OMRON

AnyFeeder

AnyFeeder SXM100/140
AnyFeeder SX240/340

Integration Guide

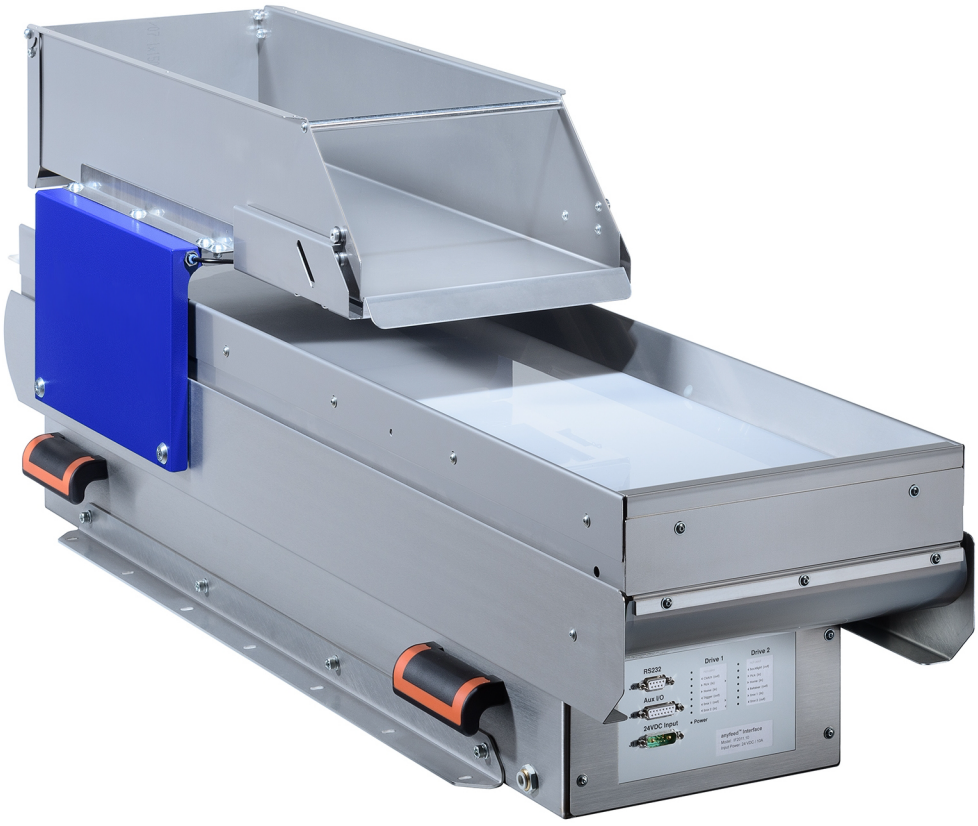

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Table of Contents

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Chapter 1: Introduction

This manual describes the steps for incorporating an AnyFeeder into your robot system.

The AnyFeeder, combined with a camera, performs flexible feeding so that a robot can pick and place products. ACE software provides interview wizards, so you can have a fully-integrated system with robot, controls and vision guidance set up quickly, with object finding features, automated calibration, and a tool library.

Changing the parts that the AnyFeeder system is handling is accomplished by adding a new Locator Model to the ACE Sight application. If the new parts are a different thickness than your existing Models, you will also have to teach a new height from the surface for picking.

1.1 Intended Audience

This guide is intended for an end-user or integrator who is familiar with Omron Adept robots and the AnyFeeder. It is assumed that you have already selected the robot and AnyFeeder models that you are going to use, as well as the accessories that will be used with those devices, such as the type of backlight, if any, for the AnyFeeder. It is also assumed that you have a working knowledge of ACE.

1.2 Prerequisites

- Omron Adept Technologies, Inc. robot

  Either a robot with an eAIB or eMB-40/60R, or one that uses a SmartController EX (running eV+).

- AnyFeeder

  The supported models are SXM100, SXM140, SX240, and SX340.

- Rigid mounting surfaces for the robot and AnyFeeder
- High-resolution camera with lens
  - Camera-mounting structure
  - Camera interface cables
- Keyboard, Monitor, and Mouse
  (for interfacing with and programming the robot and vision system)
- SmartController EX (option, recommended for Quattro)
- SmartVision MX industrial computer
- Power Supplies for AnyFeeder, SmartController EX, robot, and SmartVision MX

This guide assumes that the robot and any related equipment, such as a conveyor, are installed and functional. This guide focuses on the introduction of an AnyFeeder into that system.

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AnyFeeder Components

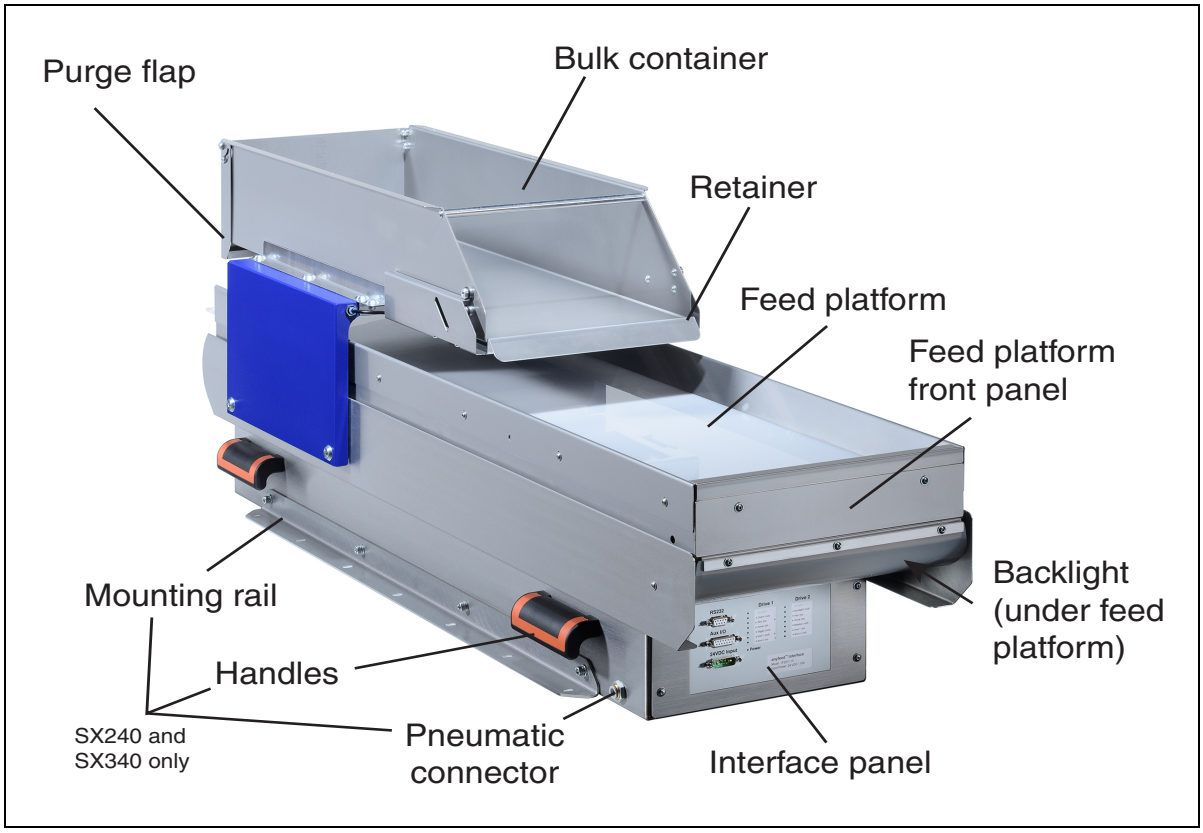

Figure 1-1. AnyFeeder Parts, Model SX240 shown

There are four different AnyFeeder-models supported:

- AnyFeeder SXM100
- AnyFeeder SXM140
- AnyFeeder SX240
- AnyFeeder SX340

In most respects, the feeders are similar enough that they will be covered together.
In areas where there are significant differences, information is given for each model or presented separately as appropriate.

Your AnyFeeder package includes:

- AnyFeeder Feeder
- 24 VDC Power Cable, 5 m (also called servo cable)
- RS232 Cable, 4.5 m
- User's Guide

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You will need to add:

- A Feed Surface

  These come in various colors and textures, depending on the parts to be handled.

You may want to add:

- Backlight

  This can be red or infra-red.

1.3 How Can I Get Help?

Websites

Refer to one of the following corporate websites:

http://www.ia.omron.com

and

http://www.adept.com

Related Manuals

The following table lists manuals related to this document.

To ensure system safety, make sure to always read and heed the information provided in all Safety Precautions, Precautions for Safe Use, and Precaution for Correct Use of manuals for each device which is used in the system.

Table 1-1. Related Manuals

Manual Title	Description
AnyFeeder User's Guide	Instructions for installation and configuration of an AnyFeeder.
Your robot user's guide	Instructions for installation, use, and maintenance of your robot.
Robot Safety Guide	Contains safety information for our robots.
SmartController User's Guide	Instructions for use of the optional SmartController motion controller.
SmartVision MX User's Guide	Instructions for use of the SmartVision MX industrial PC.
ACE User's Guide	Describes the installation and use of ACE software.
ACE Sight Reference Guide	Describes V+ and microV+ keywords and properties. Also describes framework and tool properties.

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Support

If, after reading this manual, you are having problems with your AnyFeeder, contact your local Omron Support.

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Chapter 2: Safety

2.1 Warnings, Cautions, and Precautions

There are six levels of special alert notation used in our manuals.
In descending order of importance, they are:

DANGER: This indicates an imminently hazardous electrical situation which, if not avoided, will result in death or serious injury.

DANGER: This indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING: This indicates a potentially hazardous electrical situation which, if not avoided, could result in injury or major damage to the equipment.

WARNING: This indicates a potentially hazardous situation which, if not avoided, could result in injury or major damage to the equipment.

CAUTION: This indicates a situation which, if not avoided, could result in damage to the equipment.

Precautions for Safe Use: This indicates precautions on what to do and what not to do to ensure using the product safely.

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2.2 Safety Precautions

WARNING: An AnyFeeder or industrial robot can cause personal injury or damage to itself and other equipment if the following safety precautions are not observed:

- All personnel who install, operate, program, or maintain the system must read this guide, the AnyFeeder User's Guide, the robot user's guide, and the *Robot Safety Guide*, and complete an appropriate Omron training course for their responsibilities in regard to the feeder.
- All personnel who install the feeder system must read this guide, read the *Robot Safety Guide*, and must comply with all local and national safety regulations for the location in which the feeder system is installed.
- Power to the feeder and robot must be locked out and tagged out before any maintenance is performed.
- Understand the specifications of the equipment that is used in the system. Allow some margin for ratings and performance.
- Provide safety measures, such as installing a safety circuit, in order to ensure safety and minimize the risk of emergency situations.

2.3 What to Do in an Emergency Situation

Press any E-Stop button (a red push-button on a yellow background) on any robot being used with the feeder, power-down the feeder, and then follow the internal procedures of your company or organization for an emergency situation. If a fire occurs, use CO_2 to extinguish the fire.

2.4 Additional Safety Information

We provides other sources for more safety information:

Robot Safety Guide

The *Robot Safety Guide* provides detailed information on safety for our robots.
It also gives resources for more information on relevant standards. It ships with each robot.

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Chapter 3: Component Setup

3.1 Robot System with AnyFeeder

This chapter describes the basic parts of a robot system with an AnyFeeder.

The following diagram shows a simple overview of typical components.

