iVu Plus TG and Color Gen2 Image Sensors

Instruction Manual

Original Instructions
179042 Rev. H
8 February 2021
© Banner Engineering Corp. All rights reserved

179042

ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

Contents

1 Product Description 6
1.1 Models 6
2 Overview 8
2.1 Features and Indicators 8
2.2 Vision Manager Software 8
2.3 Demo Mode 8
2.4 Sensor Types 9
2.5 Multiple Sensors 9
2.6 Multiple Inspections 9
2.7 Imager Resolution 9
2.8 Communication Channels 9
3 Specifications and Requirements 11
3.1 Specifications 11
3.2 PC Requirements 11
3.3 Dimensions 12
3.4 Using iVu Gen1 and Gen2 Devices in the Same Application 15
3.5 Banner Engineering Corp. Software Copyright Notice 16
3.6 Additional Copyright Information 16
3.7 Trademarks 16
4 Installation Instructions 17
4.1 Mount the iVu 17
4.2 Cable Connections 17
4.3 Installing a Filter on an iVu 18
4.4 Install the Software 19
5 Vision Manager 20
5.1 Connect to the Sensor 20
5.2 Home Screen 21
5.2.1 Sensor Neighborhood 21
5.2.2 Sensor Maintenance 23
5.2.3 Emulators 24
5.2.4 About 25
5.3 Sensor Screen 25
6 Getting Started 26
6.1 Setting up an Inspection 26
6.1.1 Acquiring a Good Image 26
6.2 Add a New Inspection 28
6.3 Trigger Modes 29
6.4 Change the Running Inspection 29
7 Device Home Screen 31
7.1 Display Mode 31
7.1.1 Image with Annotations 31
7.1.2 Image without Annotations 31
7.1.3 Inspection Statistics 32
8 Device Main Menu 34
8.1 Icon Reference 35
8.1.1 Action Icons 35
8.1.2 Display Icons 37
8.1.3 Communications Log Icons 37
9 Device Inspection Menu 38
9.1 Sensors Menu 38
9.1.1 Area Menu 38
9.1.2 Blemish Menu 39
9.1.3 Match Menu 41
9.1.4 Sort Menu 42
9.1.5 Average Color Menu 43
9.1.6 Color Compare Menu 46
9.1.7 Color Area Menu 47
9.2 Motion Menu 48
9.2.1 Number of Edges 49
9.2.2 Sensitivity 49
9.2.3 Rotation 49
9.2.4 Teach ROI Type 49
9.2.5 Percent Match 49

9.2.6 Rotation Range 49
9.2.7 Edit Pattern 50
9.2.8 Advanced 50
9.2.9 Timeout 50
9.3 Properties Menu 50
9.3.1 Inspection Name 50
9.3.2 Inspection ID 50
9.3.3 Motion 51
9.4 Stored Inspections Menu 51
9.4.1 Select 51
9.4.2 Add New 51
9.4.3 Startup 52
9.4.4 Delete Inspections 52
9.4.5 Set Name/ID 52
10 Device Imager Menu 53
10.1 Auto Exposure 53
10.2 Exposure 53
10.3 Gain 53
10.4 Trigger 54
10.5 Focus 54
10.6 Strobe Menu 55
10.6.1 External 55
10.6.2 Internal 55
10.7 FOV (Field of View) 55
10.7.1 Adjust the Field of View (Grayscale Models only) 55
10.8 Resolution 56
10.9 White Balance 57
11 Device System Menu 58
11.1 Mode 58
11.2 System Configuration Menu 58
11.2.1 Save to USB 59
11.2.2 Load from USB 59
11.2.3 Reset to Defaults 59
11.3 System Information 59
11.4 Lock Device 59
11.5 Communications Menu 60
11.5.1 Ethernet I/O 60
11.5.2 Serial I/O 61
11.5.3 Industrial Ethernet 61
11.5.4 Command Channel 65
11.5.5 Data Export Menu 66
11.5.6 Image Export 68
11.6 Discrete I/O Menu 69
11.6.1 Input Polarity 69
11.6.2 Input Pullup 70
11.6.3 Output Type 70
11.6.4 Output 1, 2, and 3 70
11.7 Display Settings 71
11.7.1 Fail Hold Time 72
11.7.2 LCD Timeout 72
11.7.3 Touch Calibration 72
11.7.4 Advanced 72
11.8 Reboot Sensor 72
11.9 Firmware Update 73
11.10 Set the Language 73
11.11 iVu Trigger, Remote Teach, and I/O Waveforms 73
11.11.1 PNP (Low-to-High) Trigger and Remote Teach Input Waveforms 73
11.11.2 NPN (High-to-Low) Trigger and Remote Teach Input Waveforms 73
11.11.3 iVu Output Waveforms 74
12 Device Logs Menu 76
12.1 Inspection Logs Menu 76
12.1.1 View Logs 76
12.1.2 Setup 77
12.2 System Logs 77
12.3 Communication Logs Menu 77
12.3.1 Industrial Ethernet Log 78
12.3.2 Command Channel Log 78
12.3.3 Image Export Log 79
13 Configuring Sensors 80
13.1 Setting the Trigger 80

13.2 Configuring an Area Sensor 80
13.3 Configuring a Blemish Sensor 82
13.4 Configuring a Match Sensor 84
13.4.1 Remote Teach 87
13.5 Configuring a Sort Sensor 87
13.6 Configuring Motion 88
13.6.1 Number of Edges 89
13.6.2 Sensitivity 89
13.6.3 Rotation 89
13.6.4 Teach ROI Type 89
13.6.5 Percent Match 89
13.6.6 Rotation Range 90
13.6.7 Timeout 90
13.7 Configuring an Average Color Sensor 90
13.8 Configuring a Color Compare Sensor 91
13.9 Configuring a Color Area Sensor 92
13.10 Configuring Multiple Sensors in the Inspection 94
13.11 Configuring a Mask 96
14 Communications Guide 97
14.1 iVu Plus Communication Summary of Ethernet and Serial 97
14.1.1 Communication Channels 97
14.1.2 Industrial Ethernet 97
14.1.3 Command Channel 97
14.1.4 Data Export 98
14.1.5 Image Export 100
14.2 Enabling Communications 100
14.2.1 Setting Up Ethernet Communications 100
14.2.2 Setting Up Serial Communications 104
14.3 Testing and Troubleshooting iVu Communications 107
14.3.1 Understanding the Communication Log 107
14.3.2 Ethernet I/O 108
14.3.3 Serial I/O 108
14.4 Command Channel Primer 110
14.4.1 Command Channel Commands 110
14.4.2 Conventions Used for Examples 111
14.4.3 Examples 111
14.4.4 Command Channel Reference 112
14.4.5 Multiple Sensors in an Inspection 122
14.4.6 Command Channel Command Status Register 122
14.4.7 Command Channel Error Codes 122
14.5 iVu Discovery Protocol 124
14.5.1 UDP Usage 124
14.5.2 Packet Format 124
14.5.3 Message Flow 127
15 Industrial Ethernet Overview 130
15.1 Device Setup 130
15.1.1 Set IP Address 130
15.1.2 Set the Industrial Ethernet Protocol (Ethernet/IP™/Modbus/PCCC/PROFINET®) 130
15.1.3 Set Trigger Mode 130
15.2 Supported Functions 130
15.2.1 iVu Input Values 130
15.2.2 iVu Output Values 130
15.3 iVu Operation 131
15.3.1 General Command Execution 132
15.4 EtherNet/IP™ 132
15.4.1 Inputs to the iVu (Outputs from the PLC) 133
15.4.2 Outputs from the iVu (Inputs to the PLC) 133
15.4.3 Multiple Sensors Mapping Options 134
15.4.4 Input and Output Flags Bits 139
15.4.5 Configuration Assembly Object 139
15.4.6 Data Formats 139
15.4.7 Minimum Requested Packet Interval (RPI) Value 139
15.4.8 iVu Plus TG and Color Gen2 Image Sensors EDS File Installation in ControlLogix Software 140
15.4.9 RSLogix5000 Configuration 145
15.5 Modbus/TCP 151
15.5.1 iVu Input Values 153
15.5.2 iVu Output Values 153
15.5.3 Multiple Sensors Mapping Options 153
15.5.4 Input and Output Bits 158
15.6 PLC5, SLC500, and MicroLogix (PCCC) 159

15.6.1 Configuration 159
15.6.2 Inputs to iVu (Outputs from PLC) 163
15.6.3 Outputs from iVu (Inputs to PLC) 163
15.6.4 Multiple Sensors Mapping Options 164
15.6.5 Input and Output Flags 168
15.7 PROFINET® 169
15.7.1 General Station Description (GSD) File 169
15.7.2 PROFINET IO Data Model 169
15.7.3 Configuration Instructions 181
15.8 Sample Timing Diagrams 201
15.9 Command Channel Command Status Register 203
15.10 Diagnostic Guide 203
15.10.1 Ethernet Diagnostics 203
15.10.2 Networking and TCP/IP Diagnostics 204
15.10.3 Industrial Protocols Troubleshooting 206
15.11 Additional Information 211
15.11.1 iVu Command Channel Commands (iVu Command Channel over Industrial Ethernet) 211
16 Troubleshooting 216
16.1 LED Indicator Troubleshooting 216
16.1.1 Errors 216
16.1.2 Warnings 216
16.2 How to Round-Trip Debug Using the Emulator 216
16.2.1 How to Debug Using Inspection Logs 217
16.2.2 How to Debug Using Bitmap Files 217
16.3 Vision Manager Error Codes 218
17 Accessories 227
17.1 Power Cable — Required 227
17.2 Remote Display—Required for Setup (Remote Display Models Only) 227
17.2.1 RDM35 Remote Display Accessory Kit 227
17.3 Ethernet Cable Options 228
17.4 USB Cable — Optional 228
17.5 USB Flash Drive — Optional 228
17.6 Brackets 229
17.7 Micro Video Lens Accessories 230
17.7.1 Micro Video Lens Models 230
17.7.2 Micro Video Lens Filters — Optional 230
17.8 C-Mount Lens Accessories 230
17.8.1 C-Mount Lens Models 230
17.8.2 C-Mount Lens Enclosure Models 231
17.8.3 C-Mount Lens Filters — Optional 231
18 Product Support and Maintenance 232
18.1 Product Support 232
18.2 Maintenance 232
18.2.1 Clean the iVu 232
18.2.2 Update the iVu Firmware 232
18.2.3 How to Set or Modify a Device Name using the Emulator 233
18.2.4 How to Reset the Device Password 234
18.3 Contact Us 234
18.4 Banner Engineering Corp Limited Warranty 234
18.5 FCC Part 15 and CAN ICES-3 (A)/NMB-3(A) 234

1 Product Description

The iVu Plus TG and Color Gen2 Image Sensors are used to monitor parts for type, size, orientation, shape, location, and color or color variations. The device can be set up and monitored using an integrated or remote touchscreen display with no PC required. The following features are available:



- All-in-one solution with camera, controller, lens, and light included in one package
- Configure in minutes using Vision Manager PC software, onboard touchscreen display or using remote touchscreen to access to hard to reach places
- Highly capable image sensors to solve a wide range of vision applications, such as item detection, matching, part positioning or color verification
- Inspect multiple points with a wide variety of grayscale or color tools, depending on your application
- Compact, rugged, IP67 housing available with a variety of integrated ring lights including red, blue, green, white, infrared or UV
- Interchangeable lenses, including C-mount, for maximum application flexibility
- Factory communications (EtherNet/IP™ [2], Modbus/TCP, PROFINET® [3], PCCC and Serial RS-232) for integration on the manufacturing floor
- Ability to change parameters on the fly with full runtime editing to reduce costly downtime

WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

CAUTION: Electrostatic Discharge

Avoid the damage that electrostatic discharge (ESD) can cause to the Sensor.

Always use a proven method for preventing electrostatic discharge when installing a lens or attaching a cable.

1.1 Models

Table 1: iVu Models with an Integrated Display

Ring Light Options	Micro Video Lens Options (Focal Length)						C-Mount Lens Options
	4.3 mm	6 mm	8 mm	12 mm	16 mm	25 mm	
None	**IVU2PTGX04**	**IVU2PTGX06**	**IVU2PTGX08**	**IVU2PTGX12**	**IVU2PTGX16**	**IVU2PTGX25**	**IVU2PTGXC**
Red	**IVU2PTGR04**	**IVU2PTGR06**	**IVU2PTGR08**	**IVU2PTGR12**	**IVU2PTGR16**	**IVU2PTGR25**	N/A
Blue	**IVU2PTGB04**	**IVU2PTGB06**	**IVU2PTGB08**	**IVU2PTGB12**	**IVU2PTGB16**	**IVU2PTGB25**	N/A
Green	**IVU2PTGG04**	**IVU2PTGG06**	**IVU2PTGG08**	**IVU2PTGG12**	**IVU2PTGG16**	**IVU2PTGG25**	N/A
IR	**IVU2PTGI04**	**IVU2PTGI06**	**IVU2PTGI08**	**IVU2PTGI12**	**IVU2PTGI16**	**IVU2PTGI25**	N/A
White	**IVU2PTGW04**	**IVU2PTGW06**	**IVU2PTGW08**	**IVU2PTGW12**	**IVU2PTGW16**	**IVU2PTGW25**	N/A
UV 365 [4]	**IVU2PTG604**	**IVU2PTG606**	**IVU2PTG608**	**IVU2PTG612**	**IVU2PTG616**	**IVU2PTG625**	N/A
UV 395 [4]	**IVU2PTG904**	**IVU2PTG906**	**IVU2PTG908**	**IVU2PTG912**	**IVU2PTG916**	**IVU2PTG925**	N/A

[2] EtherNet/IP™ is a trademark of ODVA, Inc.
[3] PROFINET® is a registered trademark of PROFIBUS Nutzerorganisation e.V.
[4] Blue Filter Kit (FLTMB) is included with ultraviolet (UV) models.

