-1), and 15 pin coupler (144210-1).

7. Using a Phillips screwdriver, remove two gland plates from side of XRC controller.

8. Mount RJ-11 and 15-pin couplers to side of controller using hardware provided.

![caution symbol] **CAUTION!**

Route wires and cables away from hazardous work areas to avoid wire breakage and unnecessary interruption of system operation.

9. Route serial and I/O cables to XRC controller.
10. Plug serial cable into RJ-11 coupler.
11. Plug I/O cable into 15-pin coupler.

![danger symbol] **DANGER!**

All power must be disconnected from the controller before beginning internal wiring. Failure to disconnect power can result in serious personal injury, loss of life, or equipment damage. Be sure to follow all Lockout/Tagout procedures.

12. With power off, open XRC cabinet.
13. Locate internal serial communication cable (144087-3), I/O cable (144207-1), I/O breakout card and relay assembly, and serial converter (144081-1).
14. Mount I/O breakout card and relay assembly to inside of cabinet door using hardware provided.
15. Plug serial cable into RJ-11 coupler at gland plate.
16. Route serial cable to XCP01 board.
17. Plug serial converter into CN03/RS232C connection on XCP01 board.
18. Plug serial cable into serial converter.

XCP01 BOARD

CON - 4T2 SERIAL CONVERTER AND SERIAL CABLE
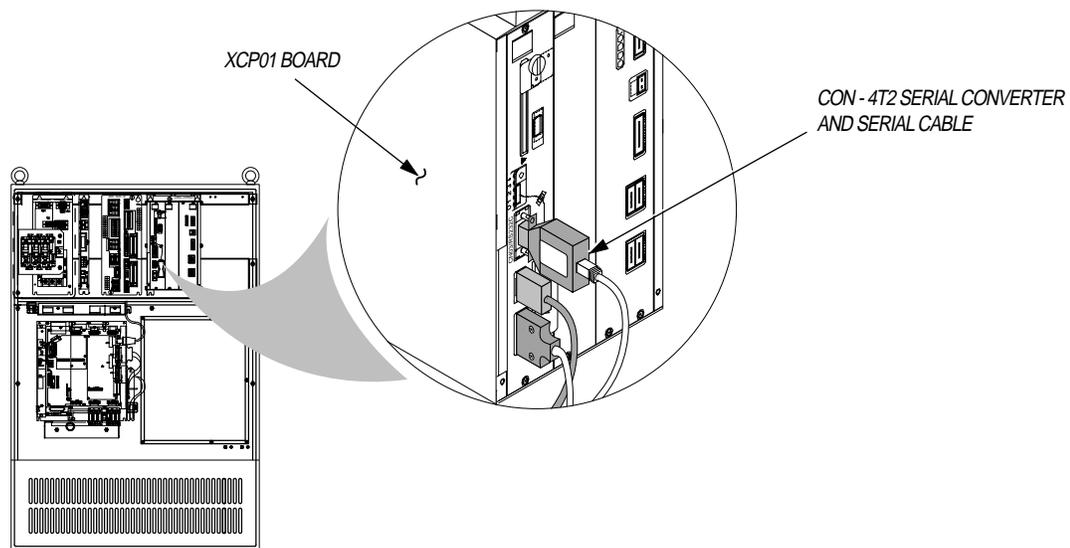
Figure 3-1   Serial Cable Connection

19. Plug I/O cable into 15-pin coupler at gland plate.
20. Route I/O cable to I/O breakout card.
21. Plug I/O cable into I/O breakout card.

3.1.3   Wiring I/O Connections

Inputs for the Series 600 are current sinking (NPN-type) and outputs are current sourcing (PNP-type). Both inputs and outputs are active in the high state. That is, switching any I/O line to 24V is read as an active signal. Refer to Power and Digital I/O Connections (15-pin Connector), Section 2.6 of the DVT Series 600 SmartImage Sensor Installation Guide.

3.2   Software Installation

3.2.1   Robot Controller Software

The XRC controller must have the DCI Communications option installed. Motoman Visual DCI must be initialized by a trained Motoman technician. Reinitialization of the XRC controller by a non-Motoman employee may void your warranty. If the Motoman Visual DCI option has not been installed, please contact the Motoman service staff at (937) 847-3200.

3.2.2   DVT FrameWork™

To install DVT FrameWork™ software on your PC, please refer to Installing FrameWork on a PC & SmartImage Sensor, Section 1.4 of the DVT FrameWork™ User Guide.

3.2.3   Motoman Driver

Once the DVT FrameWork™ software has been successfully installed on your PC, it is important to select the Motoman driver to enable communication between the XRC controller and the PC. To select the Motoman driver, proceed as follows:

1. Open DVT FrameWork™ software on your PC.
1. Click the `Comm` menu and select `Image Sensor Communications`. The Image Sensor Communications window appears.
2. Click `Serial Port B → Edit`. The Terminal Properties window appears.
3. Select the terminal driver Motoman Driver.

NOTE: *Refer to Hardware Configuration for Data Link Use, Section 6.5 of the DVT FrameWork User Guide for more information on driver selection.*

3.2.4   P-Variable Storage

FrameWork™ combines X, Y, and Z position data output in an equation editor format. Script Tool combines the parameters in a mathematical equation and stores this as default in P-variable #7. To change the default P-variable storage location, simply edit the Script Tool equation as follows:

1. Click `Products → Open Result Table`. The Result table appears.
2. Right click `Write` and select `Parameters`. The Script Tool Parameter window appears.
3. Select the Script tab.
4. Edit the P-variable number.

NOTE: *Refer to DVT FrameWork™ User Guide for more information on MotoWrite Pvar and Script Tool.*

5. Click *OK* once you have selected the appropriate P-variable

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