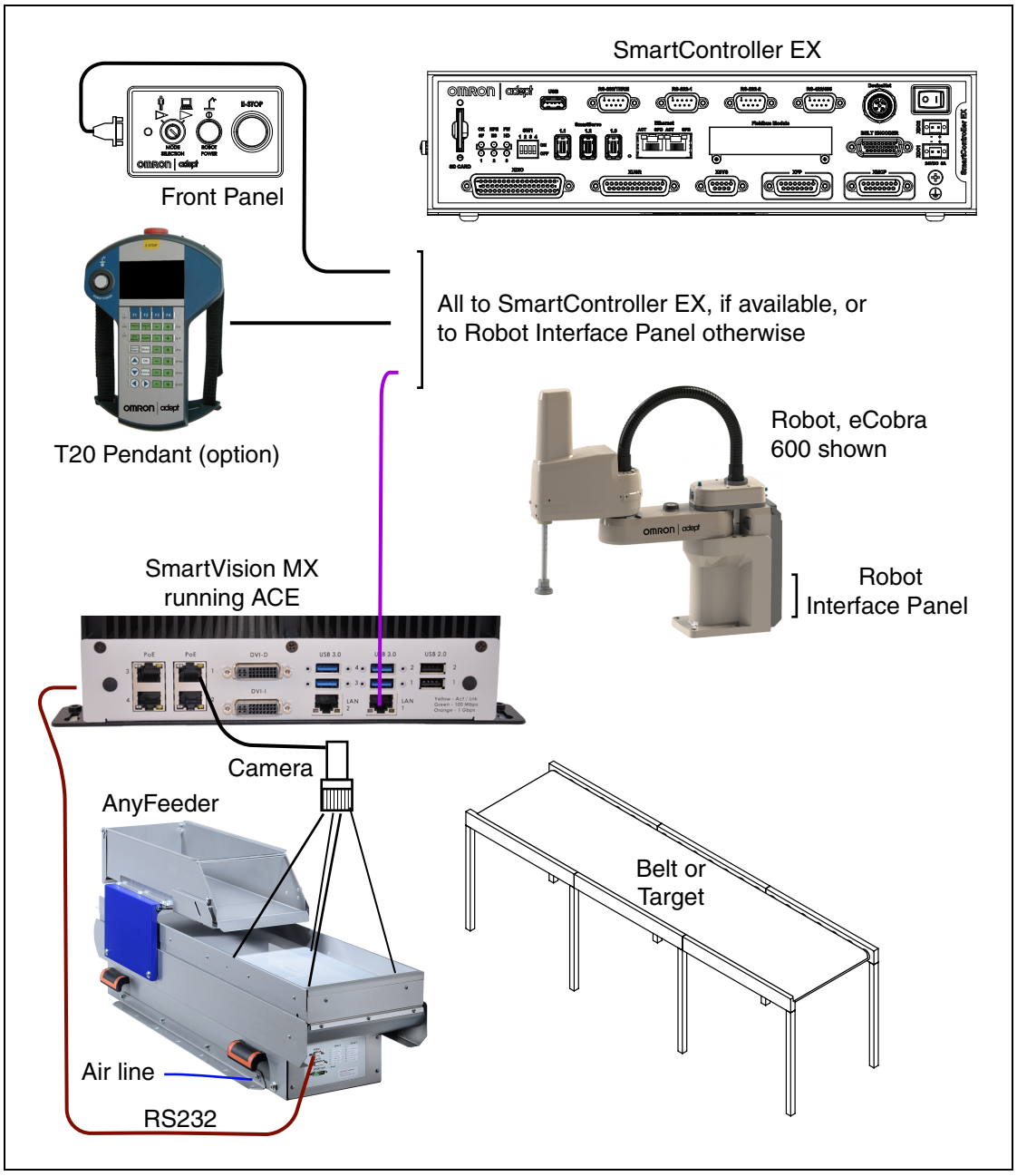

Figure 3-1. Overview of Robot System with AnyFeeder

NOTE: More detailed figures, showing connectivity, are shown in System Installation on page 17.

3.2 Basic Components

- Robot

  All Omron Adept robots running eV+ are supported.
  With an eCobra, the Pro version is required for active conveyor tracking, and either the Standard or Pro version is required for use of ACE Sight.

- Front Panel
- T20 Pendant - optional
- SmartVision MX

  This comes pre-loaded with ACE. It includes the USB license dongle.

- SmartController EX - optional

  This is recommended when using a Quattro with an AnyFeeder.

- AnyFeeder

  The supported models are SXM100, SXM140, SX240, and SX340.

- Camera

  If you are using an IR backlight, we recommend you also use an IR lens filter. For Basler cameras sold by Omron Adept Technologies, Inc., the filter is PN: 09324-000.

- Conveyor or other target

3.3 Power Required

- Robot - according to robot user's guide

  This is typically both VAC and 24 VDC.

- AnyFeeder - from user-supplied power supply

  24 VDC, 10 A

- Camera - PoE or separate, user-supplied power
- SmartController (option) - from user-supplied power supply

  24 VDC, 5 A - this can share a 6 A power supply with the robot

- SmartVision MX - from user-supplied power supply

  24 VDC, 6 A

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3.4 Data and Air Required

- SmartVision MX to SmartController EX if present, otherwise to eAIB or eMB-40/60R
- AnyFeeder to SmartVision MX (RS-232)
- Camera to SmartVision MX
- T20 Pendant (option) to SmartController EX if present, or else eAIB or eMB-40/60R
- Front Panel to SmartController EX if present, or else eAIB or eMB-40/60R
- Pneumatic, to the SX240 and SX340 model AnyFeeders.

3.5 Camera AnyFeeder Setup

The camera's field-of-view needs to cover the entire pick window of the AnyFeeder's feed surface.

The AnyFeeder must be mounted such that the robot can reach any part on the pick window without touching the sides of the AnyFeeder, and without any joints exceeding their limits.

AnyFeeder SXM100							
Chipsize inches	**FOV mm**	**Resolution mm/Pixel**	**Distance FOV Lens mm**	**Lens mm**	**Lens P/N**	**IR Filter P/N**	**Dot Matrix**
1/1.8	110x148	0.092	550	25	09323-000	09324-000	4 mm
1/1.8	110x148	0.092	760	35	09323-100	09324-000	4 mm
1/1.8	110x148	0.092	1090	50	Custom	Custom	4 mm
1	140x140	0.068	655	50	Custom	Custom	2 mm

AnyFeeder SXM140							
Chipsize inches	**FOV mm**	**Resolution mm/Pixel**	**Distance FOV Lens mm**	**Lens mm**	**Lens P/N**	**IR Filter P/N**	**Dot Matrix**
1/1.8	150x202	0.125	730	25	09323-000	09324-000	4 mm
1/1.8	150x202	0.125	1025	35	09323-100	09324-000	4 mm
1/1.8	150x202	0.125	1460	50	Custom	Custom	4 mm
1	200x200	0.098	650	35	Custom	Custom	4 mm
1	200x200	0.098	935	50	Custom	Custom	4 mm

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AnyFeeder SX240							
Chipsize inches	**FOV mm**	**Resolution mm/Pixel**	**Distance FOV Lens mm**	**Lens mm**	**Lens P/N**	**IR Filter P/N**	**Dot Matrix**
1/1.8	250x337	0.201	770	16	09322-000	09324-000	8 mm
1/1.8	250x337	0.201	1200	25	09323-000	09324-000	8 mm
1/1.8	250x337	0.201	1680	35	09323-100	09324-000	8 mm
1	330x330	0.161	485	16	Custom	Custom	4 mm
1	330x330	0.161	760	25	Custom	Custom	4 mm
1	330x330	0.161	1055	35	Custom	Custom	4 mm
1	330x330	0.161	1510	50	Custom	Custom	4 mm

AnyFeeder SX340							
Chipsize inches	**FOV mm**	**Resolution mm/Pixel**	**Distance FOV Lens mm**	**Lens mm**	**Lens P/N**	**IR Filter P/N**	**Dot Matrix**
1/1.8	350x472	0.292	1070	16	09322-000	09324-000	10 mm
1/1.8	350x472	0.292	1670	25	09323-000	09324-000	10 mm
1/1.8	350x472	0.292	2340	35	09323-100	09324-000	10 mm
1	470x470	0.230	760	25	Custom	Custom	8 mm
1	470x470	0.230	1060	35	Custom	Custom	8 mm
1	470x470	0.230	1510	50	Custom	Custom	8 mm

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3.6 AnyFeederInterface Panel LEDs

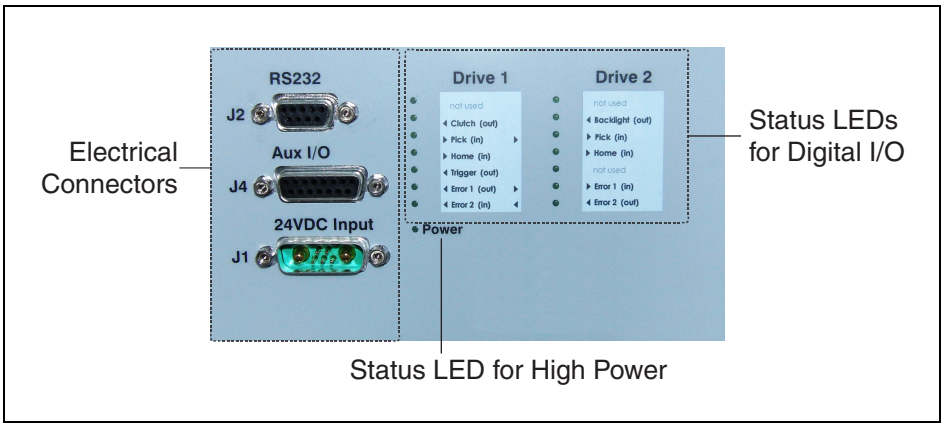

Figure 3-2. Interface Panel on AnyFeeder

4.1 System Cables, without SmartController

The letters in the following figure correspond to the letters in the table of cables and parts. The numbers correspond to the steps in the cable installation overview table. The tables are on the pages following the figure.

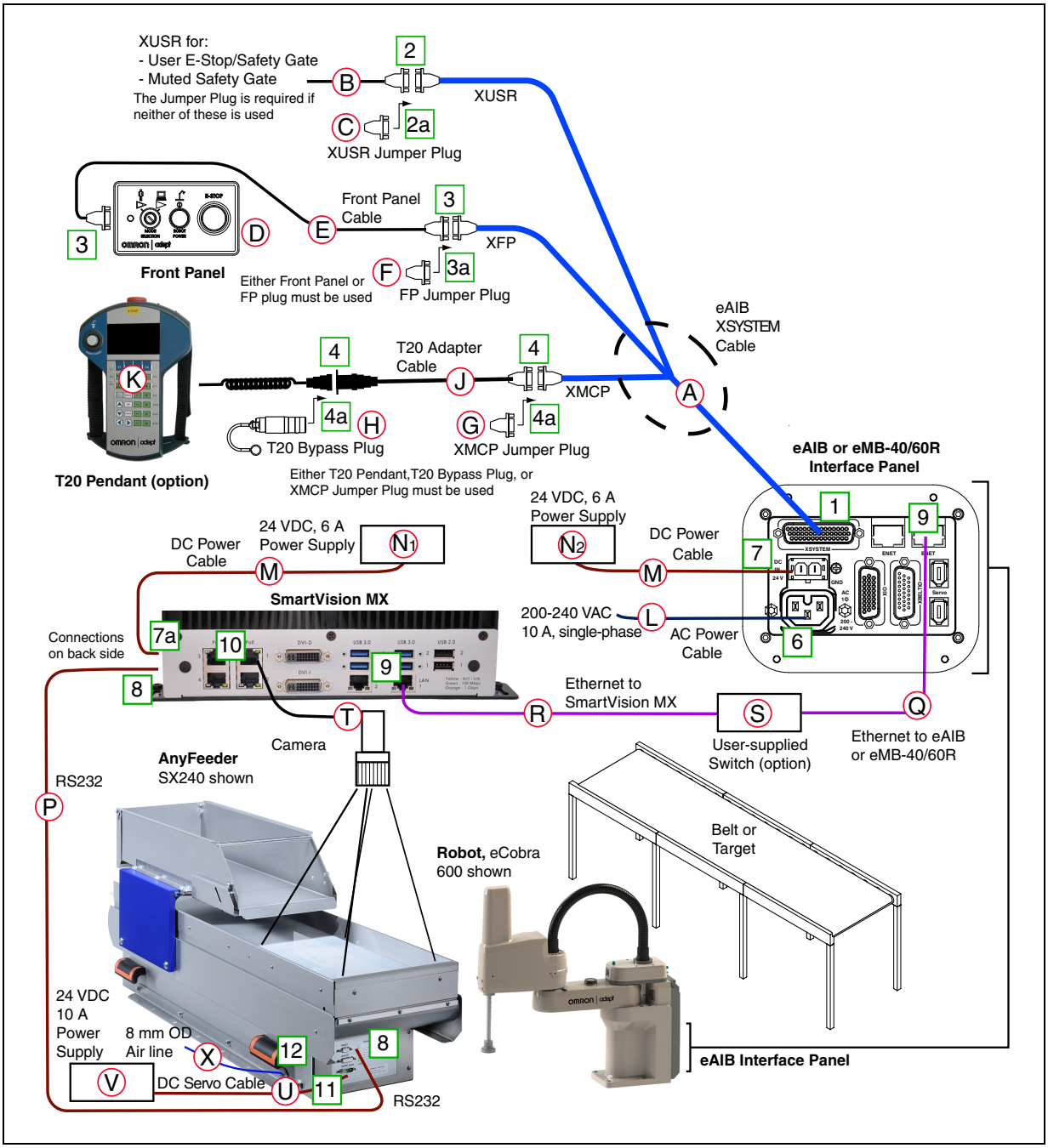

Figure 4-1. System Cable Diagram for AnyFeeder, eCobra with Pendant Shown

The pendant is an option, and may not be present in your system. This figure includes the optional T20 pendant.

List of Cables and Parts

Open the Accessory box and locate the eAIB XSYSTEM cable. Connect the cables and peripherals as shown in the preceding figure. Parts and steps are covered in the following two tables.