Table 2: iVu Models with a Remote Display

Ring Light Options	Micro Video Lens Options (Focal Length)						C-Mount Lens Options
	4.3 mm	6 mm	8 mm	12 mm	16 mm	25 mm	
None	**IVU2PRGX04**	**IVU2PRGX06**	**IVU2PRGX08**	**IVU2PRGX12**	**IVU2PRGX16**	**IVU2PRGX25**	**IVU2PRGXC**
Red	**IVU2PRGR04**	**IVU2PRGR06**	**IVU2PRGR08**	**IVU2PRGR12**	**IVU2PRGR16**	**IVU2PRGR25**	N/A
Blue	**IVU2PRGB04**	**IVU2PRGB06**	**IVU2PRGB08**	**IVU2PRGB12**	**IVU2PRGB16**	**IVU2PRGB25**	N/A
Green	**IVU2PRGG04**	**IVU2PRGG06**	**IVU2PRGG08**	**IVU2PRGG12**	**IVU2PRGG16**	**IVU2PRGG25**	N/A
IR	**IVU2PRGI04**	**IVU2PRGI06**	**IVU2PRGI08**	**IVU2PRGI12**	**IVU2PRGI16**	**IVU2PRGI25**	N/A
White	**IVU2PRGW04**	**IVU2PRGW06**	**IVU2PRGW08**	**IVU2PRGW12**	**IVU2PRGW16**	**IVU2PRGW25**	N/A
UV 365 [5]	**IVU2PRG604**	**IVU2PRG606**	**IVU2PRG608**	**IVU2PRG612**	**IVU2PRG616**	**IVU2PRG625**	N/A
UV 395 [5]	**IVU2PRG904**	**IVU2PRG906**	**IVU2PRG908**	**IVU2PRG912**	**IVU2PRG916**	**IVU2PRG925**	N/A

Table 3: iVu Color Models with an Integrated Display [6]

Ring Light Options	Micro Video Lens Options (Focal Length)						C-Mount Lens Options
	4.3 mm	6 mm	8 mm	12 mm	16 mm	25 mm	
None	**IVU2PTCX04**	**IVU2PTCX06**	**IVU2PTCX08**	**IVU2PTCX12**	**IVU2PTCX16**	**IVU2PTCX25**	**IVU2PTCXC**
White	**IVU2PTCW04**	**IVU2PTCW06**	**IVU2PTCW08**	**IVU2PTCW12**	**IVU2PTCW16**	**IVU2PTCW25**	N/A

Table 4: iVu Color Models with a Remote Display [6]

Ring Light Options	Micro Video Lens Options (Focal Length)						C-Mount Lens Options
	4.3 mm	6 mm	8 mm	12 mm	16 mm	25 mm	
None	**IVU2PRCX04**	**IVU2PRCX06**	**IVU2PRCX08**	**IVU2PRCX12**	**IVU2PRCX16**	**IVU2PRCX25**	**IVU2PRCXC**
White	**IVU2PRCW04**	**IVU2PRCW06**	**IVU2PRCW08**	**IVU2PRCW12**	**IVU2PRCW16**	**IVU2PRCW25**	N/A

Note: This product emits UV light. Exempt Risk Group (RG 0) product. No optical hazard is considered reasonably foreseeable, even for continuous, unrestricted use (IEC 62471).

[5] Blue Filter Kit (FLTMB) is included with ultraviolet (UV) models.
[6] *iVu Color models include a pre-installed infrared blocking filter.*

2 Overview

The iVu Vision Sensor can be configured in just minutes with a few simple steps. Program through the integrated or remote touch screen without the use of a PC. As an alternate, use Vision Manager PC software to configure and monitor devices. Use the grayscale, color, or barcode versions to solve a wide variety of factory automation applications.

2.1 Features and Indicators

The iVu comes fully assembled with the lens and an integrated ring light (optional).

Integrated display models: The touchscreen display has a plastic cover to protect the display. Remove this cover when configuring the device. When the display is not in use, keep the display covered to protect it.

Remote display models: The remote touchscreen display is not required for normal device operation, however, it is needed to configure the device and to monitor inspections.

If an integrated ring light is not used, another light source is needed. Various lights are available from Banner Engineering. Operating in external trigger mode requires a triggering source.

Figure 1. Features



1. Power LED
   - Green: Ready/Power
   - Red (blinking or steady): Error
2. Pass/Fail LED
   - Green (steady): Pass
   - Green (blinking): Error
   - Red: Fail
3. Ethernet I/O LED
   - Green: Connected
   - Off: Disconnected
4. Focusing Window
5. Focusing Window Locking Clip
6. Integrated Display (integrated display models only)

2.2 Vision Manager Software

Set up the iVu Plus TG and Color Gen2 Image Sensors using the free Vision Manager Software, available for download at www.bannerengineering.com.

Use Vision Manager to connect to, monitor, and configure iVu devices. The simple user interface allows for quick setup of inspections, the ability to make changes on the fly and remote monitoring of live sensors. Also included in Vision Manager are iVu emulators, allowing users to create or troubleshoot inspections offline, without being connected to a device.

Use Vision Manager to configure Banner vision devices including iVu Vision Sensors and VE Smart Cameras.

2.3 Demo Mode

The first time the iVu is powered up, it starts in Demo Mode. You can choose whether to stay in Demo Mode or exit to Live Mode. Demo Mode uses stored images and inspection parameters that demonstrate how the iVu is set up, without having to worry about focus, lighting, or triggers. In this mode, practice making adjustments while working with the different sensor types and observing how the adjustments affect the results. To exit Demo Mode, go to **Main Menu** > **System** > **Mode** and select **Exit Demo Mode**. Upon exit, the iVu restarts in the normal operating mode with the default settings.

*Figure 2. **Select Type** Screen*

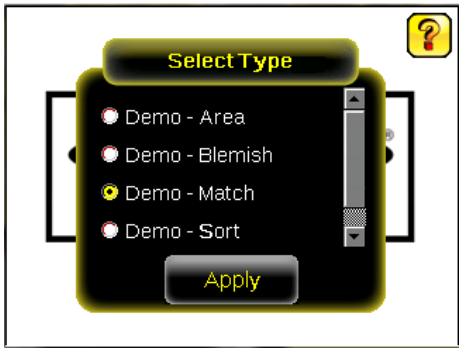
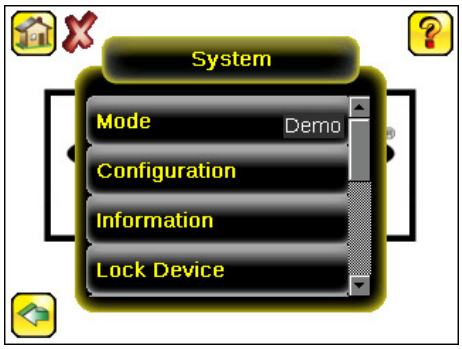


*Figure 3. **System** Menu*



Note: Switch between Live Mode and Demo Mode any time by going to **Main Menu** > **System** > **Mode**.

2.4 Sensor Types

The iVu includes the following types:

Sensor Type	Description
Area Sensor	Use an Area sensor to ensure that a feature, or multiple features, are present on a part. See Area Menu on p. 38.
Blemish Sensor	Use a Blemish sensor to find flaws on a part, or to make sure that a feature exists on a part. See Blemish Menu on p. 39.
Match Sensor	Use a Match sensor to verify that a pattern, shape, or part in any orientation matches a reference pattern. See Match Menu on p. 41.
Sort Sensor	Use a Sort sensor to recognize and sort up to ten different patterns within the same inspection. See Sort Menu on p. 42.
Average Color	Use an Average Color sensor to calculate the average color (RGB or HSI) within the area of interest on a part (color models only). See Average Color Menu on p. 43.
Color Compare	Use a Color Compare sensor to verify whether a part's color matches a reference color (color models only). See Color Compare Menu on p. 46.
Color Area	Use a Color Area sensor to ensure that a feature, or multiple features, are the correct color and are present on a part (color models only). See Color Area Menu on p. 47.

2.5 Multiple Sensors

Firmware versions 1.2.0 and newer include multiple sensor functionality. Use multiple sensors to inspect more than one feature on each part being inspected. Create and store up to 30 such inspections on the iVu.

2.6 Multiple Inspections

The iVu supports multiple inspections that facilitate storing and controlling up to 30 inspections of different sensor types.

2.7 Imager Resolution

iVu models have a 752 x 480 resolution. Resolution can be adjusted on iVu grayscale models.

2.8 Communication Channels

The iVu supports up to four communications channels:

- Command Channel—A bi-directional communication protocol that currently supports ASCII and enables other devices to remotely control the iVu and access device information and inspection results
- Industrial Ethernet—A bi-directional communication channel that allows the user to control the device and access device results using Ethernet/IP™, Modbus/TCP, PCCC, or PROFINET® protocol
- Data Export—Used to export selected inspection data to a remote device
- Image Export—Used to export inspection images to a remote device

3 Specifications and Requirements

3.1 Specifications

Power Connection
12-pin M12/Euro-style male connector; accessory cable required for operation

USB 2.0 Host
4-pin M8/Pico female connector; optional USB cable required for operation of USB flash drive

Ethernet Connection
4-pin M8/Pico male connector

Remote Display Connection
8-pin M12/Euro-style female connector; accessory cable required for remote display

Power Requirements
Voltage: 10 V dc to 30 V dc
Current: 1 A maximum (exclusive of I/O load)

Output Configuration
NPN or PNP, software selectable

Demo Mode
Full tool functionality on canned images

Sensor Lock
Optional password protection

Integrated Ring Light
Models with red, blue, green, infrared, white, ultraviolet or no integrated ring light

Output Rating
150 mA

External Strobe Output
+ 5 V dc

Acquisition
60 fps (frames per second) maximum, with full FOV

Exposure Time
0.1 ms to 1.049 s

Imager
1/3 inch CMOS 752 × 480 pixels; color or grayscale, depending on model
Adjustable Field of View (FOV), grayscale models only

Lens Mount
Micro Video Lens models: M12 × 1 mm thread; micro video lens 4.3 mm, 6 mm, 8 mm, 12 mm, 16 mm, 25 mm
C-Mount models: Standard C-mount (1 inch-32 UN)

Construction
Black PBT sensor housing; die cast zinc back cover; acrylic window
Integrated Display **Weight:** 0.36 kg (0.80 lbs)
Remote Display **Weight:** 0.41 kg (0.90 lbs)

Vibration and Mechanical Shock
Meets IEC 60068-2-6 requirements (Vibration: 10 Hz to 55 Hz, 0.5 mm amplitude, 5 minutes sweep, 30 minutes dwell)
Meets IEC 60068-2-27 requirements (Shock: 30G 11 ms duration, half sine wave)

Environmental Rating
IEC IP67, micro video lens models only

Operating Conditions
Integrated Display **Stable Ambient Temperature:** 0 °C to +45 °C (+32 °F to +113 °F)
Remote Display **Stable Ambient Temperature:** 0 °C to +40 °C (+32 °F to +104 °F)

Certifications

3.2 PC Requirements

Operating System
Microsoft® Windows® operating system version 7, 8, or 10 [7]

System Type
32-bit, 64-bit

Hard Drive Space
80 MB (plus up to 280 MB for Microsoft .NET 4.5, if not already installed)

Memory (RAM)
512 MB minimum, 1 GB+ recommended

Processor
1 GHz minimum, 2 GHz+ recommended

Screen Resolution
1024 × 768 full color minimum, 1650 × 1050 full color recommended

Third-Party Software
Microsoft .NET 4.5, PDF Viewer (such as Adobe Acrobat)

USB Port
USB 3.0, recommended if a USB to Ethernet adapter used to communicate with the sensor

Important: Administrative rights are required to install the Vision Manager software.

[7] Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.