Part	Cable and Parts List	Part #	Part of:	Notes
A	eAIB XSYSTEM Cable Assembly	13323-000		standard, eAIB
B	User E-Stop, Safety Gate	n/a	n/a	user-supplied
C	XUSR Jumper Plug	04736-000	13323-000	standard, eAIB
D	Front Panel	90356-10358		standard
E	Front Panel Cable	10356-10500	90356-10358	standard
F	Front Panel Jumper Plug	10053-000	13323-000	standard, eAIB
G	XMCP Jumper Plug	04737-000	13323-000	standard, eAIB
H	T20 Bypass Plug	10048-000	10055-000	standard, T20
J	T20 Adapter Cable	10051-003	10055-000	standard, T20
K	T20 Pendant (option)	10055-000		option
L	AC Power Cable	04118-000	90565-010	or user-supplied
M	24 VDC Power Cable	04120-000	90565-010	or user-supplied
N1	24 VDC, 6 A Power Supply	04536-000[a]		or user-supplied
N2	24 VDC, 6 A Power Supply	04536-000	90565-010	or user-supplied
P	RS232 Cable	n/a	AnyFeeder	
Q	Ethernet Cable -> eAIB or eMB-40/60R	n/a	n/a	user-supplied
R	Ethernet Cable -> SmartVision MX	n/a	n/a	user-supplied
S	Ethernet switch (optional)	n/a	n/a	user-supplied
T	Camera and cable	n/a	n/a	user-supplied
U	AnyFeeder Servo Cable	n/a	AnyFeeder	
V	24 VDC, 10 A Power Supply	n/a	n/a	user-supplied
X	8 mm OD Air Line	n/a	n/a	user-supplied

a: Only one 04536-000 power supply comes with the 90565-010 kit.

The XUSR, XMCP, and XFP jumpers intentionally bypass safety connections so you can test the system functionality during setup.

WARNING: Under no circumstances should you run a robot system, in production mode, with all three jumpers installed. This would leave the system with no E-Stops.

Cable Installation Overview

Power requirements for the SmartVision MX industrial PC are covered in that user guide. For 24 VDC, both the robot and a SmartVision MX can usually be powered by the same power supply.

Step	Connection	Part
1	Connect eAIB XSYSTEM cable to XSYSTEM on eAIB or eMB-40/60R.	A
2	Connect a user E-Stop or Muted Safety Gate to the eAIB XSYSTEM cable XUSR connector or	B
2a	verify XUSR jumper plug is installed in eAIB XSYSTEM cable XUSR connector.	C
3	Connect Front Panel cable to Front Panel and eAIB XSYSTEM cable XFP connector or	D, E
3a	if no Front Panel, install FP jumper on eAIB XSYSTEM cable XFP connector. See NOTE after table.	F
4	Connect T20 adapter cable to eAIB XSYSTEM cable XMCP connector or	J, K
4a	if no T20, install XMCP jumper or T20 Adapter Cable with T20 bypass plug.	G or H
5	Connect user-supplied ground to robot. See robot user's guide for location.	n/a
6	Connect 200-240 VAC to AC Input on eAIB Interface Panel; secure with clamp.	L
7	Connect 24 VDC to DC Input on Interface Panel.	N2, M
7a	Connect 24 VDC and shield ground to SmartVision MX. See SmartVision MX user's guide for location.	N1, M
8	Connect RS232 cable from SmartVision MX to Anyfeeder.	P
9	Connect Ethernet cable between eAIB or eMB-40/60R and SmartVision MX. A switch can be used between the two.	S
10	Connect camera and cable to SmartVision MX. Use USB PoE 1 on MX.	T
11	Connect 24 VDC Servo cable to DC Input on AnyFeeder interface panel.	U, V
12	Connect an 8 mm OD air line to the pneumatic connector, SX240, SX340.	X

NOTE: A front panel ships with each fixed (non-mobile) robot system, but you can choose not to use it if you replace its functionality with equivalent circuits. That is beyond the scope of this guide.

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Optional Cables

NOTE: The following cables are not covered in the steps in the preceding table.

Part Description	Notes
XIO Breakout Cable, 12 inputs/ 8 outputs, 5 M	Available as option
eAIB XBELT IO Adapter Cable	Available as option

The optional eAIB XBELT IO Adapter cable splits the eAIB XBELTIO port into a belt encoder lead, an Intelligent Force Sensor or IO Blox lead, and an RS-232 lead.

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4.2 System Cables, with SmartController

When the optional SmartController EX is included in the system, the Pendant, Front Panel, and XUSR connections must connect to the SmartController EX.

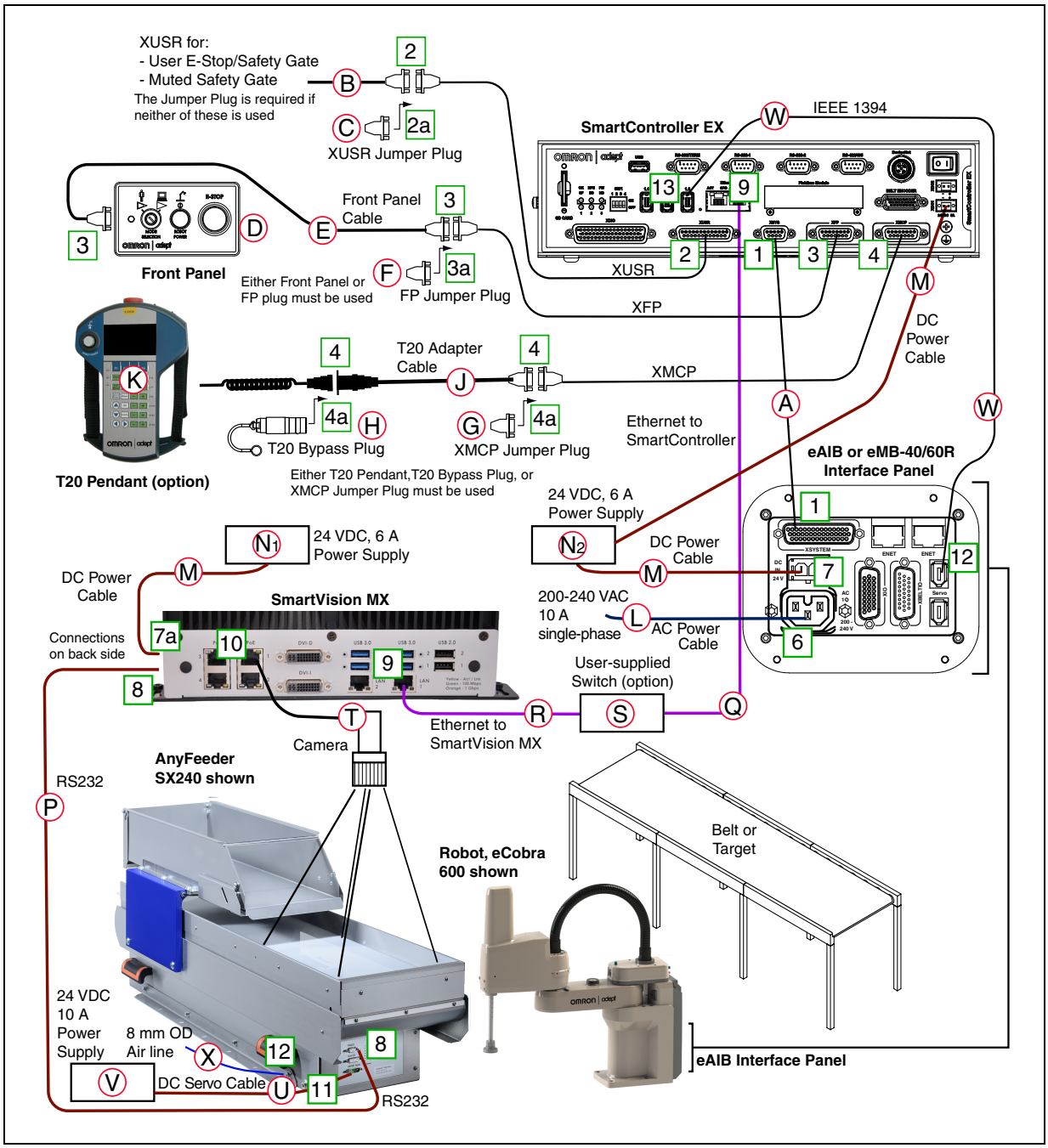

Figure 4-2. System Cable Diagram with SmartController

Installing a SmartController Motion Controller

Refer to the *SmartController EX User's Guide* for complete information on installing the optional SmartController. This list summarizes the main steps.

1. Mount the SmartController and Front Panel.
2. Connect the Front Panel to the SmartController.
3. Connect the pendant (if purchased) to the SmartController.

   Connect a jumper plug, if no pendant is being used.
4. Connect user-supplied 24 VDC power to the controller.

   Refer to the *SmartController EX User's Guide*.
5. Install a user-supplied ground wire between the SmartController and ground.

List of Cables and Parts

Part	Cable and Parts List	Part #	Part of:	Notes
A	eAIB XSYS Cable	13323-000		standard, eAIB
B	User E-Stop, Safety Gate	n/a	n/a	user-supplied
C	XUSR Jumper Plug	04736-000	13323-000	SmartController EX
D	Front Panel	90356-10358		standard
E	Front Panel Cable	10356-10500	90356-10358	standard
F	Front Panel Jumper Plug	10053-000	13323-000	SmartController EX
G	XMCP Jumper Plug	04737-000	13323-000	SmartController EX
H	T20 Bypass Plug	10048-000	10055-000	standard, T20
J	T20 Adapter Cable	10051-003	10055-000	standard, T20
K	T20 Pendant (option)	10055-000		option
L	AC Power Cable	04118-000	90565-010	user-supplied/option
M	24 VDC Power Cable	04120-000	90565-010	user-supplied/option
N1	24 VDC, 6 A Power Supply	04536-000[a]		or user-supplied
N2	24 VDC, 6 A Power Supply	04536-000	90565-010	04536-000
P	RS232 Cable to AnyFeeder	n/a	AnyFeeder	AnyFeeder
Q	Ethernet Cable, to SmartController	n/a	n/a	user-supplied
R	Ethernet Cable, to SmartVision MX	n/a	n/a	user-supplied
S	Ethernet Switch (optional)	n/a	n/a	user-supplied
T	Camera and cable	n/a	n/a	user-supplied

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Part	Cable and Parts List	Part #	Part of:	Notes
U	DC Servo Cable to AnyFeeder	n/a	AnyFeeder	AnyFeeder
V	24 VDC, 10 A power supply	n/a	n/a	user-supplied
W	IEEE 1394 cable	n/a	n/a	standard
X	8 mm OD Air Line	n/a	n/a	user-supplied

a: Only one 04536-000 power supply comes with the 90565-010 kit.

The XUSR, XMCP, and XFP jumpers intentionally bypass safety connections so you can test the system functionality during setup.

WARNING: Under no circumstances should you run a robot system, in production mode, with all three jumpers installed. This would leave the system with no E-Stops.

Cable Installation Overview

Step	Connection	Part
1	Connect eAIB XSYS cable to XSYSTEM on eAIB or eMB-40/60R	A
2	Connect a user E-Stop or Muted Safety Gate to the XUSR connector or	B
2a	verify XUSR jumper plug is installed in XUSR connector.	C
3	Connect Front Panel cable to Front Panel and XFP connector or	D, E
3a	if no Front Panel, install FP jumper on XFP connector.	F
4	Connect Pendant adapter cable to XMCP connector or	J, K
4a	if no Pendant, install XMCP jumper or bypass plug.	G or H
5	Connect user-supplied ground to robot. See robot user's guide for location.	n/a
5a	Connect user-supplied ground to SmartController EX. See SmartController EX user's guide for location.	n/a
5b	Connect user-supplied ground to SmartVision MX. See SmartVision MX user's guide for location.	n/a
6	Connect 200-240 VAC to AC Input on eAIB; secure with clamp.	L
7	Connect 24 VDC to DC Input on eAIB and SmartController EX.	N2,M
7a	Connect 24 VDC to SmartVision MX.	N1,M
8	Connect RS232 cable from SmartVision MX to Anyfeeder.	P
9	Connect Ethernet cable between SmartController EX and SmartVision MX. A switch can be used between the two.	Q, R

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Step	Connection	Part
10	Connect camera and cable to SmartVision MX. Use USB PoE 1 on MX.	T
11	Connect 24 VDC Servo cable to DC Input on AnyFeeder interface panel.	U, V
12	Connect an 8 mm OD air line to the pneumatic connector SX240, SX340.	X
13	Connnect IEEE 1394 cable between SmartController EX and eAIB SmartServo.	W

Optional Cables

NOTE: The following cables are not covered in the steps in the preceding table.

Part Description	Notes
XIO Breakout Cable, 12 inputs/ 8 outputs, 5 M	Available as option
Y Cable, for XSYS cable connections to dual robots	Available as option with SmartController EX
eAIB XBELT IO Adapter Cable	Available as option

The XIO Breakout cable is for using the I/O on the eAIB.

The Y cable attaches at the SmartController EX XSYS connector, and splits it into two XSYS connectors. This is part number 00411-000. See the *Dual Robot Configuration Guide*.

The optional eAIB XBELT IO Adapter cable splits the eAIB XBELTIO port into a belt encoder lead, an Intelligent Force Sensor or IO Blox lead, and an RS-232 lead. If the system has a SmartController EX, this is only needed for Intelligent Force Sensing.

4.3 AnyFeeder Connections

Electrical Connectors on Interface Panel

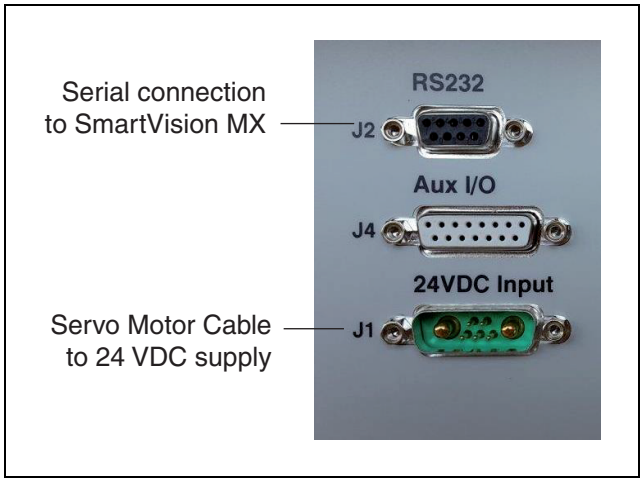

Figure 4-3. Electrical Connectors on AnyFeeder Interface Panel

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NOTE: The Aux I/O connector is not used in an Omron Adept system.

Table 4-1. Electrical Connector Pinout

Description	Function	Type	Pin #	Pinout	Cable
J1	High Power on servo motor	D-sub-M 2 + 5	A1	24 VDC	No. 1 (red)
			A2	GROUND	No. 2 (blue)
J2	RS232	D-sub 9, female	2	RX	D-sub 9, female
			3	TX	
			5	GROUND	
J4	Aux I/O	D-sub 15	1	Trigger out	Not used
			4	GROUND	
			5	GROUND	
			6	24 VDC out	
			7	24 VDC out	
			8	Pick in	
			9	Flash in	
			14	Error Drive 1	
			15	Error Drive 2	

Installing Cables and Power

The AnyFeeder requires the following cable connections:

- the servo motor cable (supplied)
- the RS-232 serial communications cable (supplied)

The AnyFeeder is equipped with fuses to protect the internal components.
The motor power 24 VDC input is protected with a 10 Amp fuse, and the parallel I/O 24 VDC lines are protected with a 3 Amp fuse. These fuses can be replaced in the field.
If you suspect a problem with one or both of these fuses, contact your local Omron Support.

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RS-232 Cable Installation

An RS-232 cable is supplied with the AnyFeeder (see following figure).

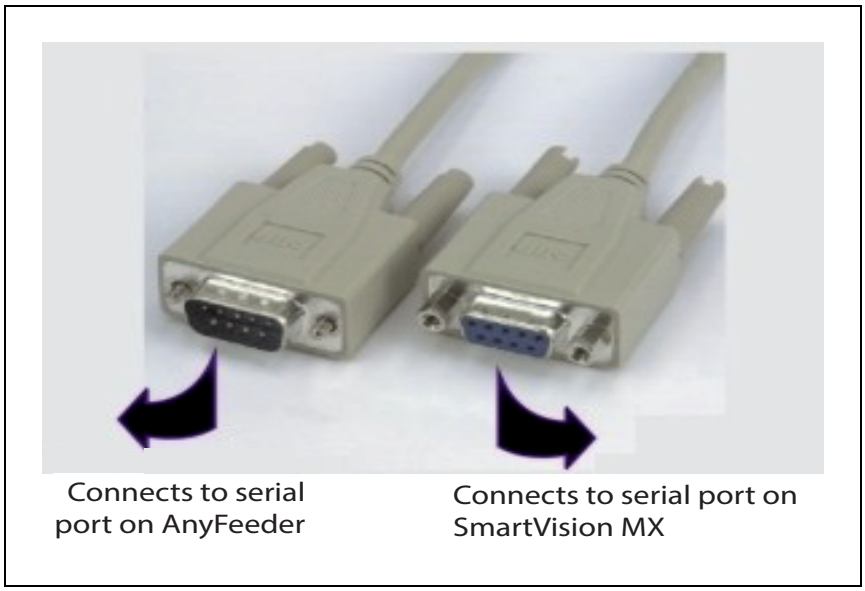

Figure 4-4. Serial Connections Cable

Connect the male end of the cable to the RS-232 (J2) port on the AnyFeeder (see following figure).

Figure 4-5. J2 - RS232 Port

Connect the female end of the cable to the serial port on the SmartVision MX.

Make sure that the cable on the AnyFeeder port is secured with the two screw locks.

Connecting the Servo Power Cable

The Servo Power Cable delivers 24 VDC power to the AnyFeeder.

1. Locate the servo motor cable with connector that was supplied with the AnyFeeder (see following figure).

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Figure 4-6. Servo Power Cable

2. Connect the wire end of the cable to the user-supplied 24 VDC / 10 A regulated power supply.
3. Attach the connector end of the cable to the Motor Power 24 VDC In (J1) connector on the front of the AnyFeeder (see following figure).

Figure 4-7. J1 - 24 VDC In Connector

NOTE: The five smaller pins in the center of this connector are not used by the AnyFeeder.

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Installing the Pneumatic Line

This section describes the pneumatic installation procedure for the AnyFeeder SX240 and SX340. The AnyFeeder SXM100 and SXM140 do not take a pneumatic line.

1. Locate the pneumatic connector below the side handle on the AnyFeeder.

Figure 4-8. Pneumatic Connector Location on AnyFeeder SX240

2. Prepare an 8 mm OD air line.
3. Attach the air line to the pneumatic connector (see following figure). Do not overtighten the connection.

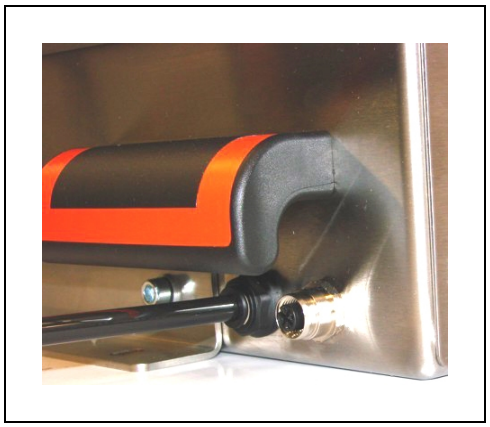

Figure 4-9. Air Line Attached to Pneumatic Connector

Chapter 5: Configuration with ACE Software

NOTE: Instructions for using serial communication with an AnyFeeder are covered in the User's Guide.

5.1 ACE Software

The following software is pre-loaded on the SmartVision MX hard drive:

- Windows® 7 Embedded
- ACE

  ACE 3.7.3.150 or later is required to support all of the AnyFeeders listed in this guide
- ACE Sight 3 (ACE-based vision software)
- Drivers for Basler ACE cameras

The SmartVision MX is designed to run ACE software. We do not support applications other than ACE.

The SmartVision MX does not come with:

- Keyboard
- Mouse
- Monitor

These are user-supplied, so you can run the ACE and ACE Sight applications, and well as control shutting down the SmartVision MX industrial PC.

The AnyFeeder can be controlled by V+ programs, usually generated by the setup wizards in ACE. This chapter provides an overview of that process.

We recommend that you use the graphical interface provided in the ACE software.
For details, see the *ACE User's Guide*, which is available within ACE under the Help tab.

5.2 ACE Sight Overview

The ACE Sight module uses the SmartVision MX to handle all vision operations. ACE Sight requires the ACE Sight USB license key [dongle], installed in the SmartVision MX, for full functionality.

Initial Configuration

A number of steps need to be taken to use ACE with an AnyFeeder.

- Create one Locator Model for each type of part that will be handled.
- Teach a "safe" location (where the robot goes on power-up)

- Teach a picture-taking position, which is where the robot will move so that it doesn't block the camera's view of the pick surface.
- Teach the camera field-of-view to the robot.
- Teach the robot where to place a part that it has picked.

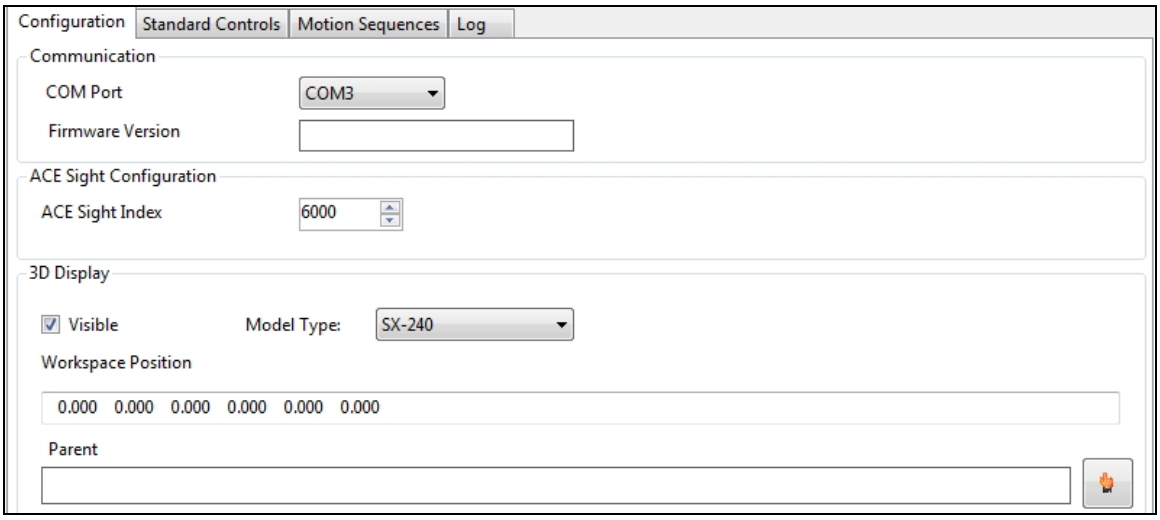

Figure 5-1. Screen AnyFeeder Object

5.3 Pick and Place Sequence Wizard

ACE Sight has a wizard named SmartController Pick and Place Sample, which can be used to step you through most of the steps needed to set up ACE Sight for use with an AnyFeeder. From the ACE Getting Started screen, select:

New Sample Application > ACE Sight/V+ Application > SmartController Pick and Place

> **NOTE:** When you first start ACE, you will have access to this wizard. Refer to the following figure.

We will not repeat all of the screens shown in this wizard. In general, you just need to follow the on-screen instructions.

You start by Selecting the Configuration. In our example configuration, with no upward-looking camera and no conveyor belt, the wizard has four phases. Other configurations will vary.

- Phase 1/4 - Select Robot

  Select SmartController

  Select Robot

  Configure End-effector (requires power-on)

  Teach Safe Position
- Phase 2/4 – Create Feeder - Feeder model, backlight, motion sequences
- Phase 3/4 – Teach Pick for Arm- or Fixed-Camera Configuration

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This includes camera setup, calibration, and Locator Model creation.

- Phase 4/4 - Teach Place for Static Position Configuration

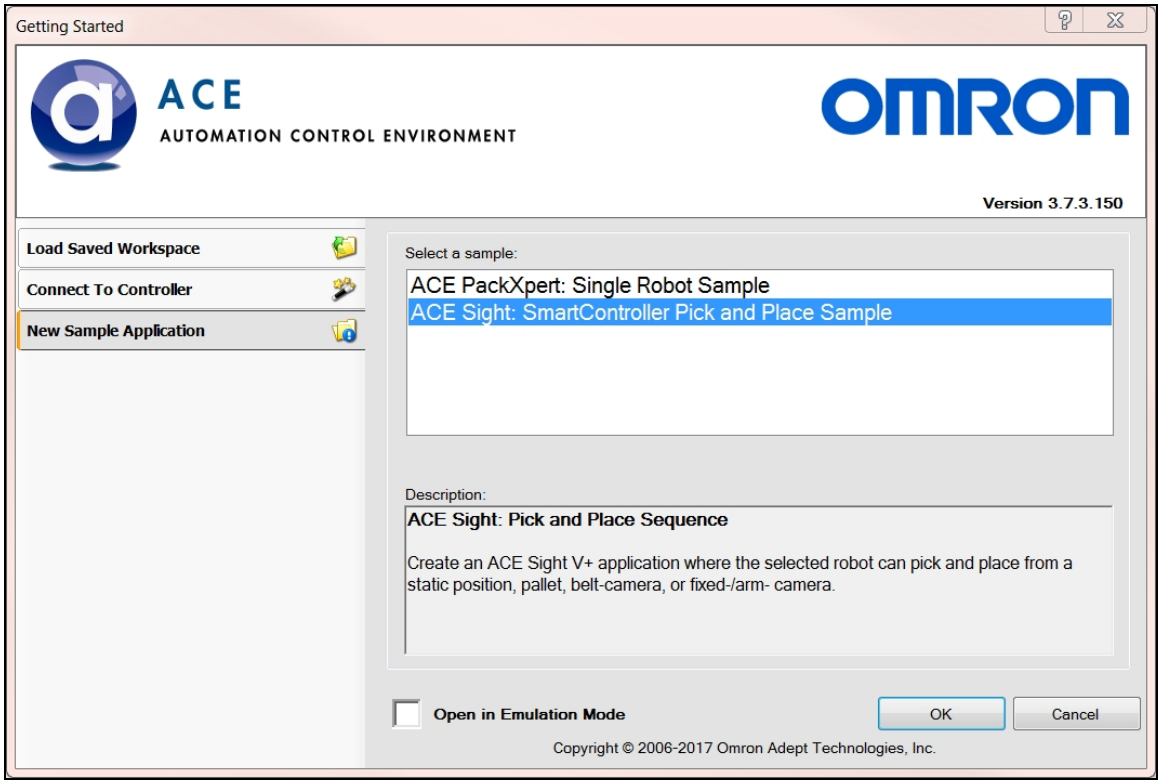

Figure 5-2. ACE Sight Pick and Place Sample

Safe and Picture-taking Positions

For teaching the Safe Position or Picture Position, you can either move the robot using a pendant, the jog pendant feature in ACE, or move the robot manually. Some of the joints may need to be released with the brake release button when moving them manually.