3.3 Dimensions

Micro Video Lens Dimensions

Figure 4. Micro Video Lens, Remote Display Models

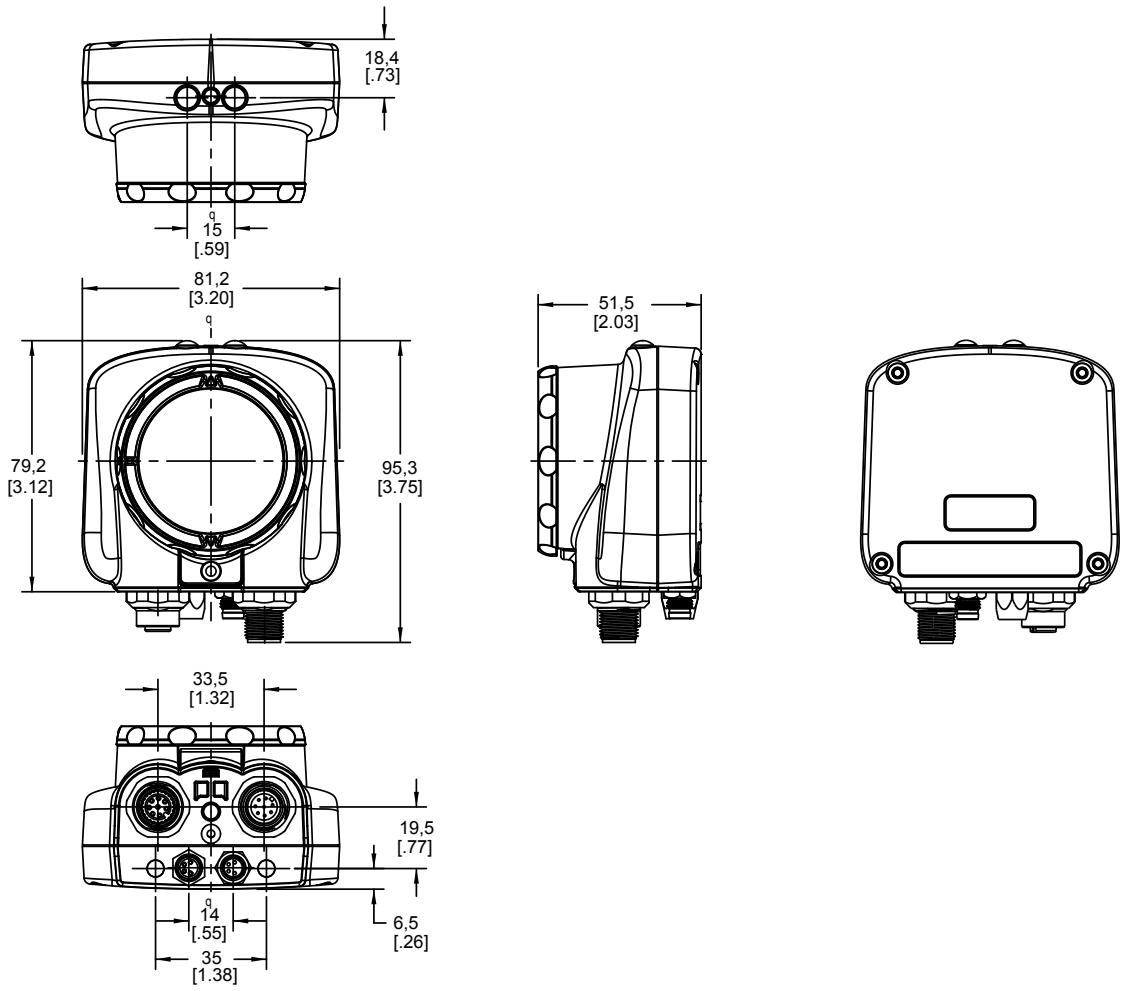
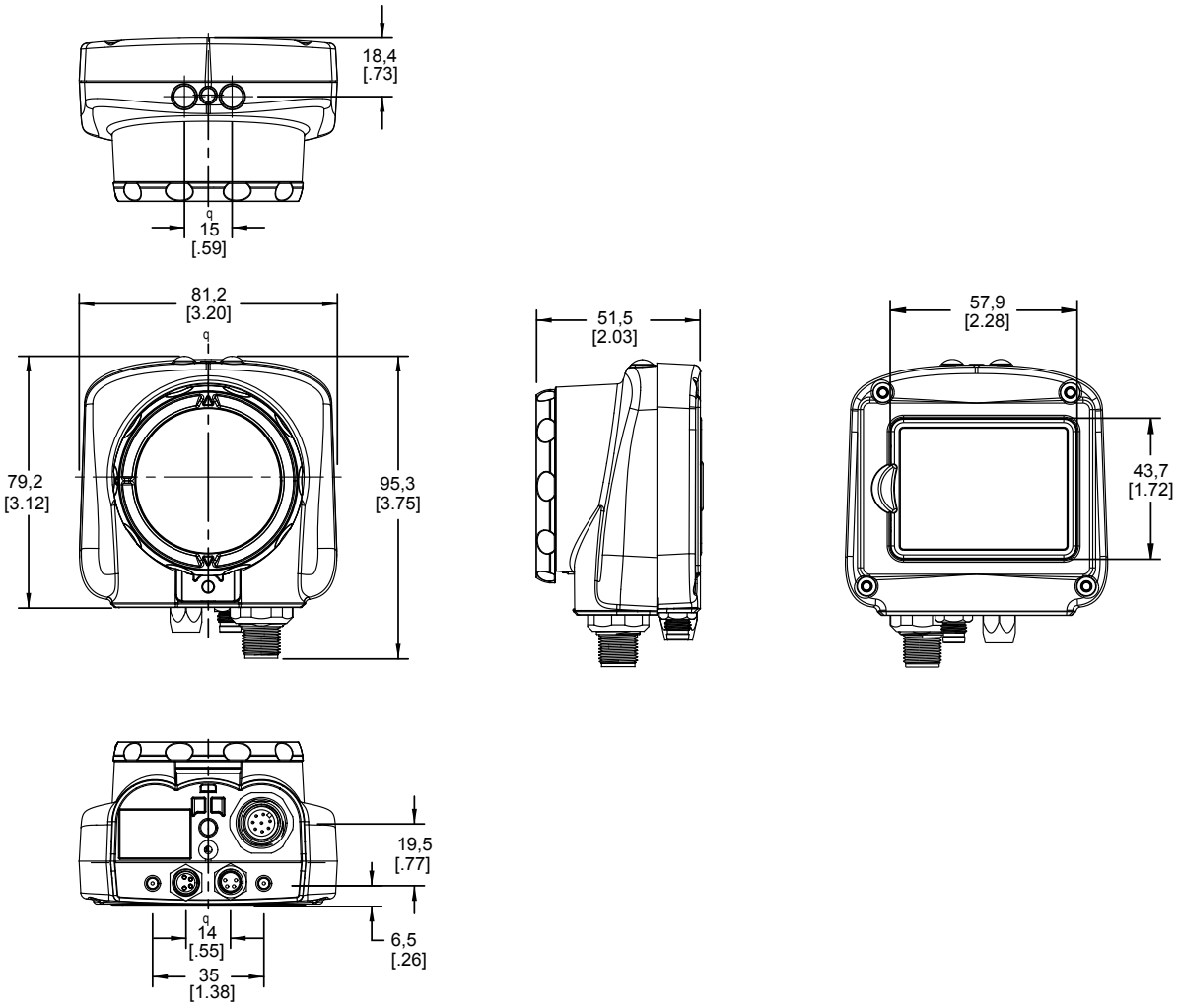


Figure 5. Micro Video Lens, Integrated Display Models



All measurements are listed in millimeters [inches], unless noted otherwise.

C-Mount Lens Dimensions

Figure 6. C-Mount Lens, Remote Display Models

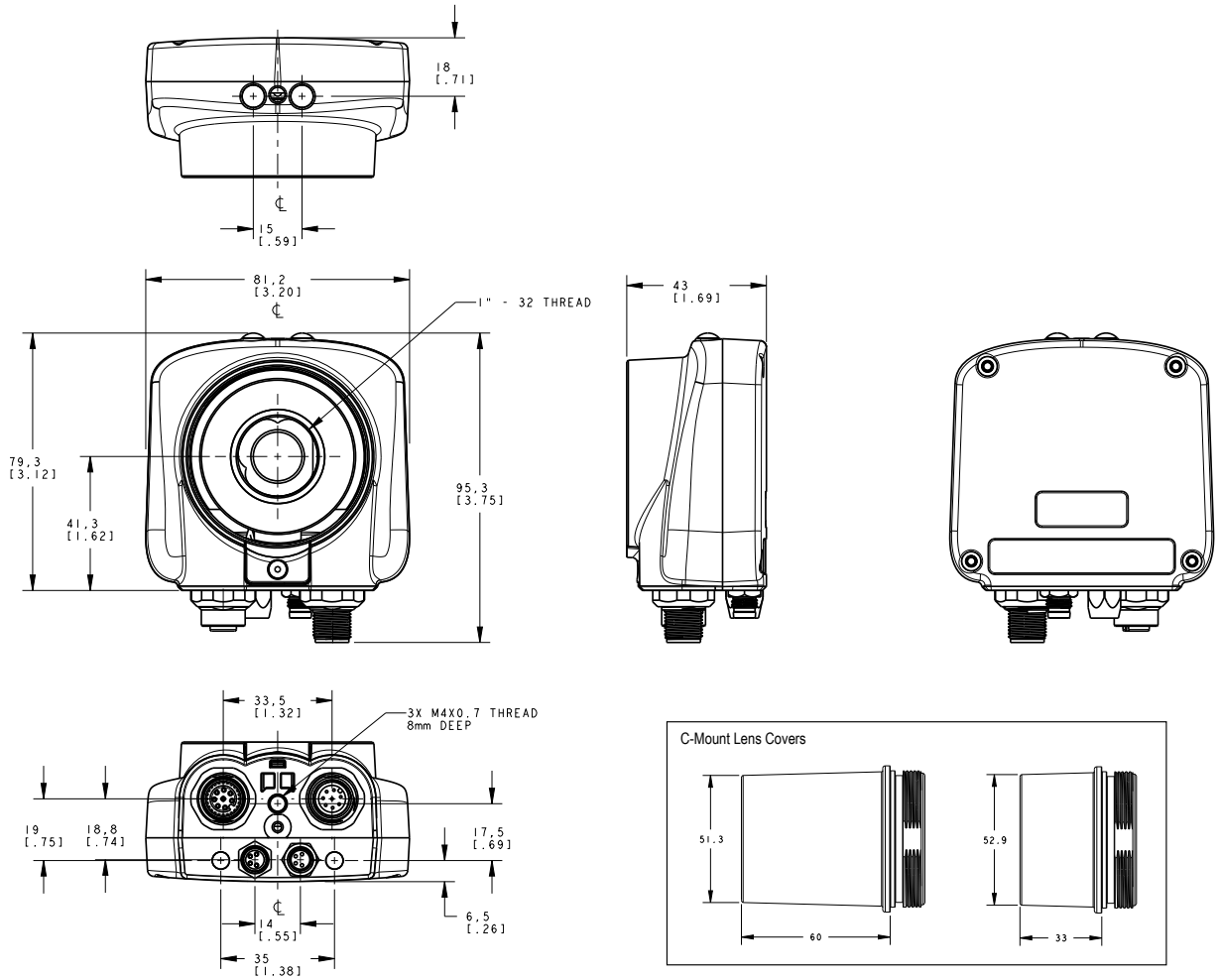
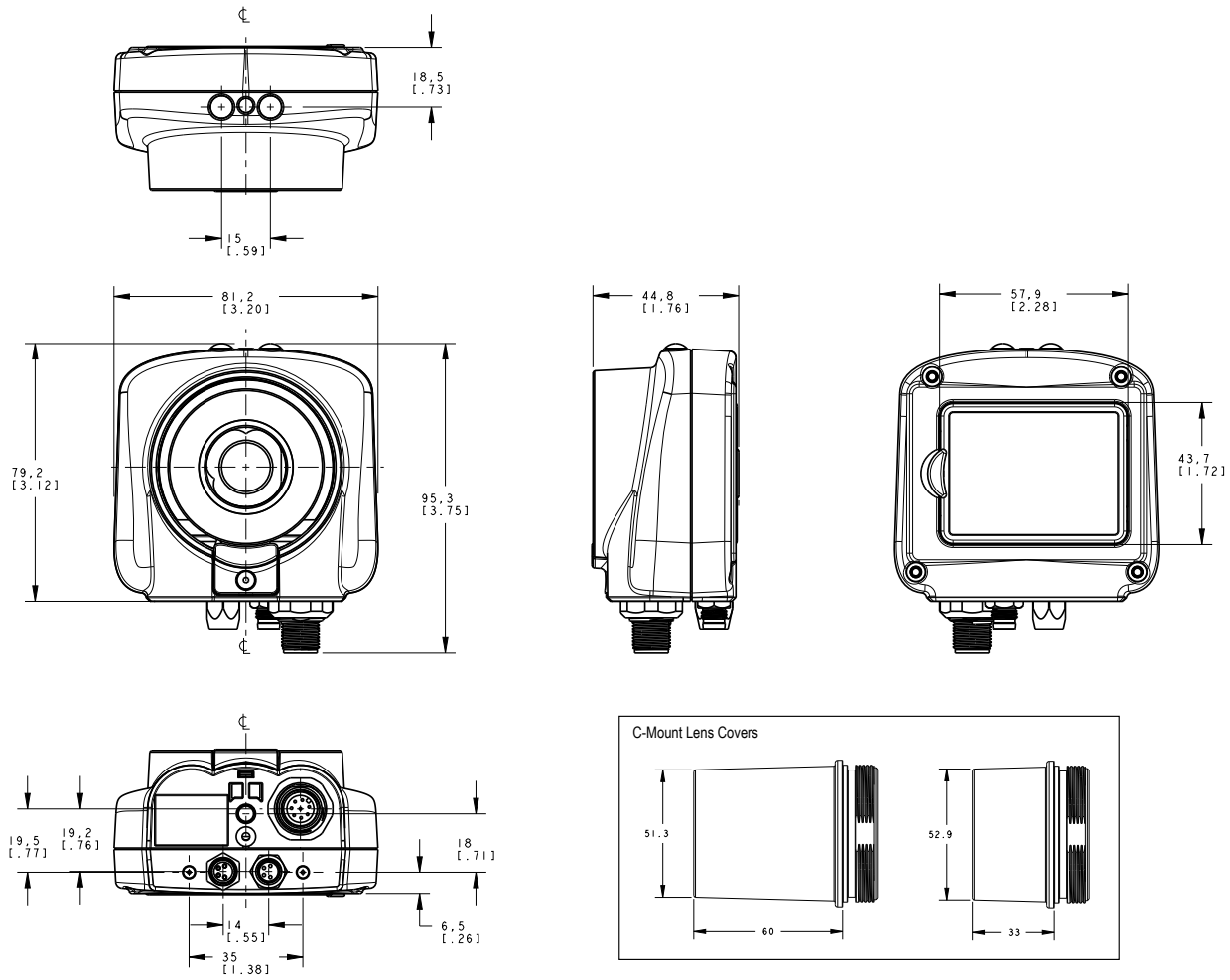


Figure 7. C-Mount Lens, Integrated Display Models



All measurements are listed in millimeters [inches], unless noted otherwise.

3.4 Using iVu Gen1 and Gen2 Devices in the Same Application

Generation 1 and Generation 2 iVu devices can be used in the same application, however steps must be taken to ensure compatibility. Gen2 output files, such as configuration and log files, are not compatible with Gen1 devices. In order to have one configuration file that applies to both Gen1 and Gen2 devices, configure inspections using a Gen1 device or the Gen1 Emulator. Settings from Gen1 are automatically converted to Gen2 when they are loaded onto a Gen2 device. Confirm all inspections after loading to ensure that they are correct.

Note: New features available on Gen2 devices will not be available when creating the inspection on Gen1 software.

3.5 Banner Engineering Corp. Software Copyright Notice

This software is protected by copyright, trade secret, and other intellectual property laws. You are only granted the right to use the software and only for the purposes described by Banner. Banner reserves all other rights in this software. For so long as you have obtained an authorized copy of this software directly from Banner, Banner grants you a limited, nonexclusive, nontransferable right and license to use this software.

You agree not to use, nor permit any third party to use, this software or content in a manner that violates any applicable law, regulation or terms of use under this Agreement. You agree that you will not reproduce, modify, copy, deconstruct, sell, trade or resell this software or make it available to any file-sharing or application hosting service.

Disclaimer of Warranties. Your use of this software is entirely at your own risk, except as described in this agreement. This software is provided "AS-IS." To the maximum extent permitted by applicable law, Banner, it affiliates, and its channel partners disclaim all warranties, expressed or implied, including any warranty that the software is fit for a particular purpose, title, merchantability, data loss, non-interference with or non-infringement of any intellectual property rights, or the accuracy, reliability, quality or content in or linked to the services. Banner and its affiliates and channel partners do not warrant that the services are secure, free from bugs, viruses, interruption, errors, theft or destruction. If the exclusions for implied warranties do not apply to you, any implied warranties are limited to 60 days from the date of first use of this software.

Limitation of Liability and Indemnity. Banner, its affiliates and channel partners are not liable for indirect, special, incidental, punitive or consequential damages, damages relating to corruption, security, loss or theft of data, viruses, spyware, loss of business, revenue, profits, or investment, or use of software or hardware that does not meet Banner minimum systems requirements. The above limitations apply even if Banner and its affiliates and channel partners have been advised of the possibility of such damages. This Agreement sets forth the entire liability of Banner, its affiliates and your exclusive remedy with respect to the software use. You agree to indemnify and hold Banner and its affiliates and channel partners harmless from any and all claims, liability and expenses, including reasonable attorney's fees and costs, arising out of your use of the Services or breach of this Agreement (collectively referred to as "Claims"). Banner reserves the right at its sole discretion and at its own expense, to assume the exclusive defense and control of any Claims. You agree to reasonably cooperate as requested by Banner in defense of any Claims.

3.6 Additional Copyright Information

The Vision Manager software includes code that is copyright (c) 1985, 1989 Regents of the University of California. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. All advertising materials mentioning features or use of this software must display the following acknowledgement: This product includes software developed by the University of California, Berkeley and its contributors.
4. Neither the name of the University nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS ``AS IS'' AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

3.7 Trademarks

ControlLogix® is a trademark of Rockwell Automation, Inc.

EtherNet/IP™ is a trademark of ODVA, Inc.

Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.

PROFINET® is a registered trademark of PROFIBUS Nutzerorganisation e.V.

All other trademarks and registered trademarks cited are the property of their respective owners.

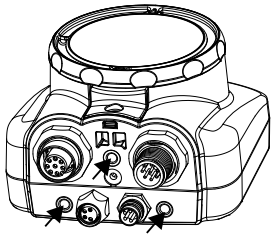
4 Installation Instructions

4.1 Mount the iVu

The iVu requires a bracket for mounting. Brackets are available from Banner Engineering. See www.bannerengineering.com. The brackets allow the iVu to be mounted either perpendicular to the part or at an adjustable angle.

1. Position the iVu on the bracket.
2. Thread three M4 x 4 mm screws (supplied) through the bracket into the mounting holes in the bottom of the iVu.

Figure 8. Mounting Bracket Mounting Holes



3. Tighten all three screws.
4. Mount the iVu and bracket to the machine or equipment at the desired location. Do not tighten the mounting screws at this time.
5. Check the iVu alignment.
6. Tighten the mounting screws to secure the iVu and the bracket in the aligned position.

4.2 Cable Connections

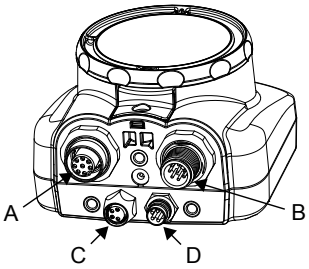
The cable connections on the iVu are shown below, and power I/O connections (**B**) are defined in the **Power I/O Connections** table below.

CAUTION: Electrostatic Discharge

Avoid the damage that electrostatic discharge (ESD) can cause to the Sensor.

Always use a proven method for preventing electrostatic discharge when installing a lens or attaching a cable.

Figure 9. iVu Cable Connections—Micro Video Lens Model



A Remote Display Connector (remote display models only)

B Power and I/O Cable Connector

C USB Connector

D Ethernet Connector

Note: Micro video lens model shown, C-Mount model connections are identical.

Table 5: Power I/O Connections

Pin #	Wire Color	Description	Direction
1	White	Output 1	Output
2	Brown	10 V dc to 30 V dc	Input
3	Green	Output 2	Output
4	Yellow	Strobe Out (5 V dc only)	Output
5	Gray	Remote Teach	Input
6	Pink	External Trigger	Input
7	Blue	Common (Signal Ground)	Input

Pin #	Wire Color	Description	Direction
8	Red	Ready	Output
9	Orange	Output 3	Output
10	Light Blue	RS-232 TX	Output
11	Black	RS-232 Signal Ground	Output
12	Violet	RS-232 Rx	Input

4.3 Installing a Filter on an iVu

Installing a Filter on the Micro Video Lens Model

To install a filter on the iVu with Micro Video Lens, use the illustration as a guide and follow the steps listed below.

CAUTION: Failure to follow these instructions may cause damage to your iVu.

CAUTION: Electrostatic Discharge

Avoid the damage that electrostatic discharge (ESD) can cause to the Sensor.

Always use a proven method for preventing electrostatic discharge when installing a lens or attaching a cable.

Figure 10. Micro Video Lens Model Components



A Lens
B Focusing Window
C Locking Clip
D Locking Screw
E Filter Cap
F Filter

Note: Filter kits are available separately.

1. Remove the locking screw (D) using the 1/16-inch hex key.

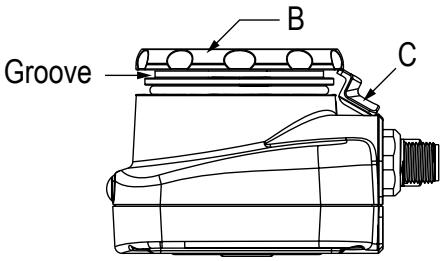
   Note: The locking clip (C) inserts in a groove near the top of the focusing window (B). When removing the window, the locking clip will be loose. Do not to lose the clip while removing the window.

2. Unscrew the focusing window by turning it clockwise approximately 5 complete turns or until the focusing window disengages from the light/lens assembly.

   Note: The light/lens assembly may include an integrated ring light or a blank disk if an integrated ring light is not used. Be careful that the light/lens assembly does not pull out when removing the focusing window. Pull gently on the focusing window. If the lens assembly moves with the window, continue to rotate the window clockwise until the lens assembly does not move.

3. Set the focusing window aside. Do not to get any debris on the window's O-ring.
4. If present, remove the protective covering on the filter.
5. Place the filter into the filter cap and press the cap onto the lens.
6. After the filter is installed, place the focusing window back into the housing while inserting the locking clip into the groove as shown.

Figure 11. Locking Clip in the Groove



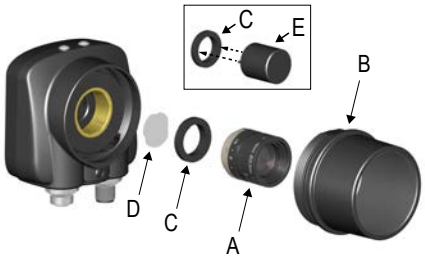
7. Press the focusing window onto the housing to make sure that there is no gap between the window and the housing. Rotate the window counter-clockwise at least two turns.
8. Replace the locking tab screw but do not tighten it until you have set up and focused the iVu again.

Installing a Filter on the C-Mount Lens Model

To install a filter on the iVu with C-Mount lens, use the illustration as a guide and follow the steps listed below.

CAUTION: Failure to follow these instructions may cause damage to your iVu.

Figure 12. C-Mount Lens Model Components



A C-Mount Lens
B Lens Enclosure
C Retainer Ring
D Filter
E Filter Retainer Ring Tool

Note: Filter kits are available separately.

1. Remove the lens enclosure and C-mount lens.
2. Install filter behind the retainer ring. Make sure it is fully seated.
3. Using the provided retainer ring tool, thread the retainer ring into the iVu until it firmly seats the filter.
4. Replace the lens and lens enclosure on the iVu.

4.4 Install the Software

Important: Administrative rights are required to install the Vision Manager software.

1. Download the latest version of the software from www.bannerengineering.com.
2. Navigate to and open the downloaded file.
3. Click **Next** to begin the installation process.
4. Confirm the software destination and availability for users and click **Next**.
5. Click **Install** to install the software.
6. Depending on your system settings, a popup window may appear prompting to allow Vision Manager to make changes to your computer. Click **Yes**.
7. Click **Close** to exit the installer.

5 Vision Manager

Connect to the iVu using Vision Manager PC Software to control the device remotely. After connecting to the device, the interface displays on the **Sensor** tab. Use the interface in the same manner as the iVu display.

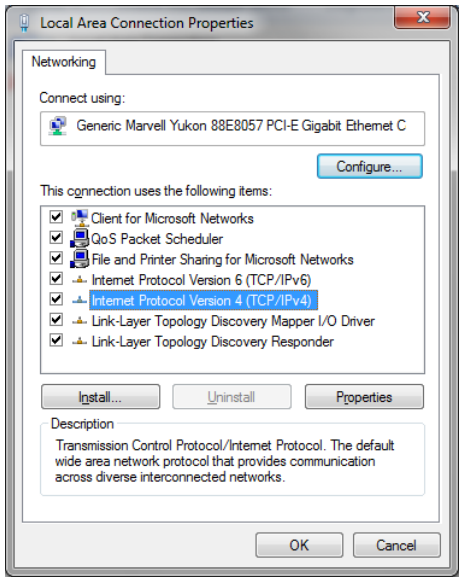
Vision Manager is not required to configure or run the iVu.

5.1 Connect to the Sensor

These instructions use Windows® operating system version 7, 8, or 10. [8]

1. Confirm the network connections.
   a) Click the **Start** button, then on the **Start** menu, click **Control Panel**.
   b) In **Control Panel**, click **Network and Internet**, then click **Network and Sharing Center**, and then click **Change adapter settings**.
   c) Right-click on the connection that you want to change, then click **Properties**.
   If you are prompted for an administrator password or confirmation, enter the password or provide confirmation.
   d) In the connection properties, click **Internet Protocol Version 4 (TCP/IPv4)**, and then click **Properties**.