The Safe Position is where the robot moves when its current motion gets interrupted or stopped.

The location of these positions can affect the system's efficiency.

After selecting the Safe and Picture-taking Positions, verify that the robot can reach those positions, with all joints remaining within their limits, by clicking Move in the bottom left of the screen.

> **NOTE:** If possible, make the tool flange higher than the sides of the AnyFeeder in both of these positions, to reduce any chance of a collision.

Create Feeder

This step includes specifying the AnyFeeder model you are using, its position, checking the functionality of its backlight (if present), as well as a variety of motion sequences.

NOTE: ACE 3.7.3.150 or later is required for support of all four AnyFeeder models.

You can position the AnyFeeder within the ACE 3-D visualizaion, so that it matches how your AnyFeeder is actually installed.

You also have the opportunity to test the backlight, if your AnyFeeder has one.

Teach Pick for Arm- or Fixed-Mount Camera

This step includes creating a camera object, setting the camera properties, performing a grid calibration, teaching a Locator Model and picture position. It will then step you through locating an instance of the object, teaching the pick position, and performing an automatic calibration. It ends with a calibration summary and teaching a vision histogram tool.

- Make sure your part is well lit. It is better to have more light and a lower exposure.
- In the Virtual Camera, under Acquisition Settings, edit the current settings. Under Video Format, ensure that the exposure is set to a low value to reduce blur.
- Adjust the lens aperture and focus of your camera until you obtain a good image.
- When focusing the lens, using a sheet of printed text at the height of the part is often the best way to get the focus correct.
- You may also need to edit the Acquisition Settings to get the best image.

Using the Calibration Grid

A pdf of the dot grid, used for camera calibration, is located in your Omron folder under Program Files. Use the file DotPitch10_CalibrationTarget.pdf in the ACE folder.

- Calibration establishes the mm/pixel ratio of the field of view of the camera and compensates for lens distortion.
- Make sure your calibration grid is printed to scale. The actual pitch between the dots must match the nominal pitch in both directions. Specifically, in the printer settings, you must make sure the grid is printed at actual size and not to fit or shrunk. For the AnyFeeder SXM100 and SXM140 you will have to trim some of the paper off after printing for it to fit inside the feed surface. This will not affect calibration.
- When you place it under the camera, it should fill the entire field of view. It must also be flat over its entire surface.
- Ensure that the height of the dot-grid matches the height of the parts being picked in the field of view. The closer the lens is to the part and the tighter the tolerances, the more critical this becomes.
- Do not change the lens settings, either the focus or aperture, after calibration.
- Calibration can be performed in the virtual camera object or during the addition of a camera to a workspace.

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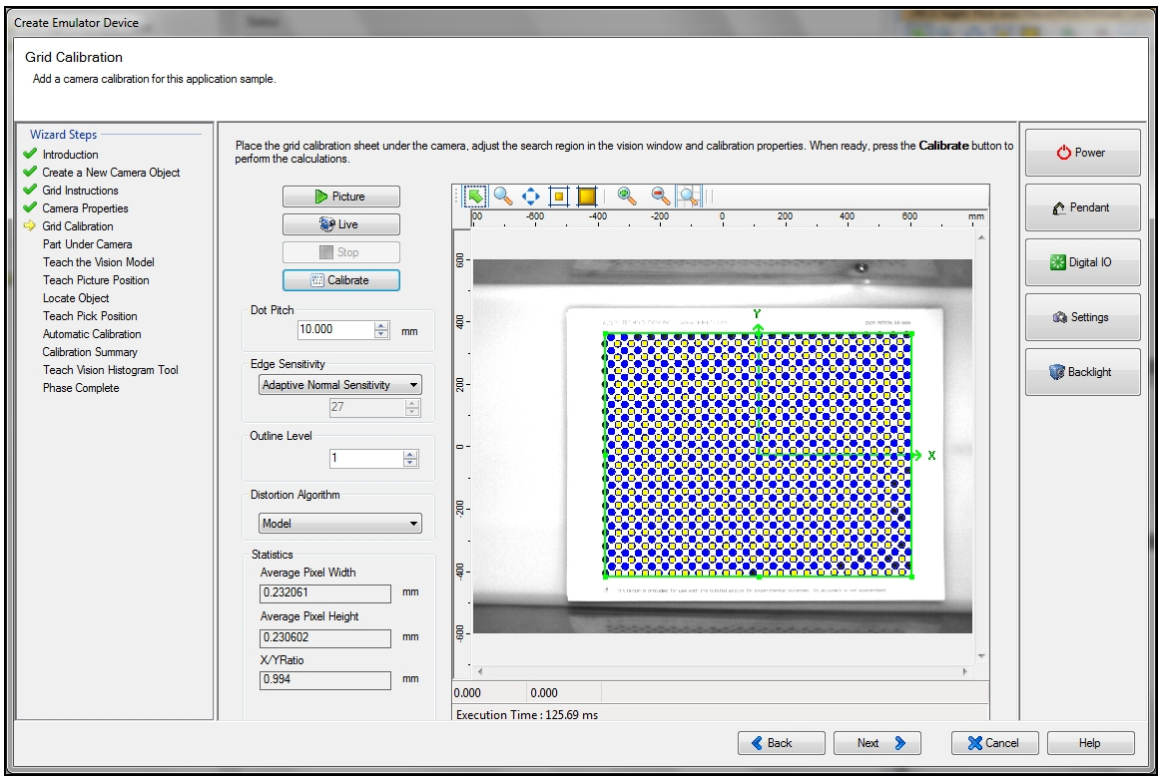

Figure 5-3. Grid Calibration Screen Shot

Locator Model

In creating your Locator Model(s), ensure that you leave room for the part and tool flange/-gripper to clear the walls of the AnyFeeder. The gripper shape, placement of the pick point on the part, and the region of interest can all affect this.

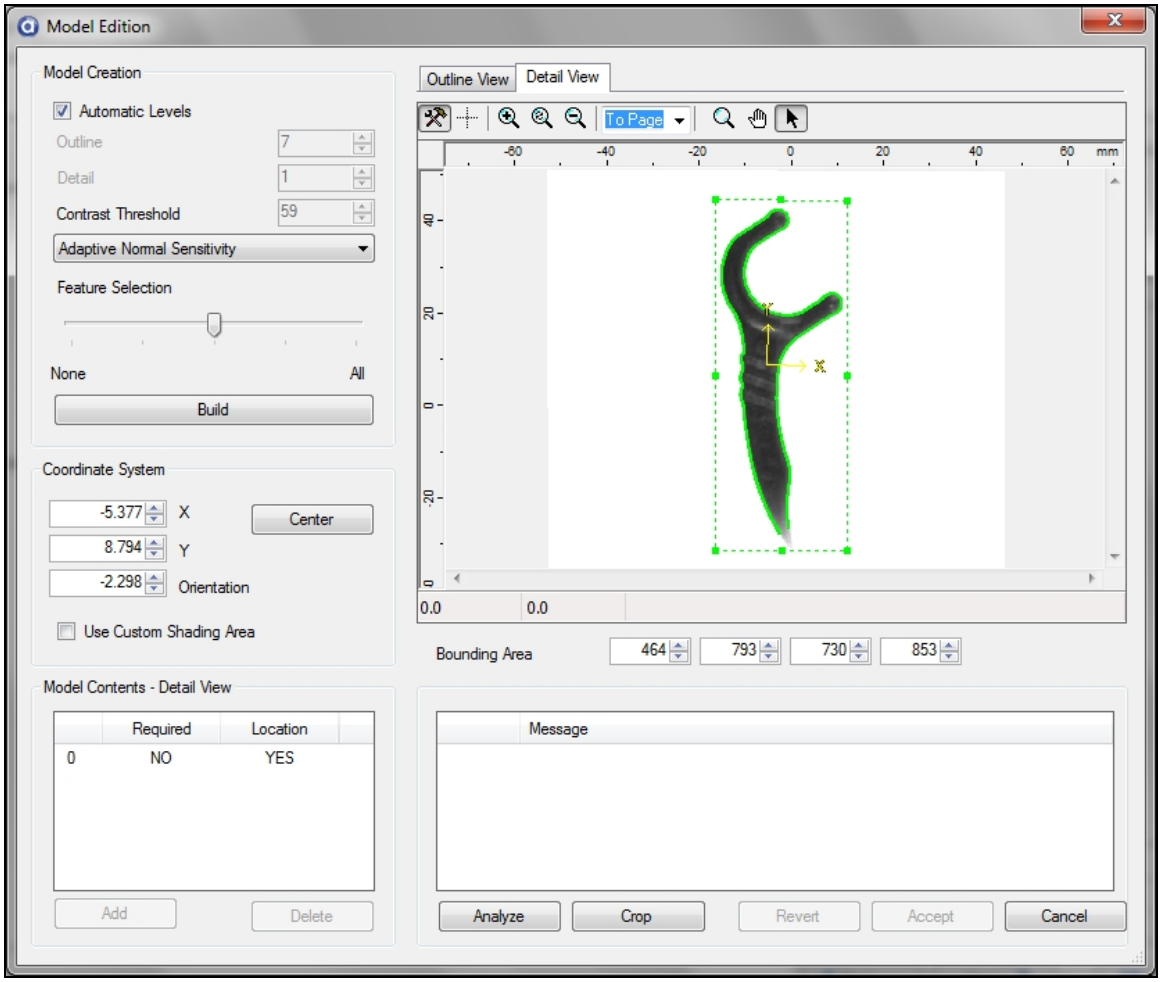

Figure 5-4. Sample Locator Model Screen Shot

Create Region of Interest

The Locator Model creation is followed by creating a region of interest, where the software will look for instances of the Model.

The green box shown in the following picture can be adjusted. This step is critical, since the robot should be able to pick any part inside this region.

Test the robot to verify that it can reach each edge of the green box region (Region of Interest) without touching the bulk container, feeder platform side panels, or feeder platform front panel.

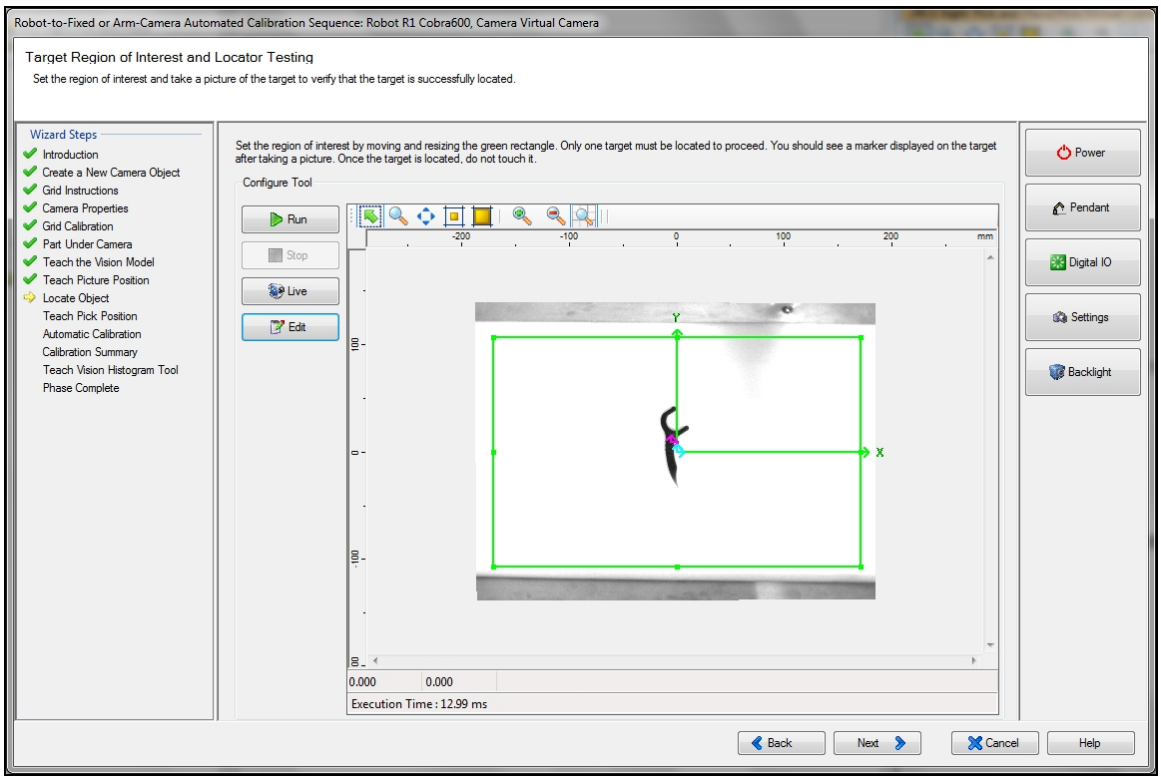

Figure 5-5. Region of Interest

Teach Picture-taking Position

Choose a position such that the robot does not interfere with the camera's view.

If, in Select Configuration, you selected using an upward-facing camera to refine the position of a picked part, the wizard would step you through that at this time. Typically, you don't need to set up another camera to refine the position, but for applications requiring more precision in placement, you can add another camera to refine the position of the part in the gripper.

Automatic Calibration

The next step is to run the automatic calibration. The purpose of this is to make sure the robot can pick any parts that are within the vision window based on the camera picture received. During this process, the robot works with the vision system to first see where the part is (while the robot is waiting at picture-taking position) and then the SmartVision MX calculates the location and directs the robot to pick up the part. If the camera calibration is performed correctly,

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typically the position error will be less than 1 mm. The valid scale factor range is from 0.92 to 1.08 mm.

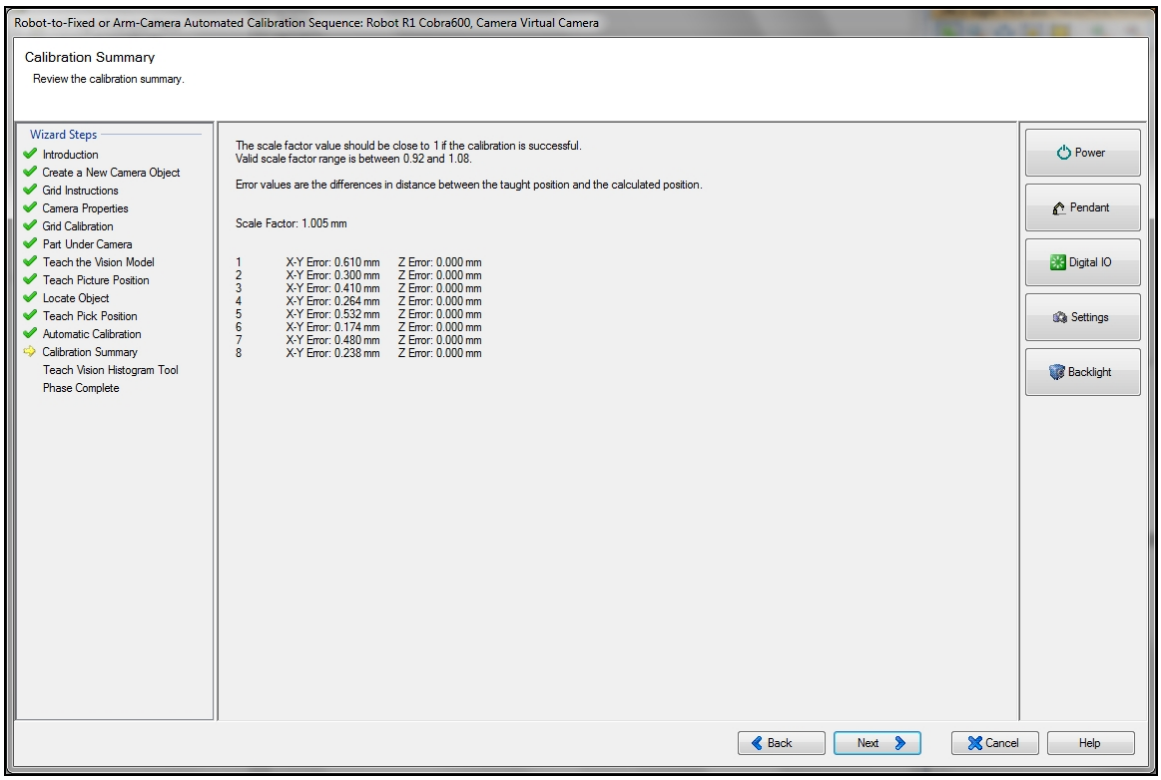

Figure 5-6. Summary of Automatic Calibration

Teach Vision Histogram Tool

The next step is to set up the histogram tool for the application. You can divide the vision window into three boxes corresponding to three zones: Dispense Zone, Flip Zone, and Front Zone. These areas can be adjusted by dragging the edge of the boxes. Refer to figure Front, Flip, and Dispense Zones on page 43

- The Dispense zone is used to find out if there are too many parts, and if a feed forward is needed.
- The Flip zone is the area where the robot is supposed to pick up the parts.

  This is typically set up to cover the center of the pick window, as well as half of the dispense zone and half of the front zone.
- The Front zone is the front area of the pick window.

Teach Place Position

After the Histogram tool is taught, you will be stepped through teaching the Place location. After this, the Pick and Place Wizard is completed.

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6.1 Configuration Refinement

At this point, the system will be able to recognize the Locator Model taught during the wizard and perform automated pick and place. Most applications can be improved by adjusting parameters that aren't covered in the sample application wizard. This could include advanced properties of the vision tools, differentiating between multiple part types, sorting to multiple place locations, avoiding picking overlapping parts, or detecting part defects.

6.2 Multiple Locator Models

In our dental floss application, we will add another Locator Model, since the dental floss parts dispensed inside the AnyFeeder could be lying with either side up.

To add another Locator Model, in the workspace Explorer window on the left, simply right-click on the Pick folder > New > Vision > Tool > Locator Model, then go through the same process in creating another Model.

To add another Locator Model, in the Workspace Explorer window on the left, right-click on Pick within the ACE Sight Pick and Place folder, then select:

New > Vision > Tool > Locator Model.

Repeat the process performed in the wizard for creating a Model.

Double-click to open the Locator, and drag in the new Locator Model: Floss_Side2 created. Click Run so the camera can find both Models.

In this case, we created another Locator Model: Floss_Side2, which corresponds to the flipped profile of a dental floss. Now you will see two Locator Models beneath the window of Models:

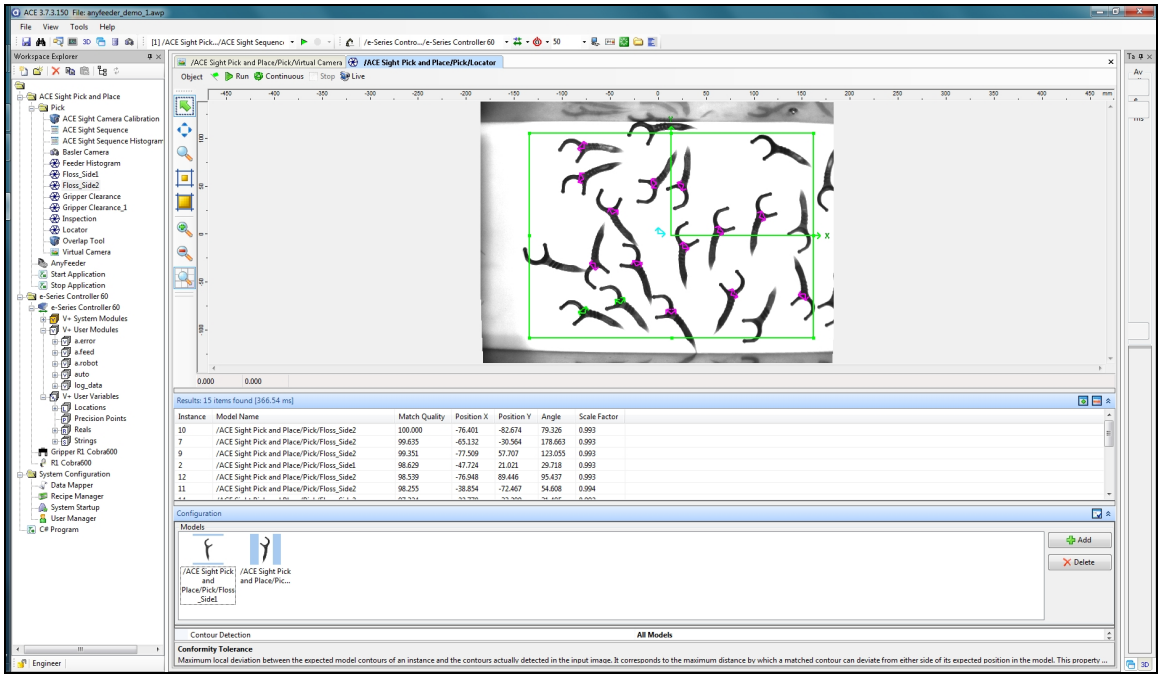

Figure 6-1. Dual Locator Models

In the Workspace Explorer – e-Series Controller 60 – V+ User Modules – a.feed folder, you can pull up the V+ program related to AnyFeeder motion sequence.

The fd.main() under the a.feed folder is the program that tied the ACE Sight histogram Tool to the AnyFeeder motion sequence. The default setting is as below that when the instance count is 0, the AnyFeeder motion sequence will be triggered based on four cases related to front.dent (Front zone density), flip.den (Flip zone density) and dispense.den (Dispense zone density).

The fd.main() program is shown below:

```
PROGRAM fd.main()
;
; ABSTRACT:     Background task controlling the Feeder
;
; INPUTS:       None
;
; OUTPUTS:      None
;
    GLOBAL REAL pick.seq
    GLOBAL $sv.client_ip
    AUTO REAL front.den, flip.den, dispense.den, inst.count

    REACTE fd.reacte

    WHILE rob.run DO
            ; Execute the sequence to locate parts for picking
        VRUN $sv.client_ip, pick.seq
        VWAITI (pick.seq) $sv.client_ip, 0
        inst.count = VRESULT($sv.client_ip, pick.seq, 3, 1, 1310, 1, 1)
            ; If instances are found, let the robot know it can pick
            ; the parts and wait for it to complete
        IF (inst.count > 0) THEN
            fd.ready = TRUE
            WHILE fd.ready
                WAIT
            END
            inst.count = inst.count-1
        END
        IF (inst.count == 0) THEN
            ; Calculate product densities in the 3 zones
            CALL fd.density(front.den, flip.den, dispense.den)
            CASE TRUE OF
                VALUE front.den > fd.front.thres:
                  ; Move the product backward from the front zone
```