Figure 13. Local Area Connection Properties



   e) In the **Internet Protocol (TCP/IPv4) Properties**, select **Use the following IP address**.
   f) Make sure that the IP address is 192.168.0.2, and the subnet mask is 255.255.255.0.
2. Open Vision Manager from the desktop or the **Start** menu.
   The **Sensor Neighborhood** tab displays and lists the available sensors.
3. From **Sensor Neighborhood**, click to connect to the desired sensor.
   The status changes from **Available** to **Connected** and the **Sensor** screen displays. Click to disconnect from the sensor.
4. If the desired sensor is not listed, verify that:
   - The network adapter connected to the sensor has the same subnet mask as the sensor (for example, 192.168.0.xxx); view the subnet mask in the Network Adapters list at **Home** > **Sensor Neighborhood** > **Network Adapters**
   - The Ethernet cable is the correct type
   - The TCP/IPv4 settings are correct

   Or, manually enter the sensor's IP address.

Note: The sensor's IP address and subnet mask are also available from the sensor display.

[8] Windows is a registered trademark of Microsoft Corporation in the United States and/or other countries.

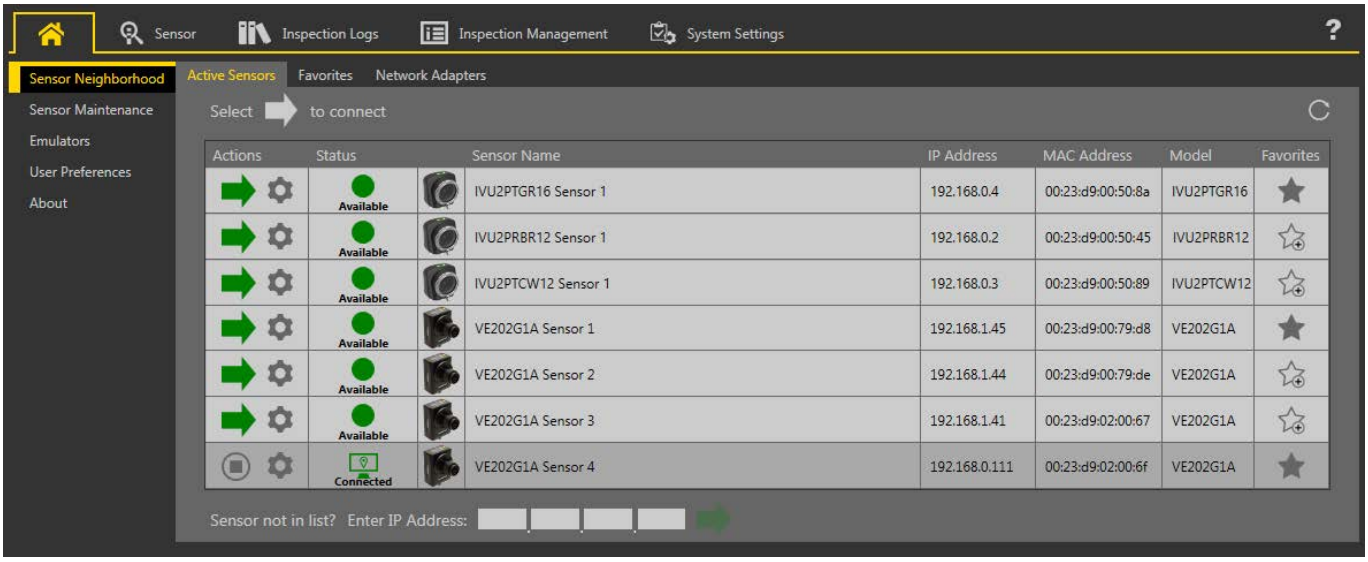
5.2 Home Screen

The **Home** screen provides access to connect to a sensor or emulator, update firmware, and view sensor and Vision Manager software information.

The following are available from the **Home** screen:

- Sensor Neighborhood
- Sensor Maintenance
- Emulators
- User Preferences (VE product interface preferences only)
- About

Figure 14. Home Screen



Only one sensor can be connected to each instance of the software. Open more than one instance of Vision Manager if you want to connect to more than one sensor at a time. Only one instance of the software can be connected to the Emulator at a time.

5.2.1 Sensor Neighborhood

Use **Sensor Neighborhood** on the **Home** screen to connect to active sensors. **Sensor Neighborhood** opens by default when the software is launched.

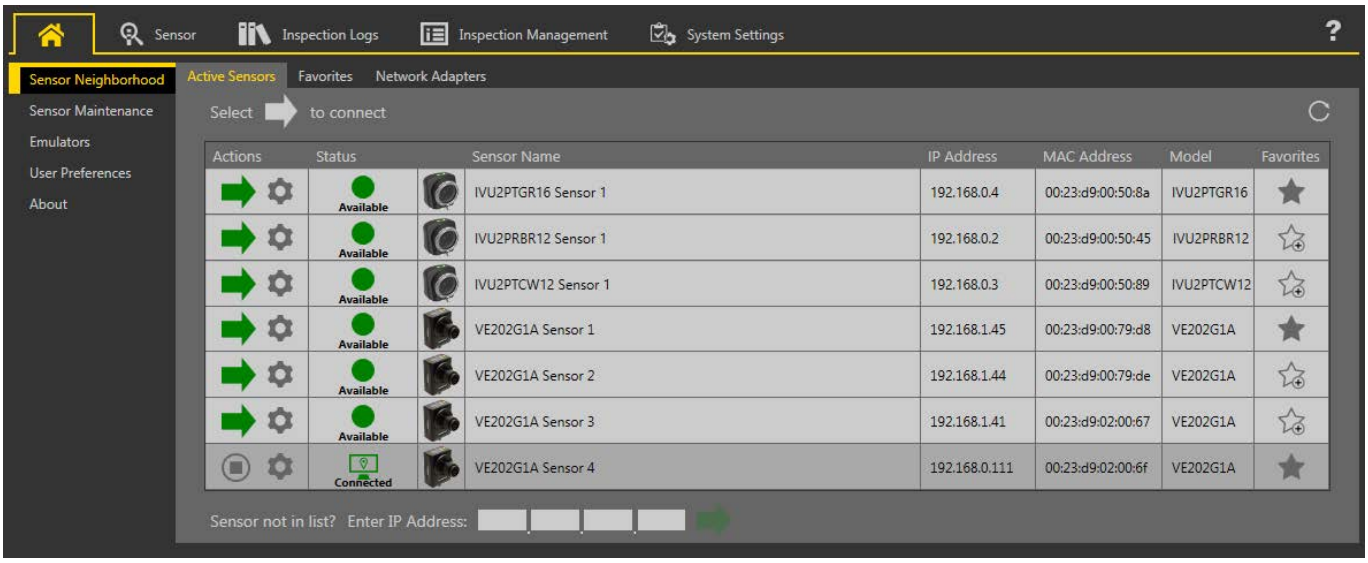
Active Sensors Tab

Use the **Active Sensors** tab in **Sensor Neighborhood** to connect to an active sensor. Available options vary depending on the type of sensor to which Vision Manager is connected.

Navigate: **Home** > **Sensor Neighborhood** > **Active Sensors**.

This tab includes sensor information such as sensor status, sensor name, IP address, MAC address, and model number. Sensors can also be added to Favorites.

Figure 15. Active Sensors Tab



To connect to a sensor, click ➡ next to the desired sensor. To disconnect from a sensor, click ⏹.

To view or change sensor Status, MAC Address, Sensor Name, IP Address, Subnet Mask, and Gateway, click ⚙.

To add the sensor to a Favorites Group, click ☆. The icon changes to ★.

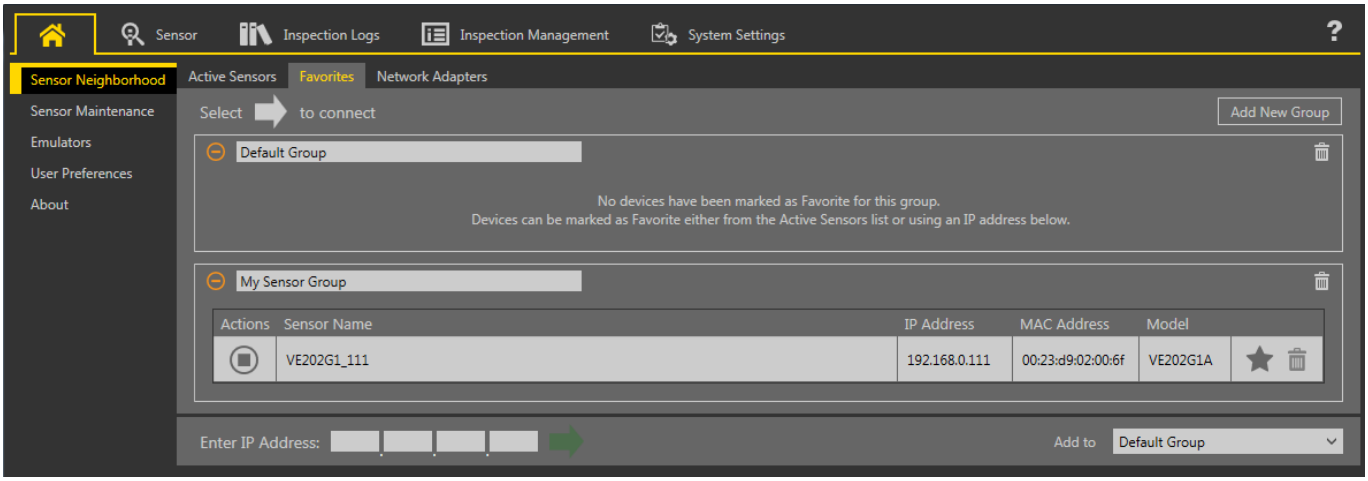
To manually connect to a sensor with a known IP address, enter the IP address in the **Enter IP Address** field and click ➡.

Favorites Tab

Save sensors to the **Favorites** tab for easy access to them. Sensors are saved to groups.

Navigate: 🏠 **Home** > **Sensor Neighborhood** > **Favorites**.

Figure 16. Favorites Tab



Click **Add New Group** to create a new Favorites Group. To add a sensor to the group, on the **Active Sensors** tab, click ☆ or from the **Favorites** tab, enter the sensor IP address and click ➡ to verify the connection to the sensor and automatically save it to the selected group.

To manually add a sensor with a known IP address to the **Favorites** tab, enter the IP address in the **Enter IP Address** field and select the desired group.

To remove a sensor from a group, click the 🗑 across from the sensor name. To move the sensor to another group, click the ★ and select the desired group.

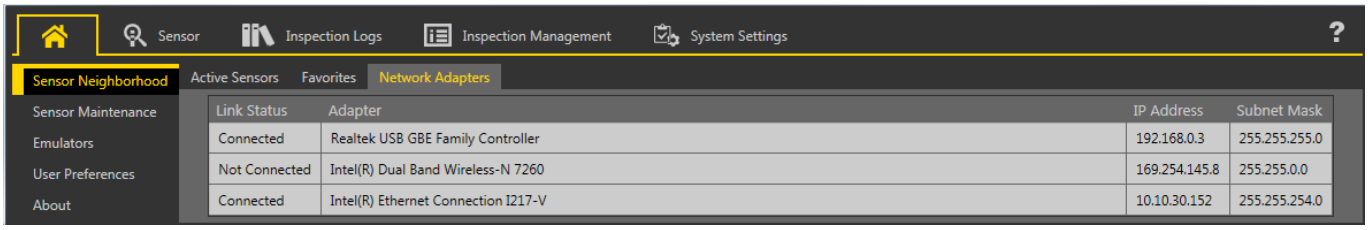
To remove a group and all the sensors within the group, click the 🗑 across from the group name.

Network Adapters Tab

Use the **Network Adapters** tab on **Sensor Neighborhood** to view the network adapters that the system searches to find sensors.

Navigate: **Home** > **Sensor Neighborhood** > **Network Adapters**.