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```
                    CALL fd.execute(fd.ms.frontmove)
                  VALUE flip.den > fd.flip.thres:
                    ; Flip the product in the pick zone
                    CALL fd.execute(fd.ms.pickflip)
                  VALUE dispense.den < fd.disp.thres:
                    ; Dispense more product into the feeder
                    CALL fd.execute(fd.ms.dispense)
                  VALUE flip.den < fd.flip.thres:
                    ; Move the product from dispense zone to the pick zone
                    CALL fd.execute(fd.ms.pickmove)
              END
          END
      END
      RETURN
.END
```

When moving the cursor to the fd.ms.frontmove, a yellow window pops up: the description of this variable is tied to motion sequence 1000 as shown below:

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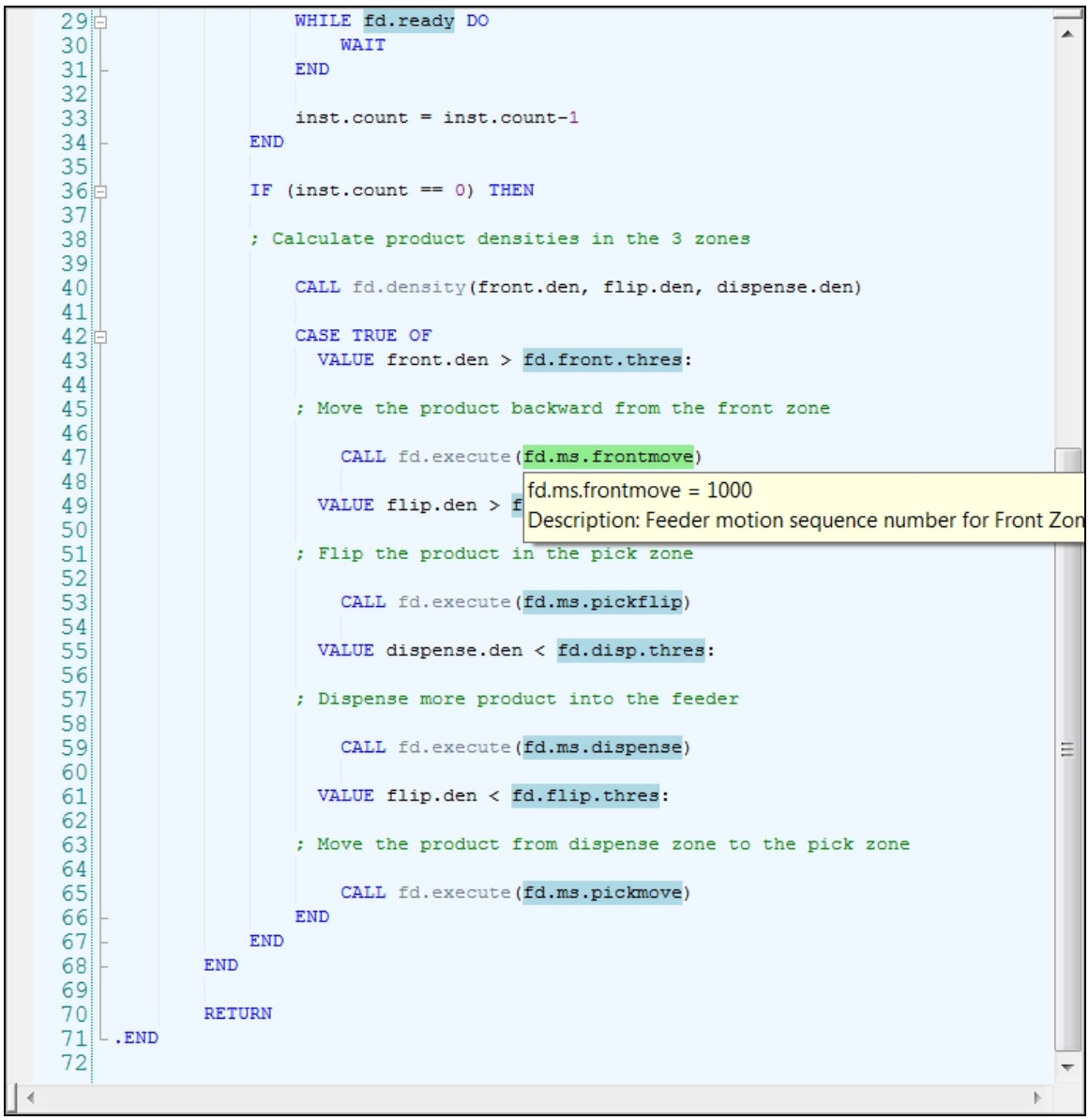

Figure 6-2. Pop-up Window for Variable

The motion sequence 1000 – 1003 is configured corresponding to the AnyFeeder movement. In the default setting, the fd.ms.frontmove is tied to motion sequence 1000 and by double-clicking the AnyFeeder module under Workspace Explorer – ACE Sight Pick and Place – Pick - Anyfeeder and click the motion sequence button, as shown in the following graphic, the output 1000 is tied to Feed backward [5, 5] + Wait [200]. You can modify this based on your application by changing [Iterations, speed] (which correspond to [5, 5]), wait time (which corresponds to [200]) or adding other Standard Controls provided by the AnyFeeder.

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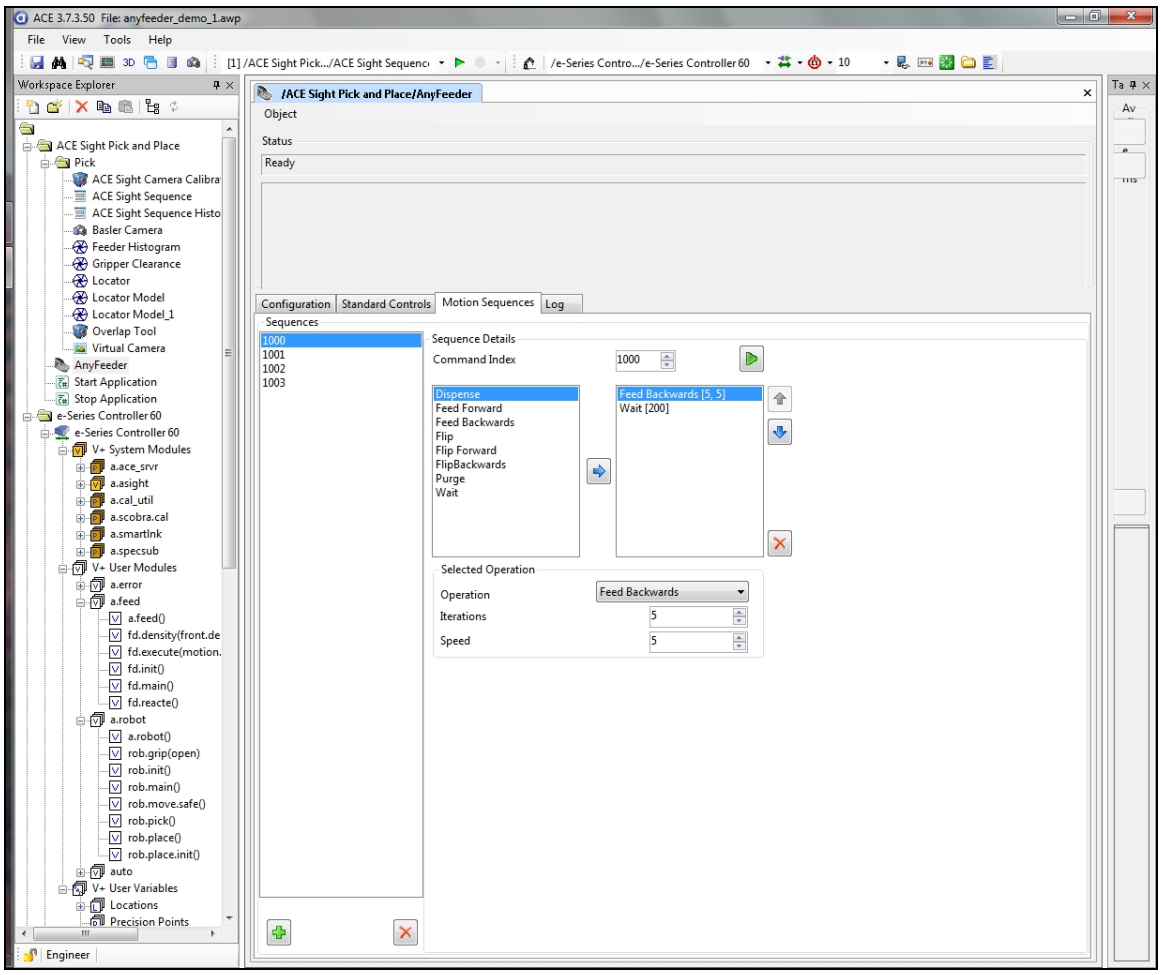

Figure 6-3. AnyFeeder Motion Sequence Parameters

You can get access to all of the Standard Controls that are provided by the AnyFeeder Object window by clicking the Standard Controls button and by adjusting the values for Iterations and Speed. You can test how these motion sequences work with your parts inside the AnyFeeder.

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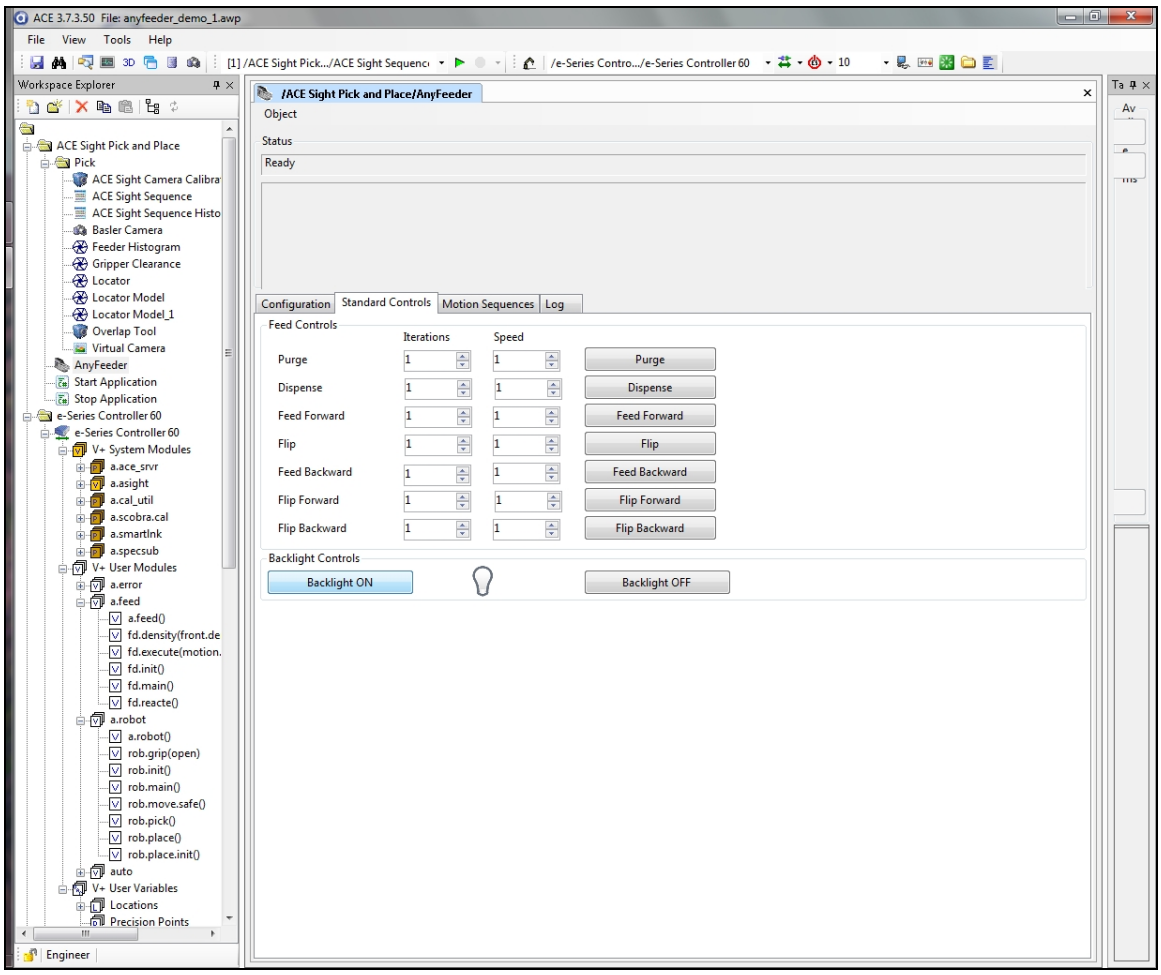

Figure 6-4. Standard Controls

As an example, we will use the dental floss motion sequence 1002. Initially, the motion sequence 1002 is tied to Dispense [5, 5] and Wait [200], but if the AnyFeeder vision window shows most of the parts overlapping each other, or most of the parts presented only in the dispense zone, you can try adding flip forward or flip. You will need to experiment with different iterations and speeds to see how the parts disperse inside the vision window.

Since the type of part and how the parts piled inside the upper bin will also affect how you define feedforward and dispense sequence, the settings for those motion sequence will largely depend on your application.

From the window below, the vision window is divided into three zones and you can find the density percentage in three zones shown in the Results window below the vision window.

The front.den corresponds to the Front Zone %, the flip.den corresponds to the Flip Zone % and the dispense.den corresponds to the Dispense Zone %.

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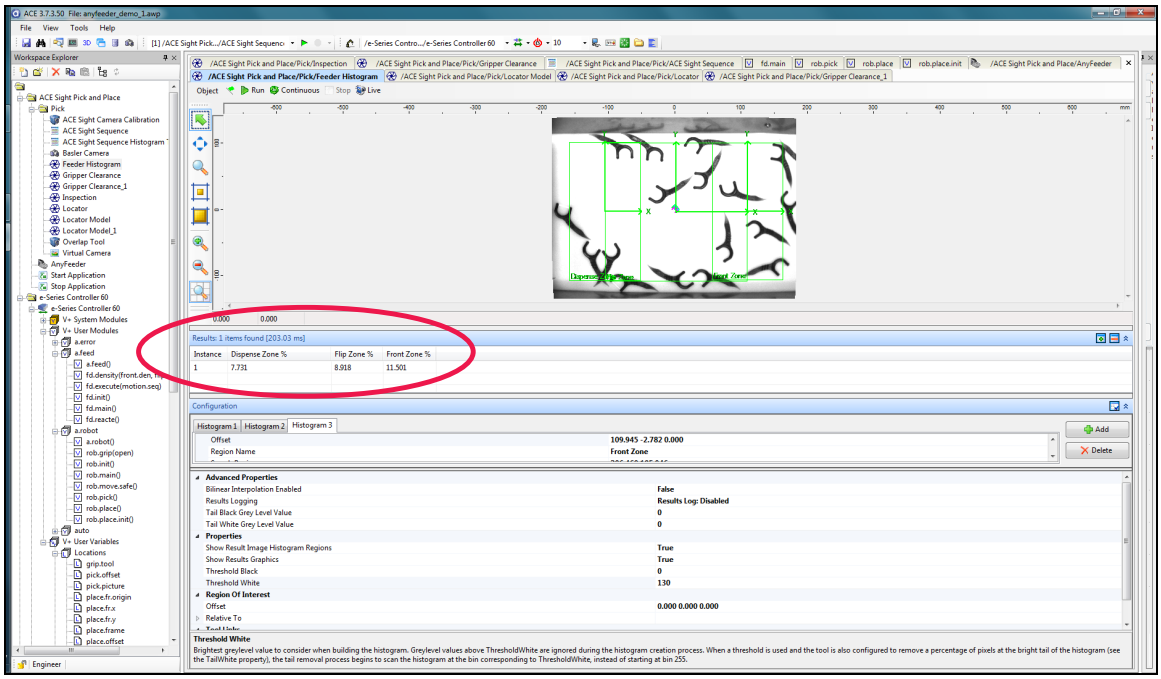

Figure 6-5. Front, Flip, and Dispense Zones

In Properties, we set ThresholdBlack and ThresholdWhite to 0 and 130, specifying the gray-scale range (0-255) the system will look for. These are explained at the bottom of the window.

Typically, you could zoom in on the image and check what gray scale range would cover 90% of the part.

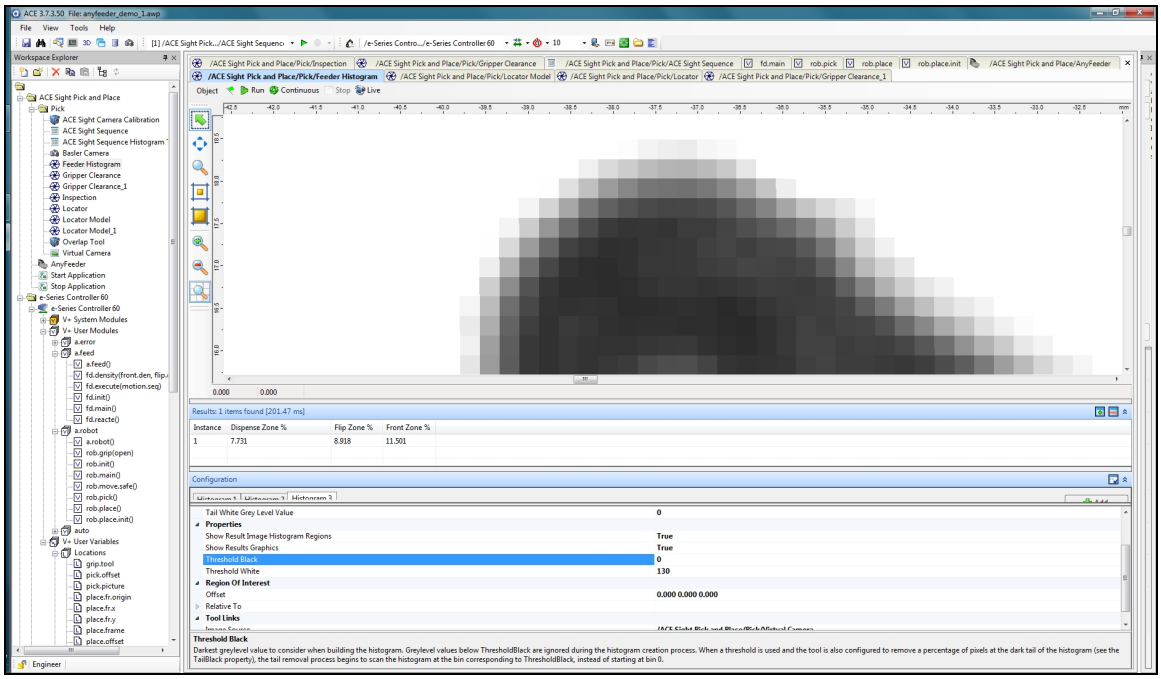

Figure 6-6. Setting ThresholdBlack

With a dark background, you will want to adjust the setting for ThresholdBlack and Threshold-White.

By triggering the motion sequence 1000 – 1003, you can test how the parts will dispense inside the three zones when different motion sequences are triggered.

From the fd.main() program, in the four cases related to triggering motion sequence 1000 – 1003, you can adjust the fd.front.thres, fd.flip.thres, and fd.disp.thres to achieve the most efficient settings.