Figure 17. Network Adapters Tab

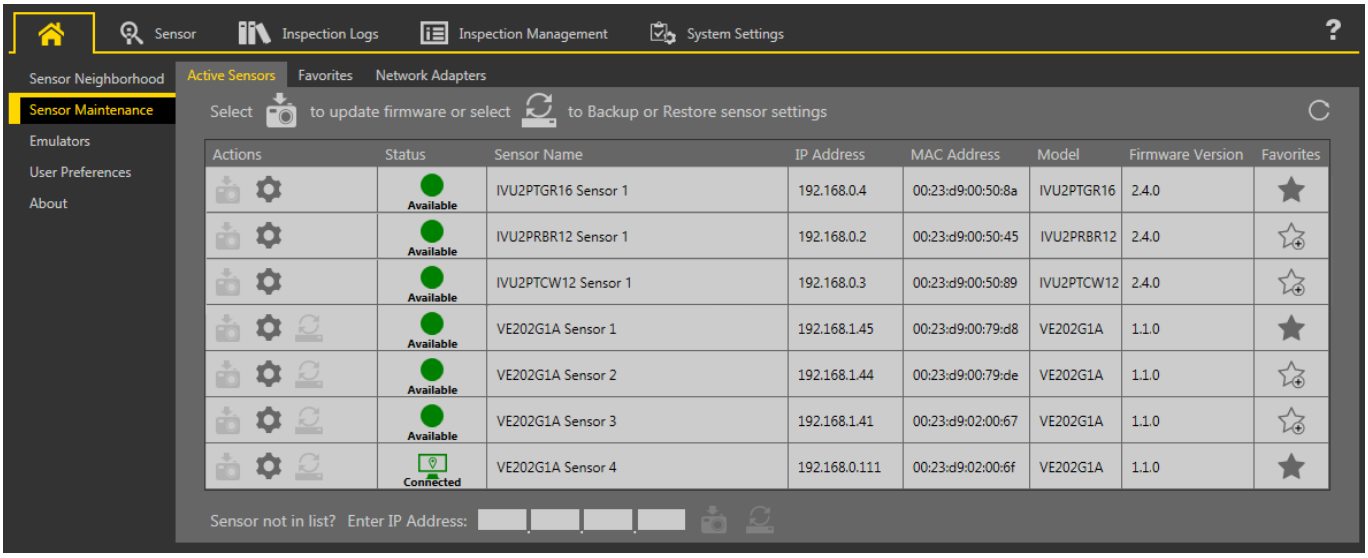


Network adapter information including Link Status (connected/not connected), Adapter name, IP Address, and Subnet Mask is also available.

5.2.2 Sensor Maintenance

Use **Sensor Maintenance** on the **Home** screen to view or change device properties.

Figure 18. Sensor Maintenance Tab



Sensor Maintenance includes sensor information such as sensor Status, Sensor Name, IP address, MAC address, Model number, Firmware Version, and which sensors are tagged as favorites.

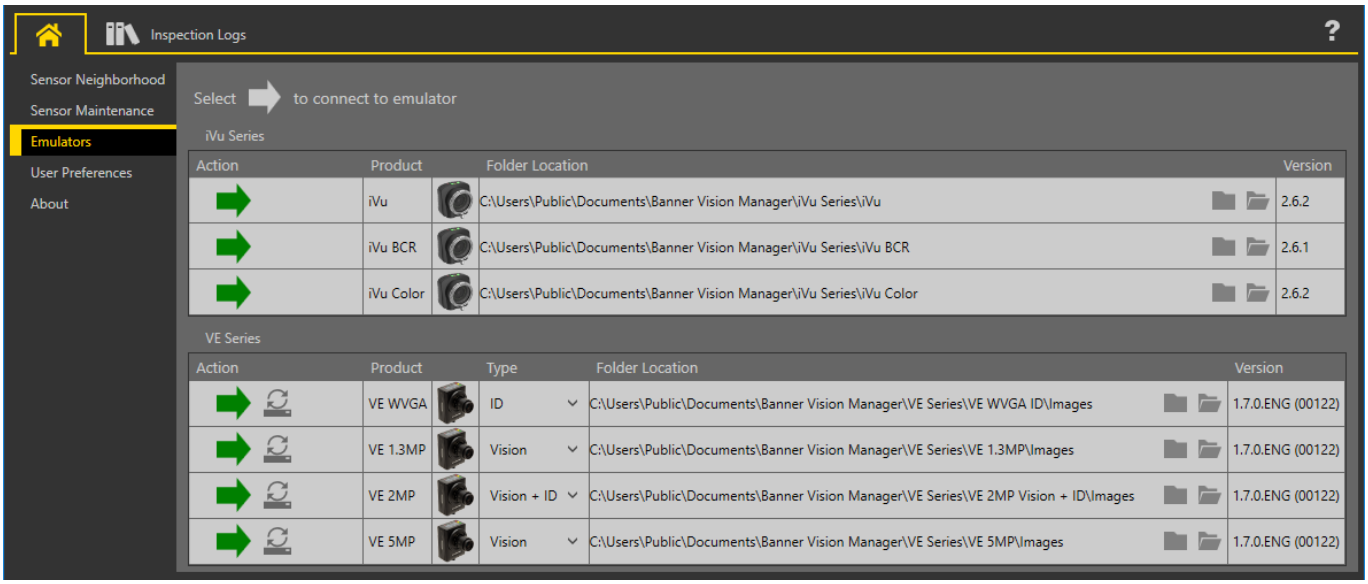
Actions include update firmware and view or change some sensor settings. Backup or restore sensor data is not available through Vision Manager. See .

Note: A firmware update requires a cable and a USB flash drive. See .

5.2.3 Emulators

Use **Emulators** on the **Home** screen to connect to the emulator.

Figure 19. Emulators



Click to connect to the desired emulator. This tab also displays the Image location on the computer, as well as the emulator version information.

Click under Folder Location to change the directory for inspections, logs, and the reference images. The default directory for images is `C:\Users\Public\Documents\Banner Vision Manager\iVu Series\[iVu model]\InspLog`. Both 8-bit monochrome bitmap (.bmp) images and inspection logs are supported. If inspection logs are placed in the InspLog directory, the emulator automatically extracts the image out of the inspection log and uses it to run the currently loaded inspection. Click to open the directory.

The **Emulators** tab includes all available features and all tools function the same as they do when running on a sensor. On the emulator, execution time is not calculated.

In general, the emulator is an inspection debugging tool where you can:

- Import stored inspections and a configuration from an iVu device
- Modify inspection parameters
- Restore the updated configuration back to the iVu device

To load files onto a live device, use a USB flash drive.

How to Use Bitmap Image Files with the iVu Emulator

You can use bitmap (.bmp) image files with the iVu Emulator for developing and simulating iVu inspections. The iVu Emulator only accepts image files in .bmp format. If you have other image file formats, use an image viewer/editor program to convert the files to 8-bit grayscale .bmp format for iVu TG models and to 24-bit color .bmp for iVu color models.

Note: Images smaller than the FOV are black-filled starting in the upper-right. Images larger than the FOV are cropped starting in the upper-left.

1. Copy the .bmp files into the InspLog folder in the corresponding iVu emulator folder.

   For example, copy .bmp files to `C:\Users\Public\Documents\Banner Vision Manager\iVu Series\[iVu model]\InspLog`.

   Note: Remove any existing .bmp or Log files in that folder to avoid confusion. The iVu Emulator automatically runs all .bmp/.log files sequentially according to filename.

2. Start Vision Manager and click **Emulators**.
3. Connect to the desired emulator.
4. Set the Trigger option to Internal.
   a. Go to **Main Menu** > **Image** > **Trigger**.

b. Set the **Trigger Interval** as desired.

The iVu Emulator runs using the .bmp files from Step 1.

Note: Banner does not recommend setting up inspections using these 8-bit grayscale images because you will need to modify the configuration after loading it on the iVu on the line. A better choice is to set up the inspection on the iVu Emulator using the Inspection Logs from the iVu.

5.2.4 About

Use **About** to view Vision Manager software information, including the version number.

5.3 Sensor Screen

Displays the device interface the same as on the actual device display or remote display.

Use the interface in the same manner as the iVu display.

*Figure 20. **Sensor** Screen*



6 Getting Started

Power up the iVu, and verify that the Power LED is ON green.

6.1 Setting up an Inspection

The device holds up to 30 inspections. Inspections may hold multiple sensors.

To set up an inspection:

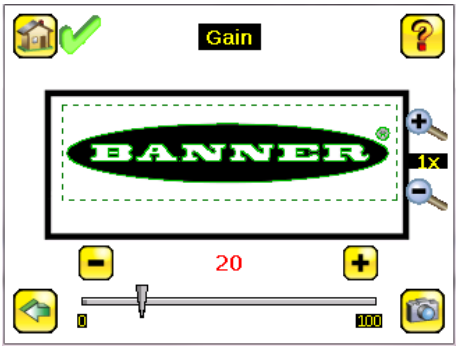
1. Acquire a good image.
2. Configure the sensor(s) in the inspection.
3. Configure multiple sensors in the inspection.

6.1.1 Acquiring a Good Image

The iVu needs to capture a good image of each part to ensure that it correctly passes good parts and fails bad parts.

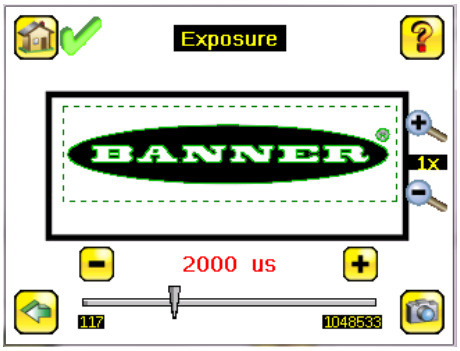
1. Go to **Main Menu** > **Imager** > **Auto Exposure** to run the **Auto Exposure** routine.
2. Check the lighting.
   - Make sure that the lighting is constant and consistent (unchanging over time, no shadows or hot spots).
   - Capture the shape and form of the target object with lighting that optimizes its contrast and separates it from the background. Depending on the target, this may mean the integral ring light is not the best choice and other Banner lights should be considered.
   - Adjust the mounting angle to provide the clearest image of the part features you are monitoring. The mounting bracket lets you easily position and adjust the iVu.
3. If needed, go to **Main Menu** > **Imager** > **Auto Exposure** to run the **Auto Exposure** routine a second time or adjust **Gain** and **Exposure** manually:
   - **Main Menu** > **Imager** > **Gain**

*Figure 21. **Gain** Screen*



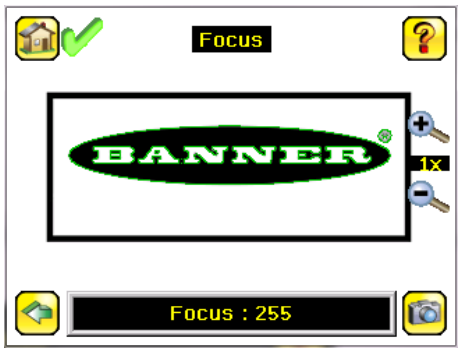
   - **Main Menu** > **Imager** > **Exposure**

*Figure 22. **Exposure** Screen*



4. Go to **Main Menu** > **Imager** > **Focus** to adjust the focus while monitoring the **Focus Number**:

*Figure 23. **Focus** Screen*



5. If you have an iVu color model, perform the white balance procedure to adjust the intensities of the color in the image so that the colors most closely match the actual objects.
    a. Go to **Imager** > **White Balance**.
    b. Move and adjust the white balance Region of Interest (ROI) to surround a white or gray object in the Field of View (FOV). If there is none, place a piece of white paper in front of the iVu to use for the white balance procedure.
    c. Click **Start**. The device moves through a series of triggers. If the sensor is not set to automatically trigger, you must manually click .

Adjust the Focus on a Micro Video Lens Model

1. Use the supplied 1/16 inch hex key to loosen the focusing window locking screw (**D**), then adjust focus on the iVu using the clear focusing window (**B**).
2. Adjust focus while monitoring the focus number. To ensure the best image, adjust the focus until the focus number peaks.

Figure 24. Adjust the Focus



Note: Turning the focusing window counter-clockwise focuses on closer objects, while turning the focusing window clockwise focuses on more distant objects.

3. After the best image has been acquired, lock the focusing window.

Figure 25. Micro Video Lens Model Components



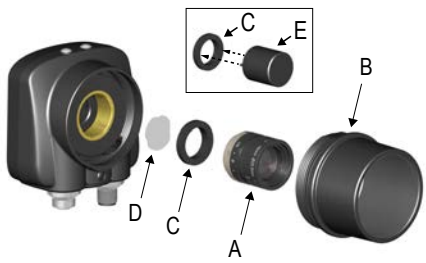
A	Lens
B	Focusing Window
C	Locking Clip
D	Locking Screw
E	Filter Cap
F	Filter

Note: The filter cap (E) and filter (F) are optional. Filter kits are available separately.

Adjust the Focus on a C-Mount Lens Model

1. Remove the lens enclosure.
2. Adjust the focus while monitoring the focus number. To ensure the best image, adjust the focus until the focus number peaks.
3. Replace the lens enclosure on the camera.

Figure 26. C-Mount Lens Model Components



A C-Mount Lens
B Lens Enclosure
C Retainer Ring
D Filter
E Filter Retainer Ring Tool

Note: The retainer ring (C) and filter (D) are optional. Filter kits are available separately.

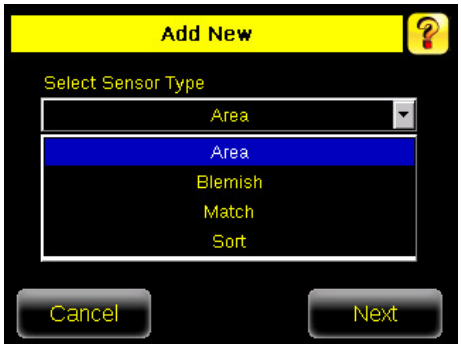
6.2 Add a New Inspection

Note: The iVu supports multiple inspections that facilitate storing and controlling up to 30 inspections of different sensor types.