```
CASE TRUE OF
    VALUE front.den > fd.front.thres:
        ; Move the product backward from the front zone
        CALL fd.execute(fd.ms.frontmove)
    VALUE flip.den > fd.flip.thres:
        ; Flip the product in the pick zone
        CALL fd.execute(fd.ms.pickflip)
    VALUE dispense.den < fd.disp.thres:
        ; Dispense more product into the feeder
        CALL fd.execute(fd.ms.dispense)
    VALUE flip.den < fd.flip.thres:
        ; Move the product from dispense zone to the pick zone
        CALL fd.execute(fd.ms.pickmove)
END
```

The default value of the fd.front.thres, fd.flip.thres, fd.disp.thres is set to 10. You can customize those values by going to the Workspace Explorer window. Select:

e-Series Controller 60 > V+ User Variables > Reals > fd.disp.thres

(or fd.front.thres or fd.flip.thres) in the V+ user variable module by typing in the number you want to use.

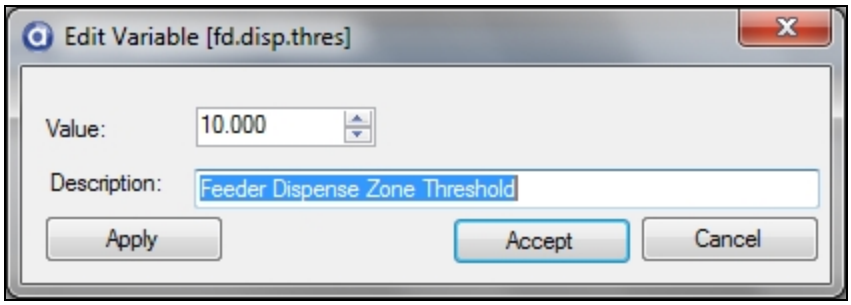

Figure 6-7. Editing the Variable fd.disp.thres

By experimenting with the motion sequence parameters, and how they affect the feeder operation, you can optimize the feeder performance so that you always have the number of parts you want inside the dispense zone, flip zone and front zone.

Other ACE Sight Vision Tools

Other vision tools can be added, such as the Gripper Clearance tool shown below:

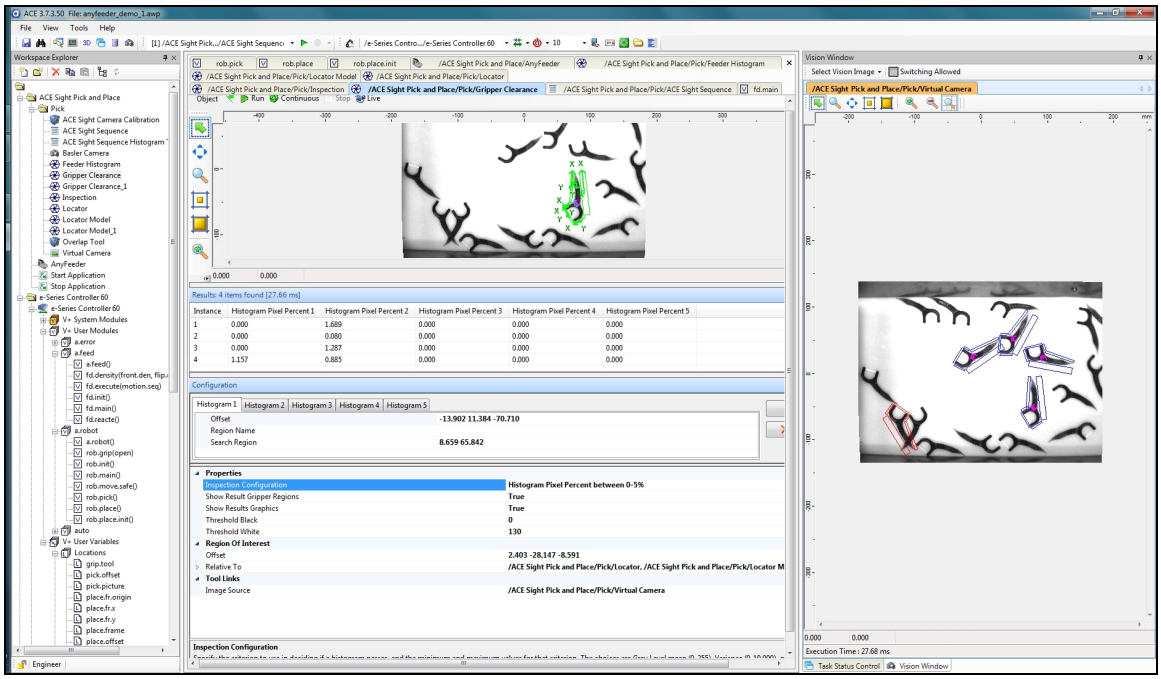

Figure 6-8. Gripper Clearance Tool

Remember to tie the ACE Sight sequence to the Vision Tools of your selection. (Previously we simply tied the ACE Sight sequence to the Locator.)

When adding customized vision tools, you must also modify the fd.main() and rob.pick() programs related to VRESULT and VLOCATION.

When adding customized vision tools, the vision sequence id will need to be updated.

Choose the correct vision tool in ACE Sight Sequence:

Properties > Vision Tool

You must also make sure that VRESULT and VLOCATION parameters related to the sequence_id are updated in fd.main(), rob.pic(), and any other programs affected.

The following screenshot in our sample application ties the ACE Sight sequence to the Inspection tool (which includes the Gripper Clearance tools tied to each of the Locator Models). Note index_id 5 shown in the VLOCATION parameters.

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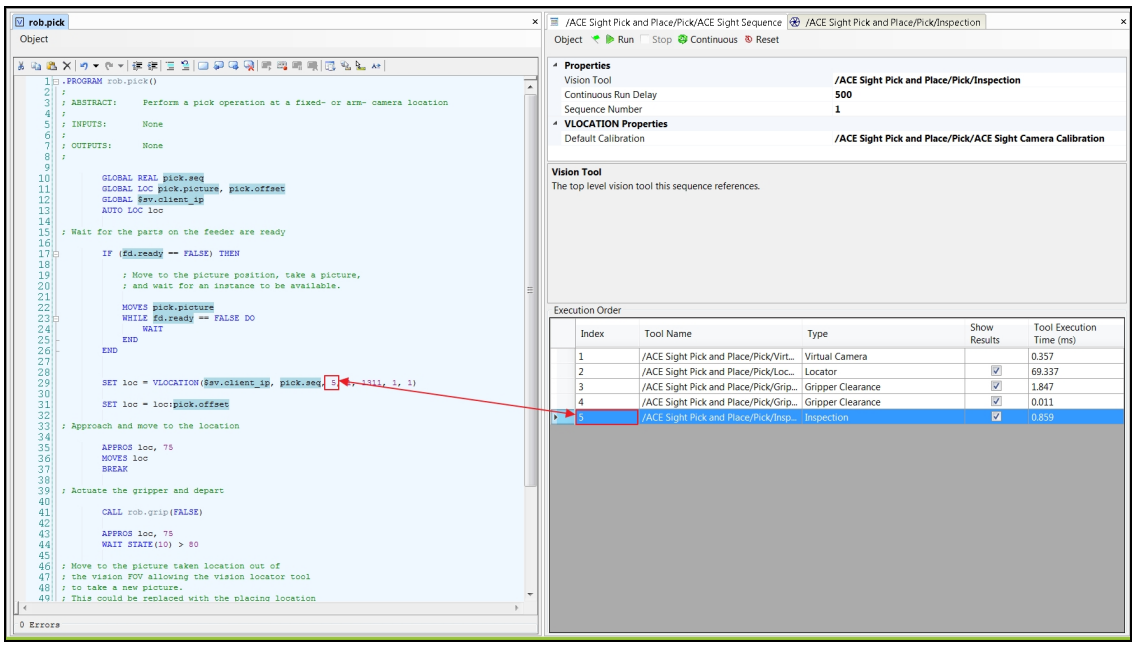

Figure 6-9. ACE Sight Index ID Used in Sample Code

The parameters shown below are V+ vision keywords that will be useful if you want to customize the system:

- VRUN: Initiates execution of a vision sequence
- VLOCATION: Returns the Cartesian transform result of sequence
- VPARAMETER: Sets the current value of a vision parameter
- VRESULT: Returns specified result of a vision sequence
- VSTATE: Returns the state of execution of a vision sequence
- VWAITI: Waits for a vision sequence to reach a specific state

For a detailed explanation and examples of these keywords, go to:

Help > ACE Guides > ACE Reference Guide > ACE Sight V+ and MicroV+ Keywords.

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7 Revision History

R262I-E-□□

Revision code	Date of revision	Revision reason and revision page
01	August. 23, 2017	First edition

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• Machine Automation Controllers (MAC) • Motion Controllers
• Programmable Logic Controllers (PLC) • Temperature Controllers • Remote I/O

Robotics
• Industrial Robots • Mobile Robots

Operator Interfaces
• Human Machine Interface (HMI)

Motion & Drives
• Machine Automation Controllers (MAC) • Motion Controllers • Servo Systems
• Frequency Inverters

Vision, Measurement & Identification
• Vision Sensors & Systems • Measurement Sensors • Auto Identification Systems

Sensing
• Photoelectric Sensors • Fiber-Optic Sensors • Proximity Sensors
• Rotary Encoders • Ultrasonic Sensors

Safety
• Safety Light Curtains • Safety Laser Scanners • Programmable Safety Systems
• Safety Mats and Edges • Safety Door Switches • Emergency Stop Devices
• Safety Switches & Operator Controls • Safety Monitoring/Force-guided Relays

Control Components
• Power Supplies • Timers • Counters • Programmable Relays
• Digital Panel Meters • Monitoring Products

Switches & Relays
• Limit Switches • Pushbutton Switches • Electromechanical Relays
• Solid State Relays

Software
• Programming & Configuration • Runtime

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