To add a new stored inspection:

1. Go to **Main Menu** > **Inspection** > **Stored Inspections** and click **Add New**.

*Figure 27. **Add New** Screen (TG models shown)*

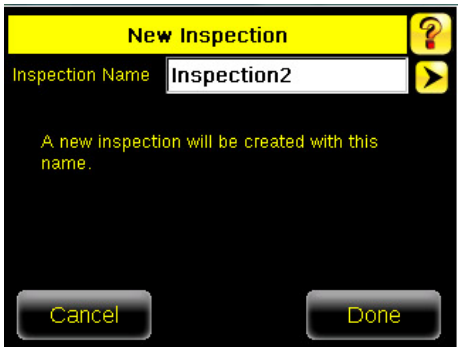


2. Select the Sensor Type for the new inspection, and click **Next**.

Sensor Type	Description
Area Sensor	Use an Area sensor to ensure that a feature, or multiple features, are present on a part. See Area Menu on p. 38.
Blemish Sensor	Use a Blemish sensor to find flaws on a part, or to make sure that a feature exists on a part. See Blemish Menu on p. 39.
Match Sensor	Use a Match sensor to verify that a pattern, shape, or part in any orientation matches a reference pattern. See Match Menu on p. 41.
Sort Sensor	Use a Sort sensor to recognize and sort up to ten different patterns within the same inspection. See Sort Menu on p. 42.
Average Color	Use an Average Color sensor to calculate the average color (RGB or HSI) within the area of interest on a part (color models only) . See Average Color Menu on p. 43.
Color Compare	Use a Color Compare sensor to verify whether a part's color matches a reference color (color models only) . See Color Compare Menu on p. 46.
Color Area	Use a Color Area sensor to ensure that a feature, or multiple features, are the correct color and are present on a part (color models only). See Color Area Menu on p. 47.

3. Click the yellow arrow to enter a custom inspection name, if desired.

*Figure 28. **New Inspection** Screen*



4. Click **Done**. The newly created inspection will now be the currently running inspection.

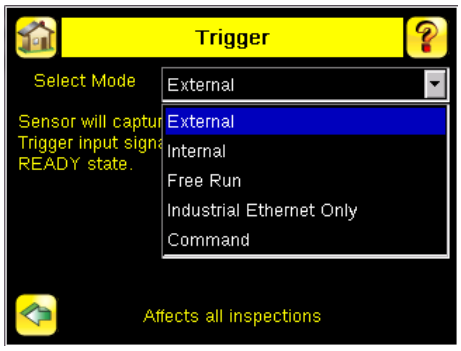
6.3 Trigger Modes

The iVu has five trigger modes that determine how the device captures and processes images:

- External
- Internal
- Free Run
- Industrial Ethernet Only
- Command

Select one of the trigger modes by accessing **Main Menu** > **Imager** > **Trigger** on the display. Trigger on p. 54 describes these trigger modes in more detail.

*Figure 29. **Trigger** Screen*

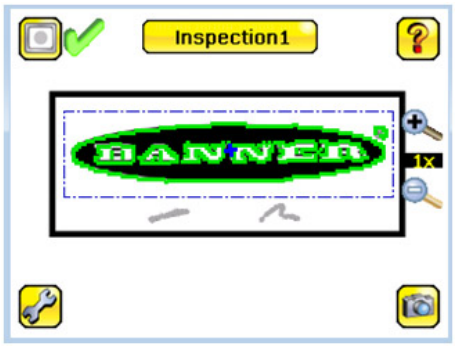


6.4 Change the Running Inspection

To change the currently running inspection:

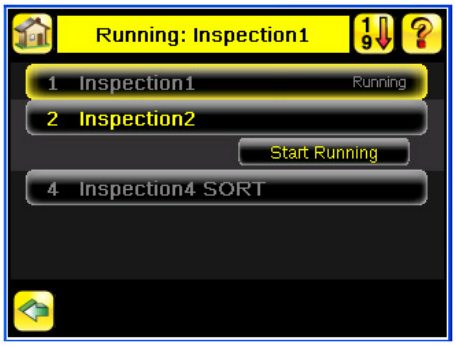
1. From the **Home** screen, click **[Inspection name]** in the top center of the screen to display all of the stored inspections.

*Figure 30. **Home** Screen*



2. Select the desired inspection and click **Start Running**.

*Figure 31. **Running [Inspection Name]** Screen*

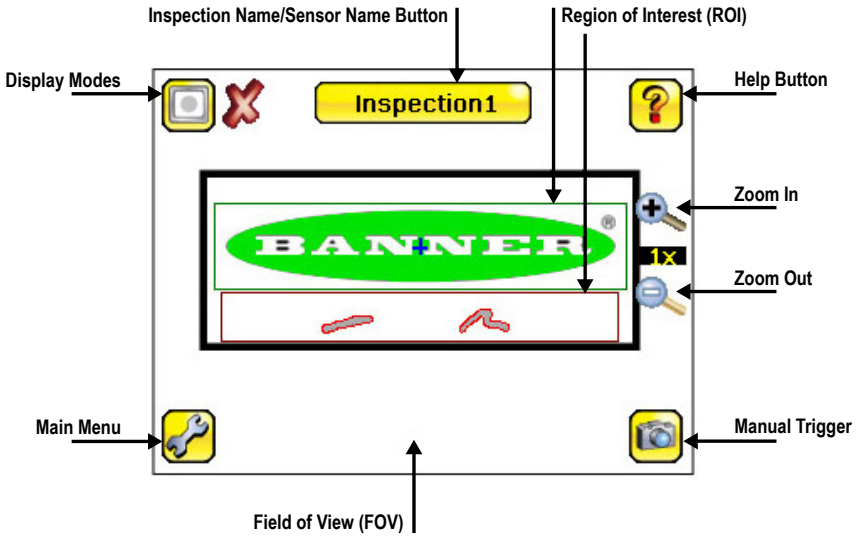


7 Device Home Screen

Use the **Home** screen on the iVu display to monitor inspections and to configure the iVu. Typically, the part being inspected is centered on the screen with the feature of interest bounded by the Region of Interest (ROI), a rectangle as shown below. The ROI can be rotated and resized, and is highlighted when selected for adjustment.

In following figure, there are two ROI because it is a multi sensor inspection. The green annotations indicate the object passes, and the red annotations indicate a failure. This sample inspection failed as shown by the red X next to the **Display mode** button.

*Figure 32. **Home** Screen*



7.1 Display Mode

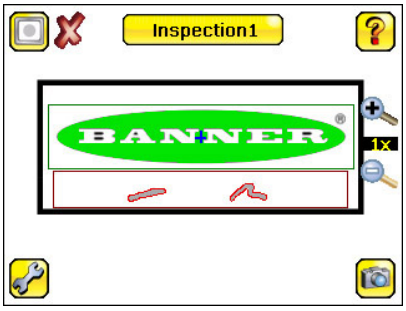
Main Menu > **Home** > **Display Mode (icon)**

Use the display mode button on the upper left corner of the display to cycle through all three display modes. The three display modes include: Image with Annotations, Image without Annotations, and Inspection Statistics.

7.1.1 Image with Annotations

Click **Display Mode** to show the image with the annotations on. The green or red areas indicate sensors that pass or fail in the ROI.

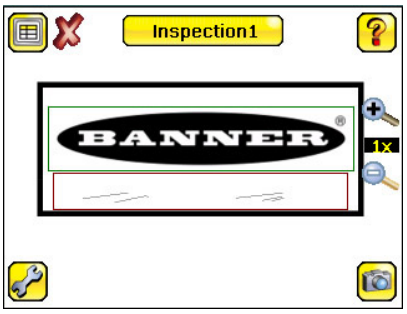
*Figure 33. **Home** Screen with Annotations*



7.1.2 Image without Annotations

Click **Display Mode** to see the image without the annotations from the sensors.

*Figure 34. **Home** Screen Without Annotations*



7.1.3 Inspection Statistics

Click **Display Mode** to access the Inspection Statistics.

The Inspection Statistic mode has three screens:

- History
- Inspection Result
- Inspection Inputs

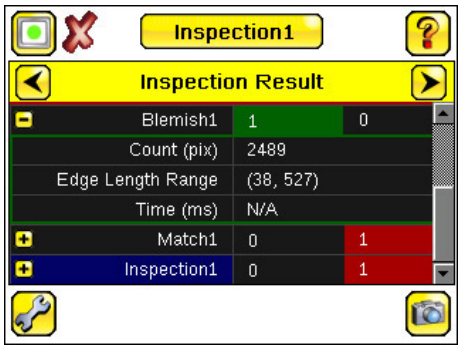
Click the arrows to access the other screens.

Inspection Results

The **Inspection Result** screen shows data about the current inspection being viewed.

The table contains the results of each sensor in the inspection. To view details of each sensor, click **+**. If a sensor fails, the box is red. An icon beside the sensor name indicates the reason it failed.

Figure 35. Inspection Result



History

The **History** screen shows inspection history from the last iVu reboot, or from the last time the statistics were reset. The history includes:

- Total Frames—Total number of inspections executed
- Passed—Running total of parts that passed inspection
- Failed—Running total of parts that failed inspection
- Missed triggers—Running total of missed triggers
- Time Range—Minimum and maximum inspection times observed

Click **Reset** to reset the statistics.

The table contains history of each sensor in the inspection. Expand or collapse data of each sensor as required using **+** and **–**. The green area indicates that the sensor passed. Red indicates that the sensor failed. If a sensor fails, an icon beside the sensor name indicates the reason for the failure.

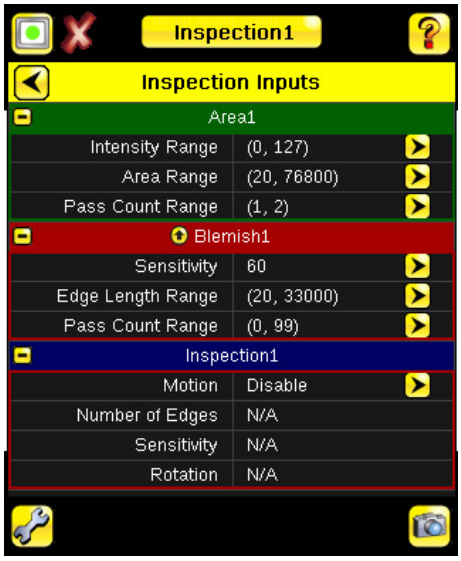
*Figure 36. **History** Screen*



Inspection Inputs

The **Inspection Input** screen lists the sensor settings. Use this screen to verify what inspection input settings were used on the latest inspection. Click **+** to expand the inspection information, or **–** to collapse the inspection information. Use the right arrows as a shortcut go to a sensor setting screen.

*Figure 37. **Inspection Inputs** Screen*



8 Device Main Menu

The Main Menu has four sections:

- **Inspection**—Modify inspection settings
- **Imager**—Run the Auto Exposure routine and adjust functions such as exposure, gain, and strobe
- **Logs**—Configure and view System and Inspection Logs
- **System**—Select the mode and manage the device

Figure 38. Menu Map - Part 1

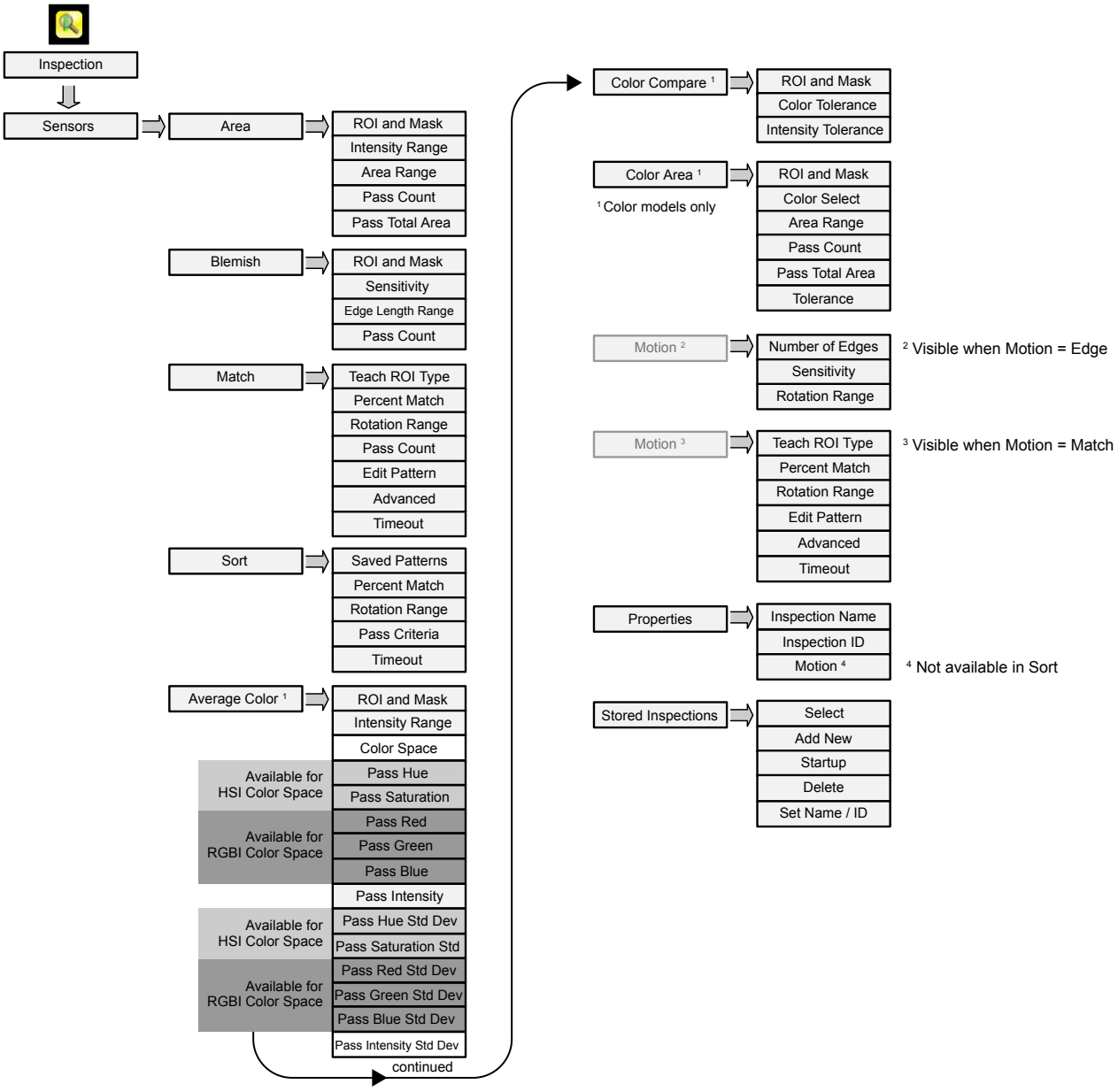
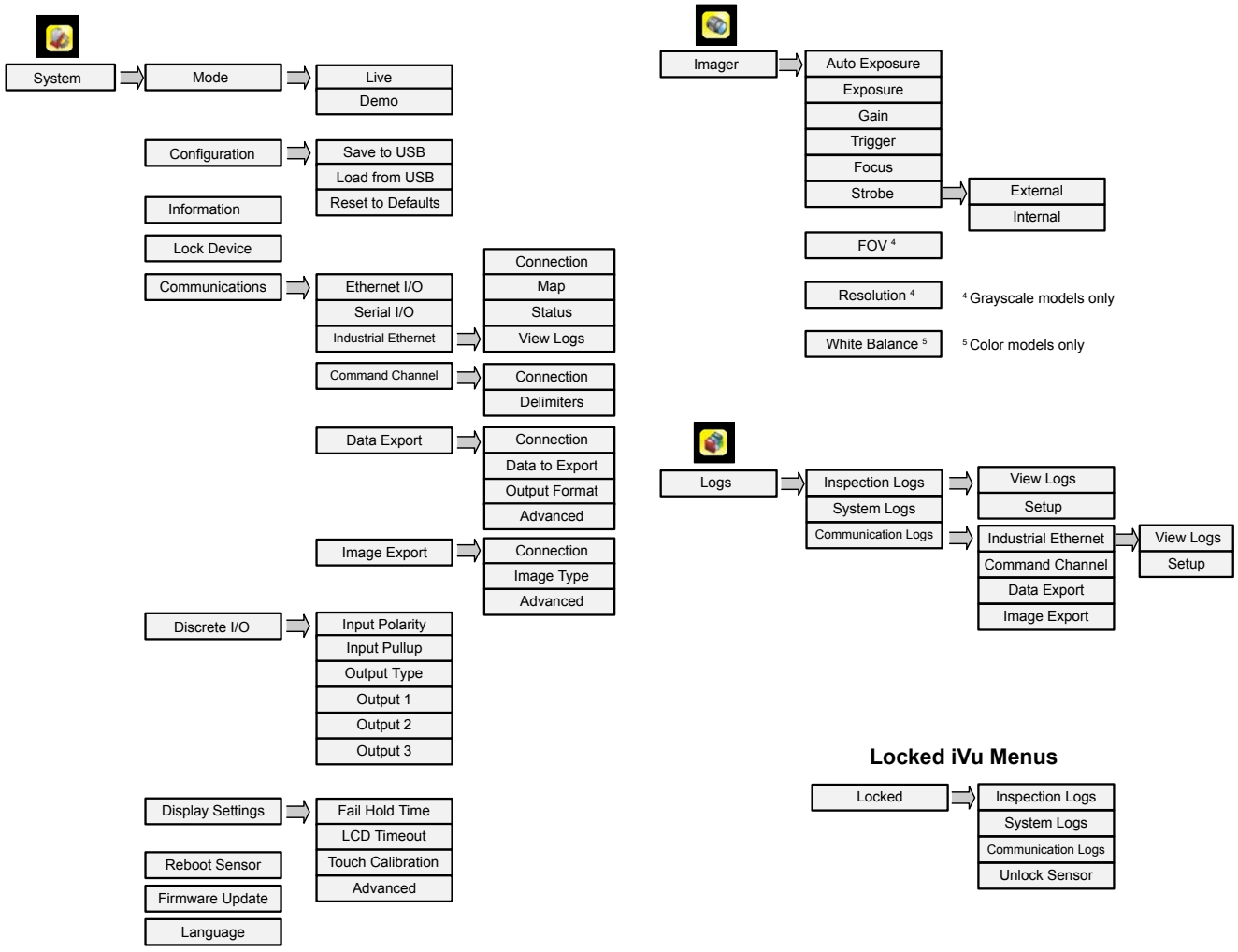


Figure 39. Menu Map - Part 2



8.1 Icon Reference

8.1.1 Action Icons

Icon	Description
	The **Main Menu** icon is on the bottom-left corner of the display on the **Home** screen. Click this icon to access sub-menus that are used to set up the iVu.
	The **Inspection** menu icon is located on the **Main Menu**. Click this icon to access parameters that need to be set for the current and all stored inspections.
	The **Imager** menu icon is located on the **Main Menu**. Click this icon to adjust parameters that affect the characteristics of the captured image.
	The **System** menu icon is located on the **Main Menu**. Click this icon to manage the device.
	The **Logs menu** icon is located on the **Main Menu**. Click this icon to set up, view, and save Inspection, Communications, and System Logs.
	The **Home Screen** icon is in the upper-left corner of the display when viewing menus and parameter screens in the **Main Menu**. Click this icon to quickly return to the **Home** screen.

Icon	Description
	The **Display Annotations** icon is one of three icons in the upper-left corner of the display while monitoring inspections on the **Home** screen. Click this icon to highlight features that the sensor finds.
	The **Hide Annotations** icon is one of three icons in the upper-left corner of the display while monitoring inspections on the **Home** screen. Click this icon to disable highlighting.
	The **Show Statistics** icon is one of three icons in the upper-left corner of the display while monitoring inspections. Click this icon to show inspection results and input parameters.
	The **Hide Log Timestamps** icon is one of the icons in the upper-left corner of the **Logs** screen. Click this icon to hide the time stamp for the logs.
	The **Show Log Timestamps** icon is one of the icons in the upper-left corner of the **Logs** screen. Click this icon to show the time stamp for the logs.
	The **Go Back** icon is located on the lower-left of the display while working in the **Main Menu**. Click this icon to return to the previous screen or menu.
	The **Help** icon is located in the upper-right corner of the display. Click this icon to view context-sensitive help for each screen.
	The **Manual Trigger** icon is located on the lower-right of the display on the **Home** screen. Click this icon to manually capture a new image.
	The **Save** icon is available at the bottom of screens such as the **Logs** screen. Click this icon to save data to a USB flash drive.
	The **Touch Calibration** screen displays the Touch Calibration point at various locations on the display. Every time the point displays, tap the center of the point to calibrate the touchscreen display.
	The **Zoom Out** icon is located on the right of the display. Click this icon to reduce the magnification of the image being displayed.
	The **Zoom In** icon is located on the right of the display. Click this icon to magnify the image being displayed.
	The **Intensity Selector** is located on the left of the of the **Intensity Range** screen. Click this icon to select the shade of one of the objects of interest. The **Color Selector** is located on the left side of the **Color** screen for the Color Area sensor. Click this icon to select the color of one of the objects of interest. (Color models only.)
	The **Decrement** icon decreases the currently displayed parameter value by one interval. Click and hold the icon to quickly decrement the value.
	The **Increment** icon increases the currently displayed parameter value by one interval. Click and hold the icon to quickly increment the value. In the Sort tool, this icon is used to indicate one of the ten storage locations for patterns.
	The **Add Mask** icon is on the left side of the display when masking is enabled. Click this icon to add a mask to the currently selected sensor.
	The **Delete Mask** icon is on the left side of the display when a mask is selected. Click this icon to delete a mask from the currently selected sensor.
	The **Circular Mask** icon is on the left side of the display when a mask is selected. Click this icon to cycle through and select a circular, elliptical, or rectangular-shaped mask.
	The **Elliptical Mask** icon is on the left side of the display when a mask is selected. Click this icon to cycle through and select a circular, elliptical, or rectangular-shaped mask.
	The **Rectangular Mask** icon is on the left side of the display when a mask is selected. Click this icon to cycle through and select a circular, elliptical, or rectangular-shaped mask.
	The **Eraser** icon is located on the left side of the screen when a Match tool is in **Edit Pattern** mode. Click this icon to enable erasing pixels from a taught pattern.
	The **Draw** icon is located on the left side of the screen when a Match tool is in **Edit Pattern** mode. Click this icon to enable restoring removed pixels to a taught pattern.

8.1.2 Display Icons

Icon	Description
	The **Inspection Passed** icon is located in the upper-left of the display. This icon indicates that the last inspection passed the test conditions.
	One of the possible **Inspection Failed** icons located in the upper-left of the display. This icon indicates that the last inspection failed.
	One of the possible **Sensor Failed** icons located in the Inspection Statistic table. This icon indicates that the sensor failed because the number of objects exceeded the test count.
	One of the possible **Sensor Failed** icons located in the Inspection Statistic table. This icon indicates that the sensor failed because there were fewer objects than specified by the test count.
	One of the possible **Sensor Failed** icons located in the Inspection Statistic table. This icon indicates that the sensor failed because the inspection timed out.
	One of the possible **Inspection Failed** icons located in the upper-left of the display. This icon indicates that the sensor is in fail hold mode.
	The **Device Locked** icon is located in the upper-left of the display. This icon indicates that the device is in a locked state. If no icon is displayed, the device is unlocked.

8.1.3 Communications Log Icons

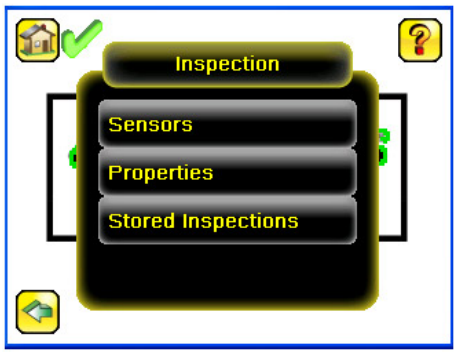
Icon	Description
	Port open.
	Port closed.
	Indicates that the command has been processed without errors.
	Indicates that the incoming entry is stalled (no new bytes), or end-of-frame delimiter was not received, or client is not reading data on Ethernet.
	Indicates whether the response frame contains an error or is dropped, the log entry icons for the request and the response frames are red, and the displayed error count increments by one.
	If the command takes a long time to process, the last long entry changes to an hourglass (for example, during trigger of long inspections).

9 Device Inspection Menu

Main Menu > **Inspection**

Adjust settings for an inspection using the **Inspection menu** icon, located on the **Main Menu**. Each type of sensor has specific settings that are available. The **Inspection Menu** is also where stored inspections can be managed.

Figure 40. Inspection Menu

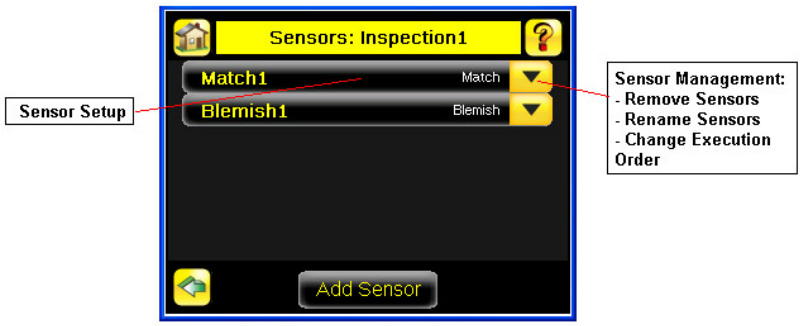


9.1 Sensors Menu

Main Menu > **Inspection** > **Sensors**

The **Sensors Menu** shows the list of sensor(s) that are included in the current inspection. Click **Add Sensor** to add a new sensor into the current inspection.

Figure 41. Sensors Menu



9.1.1 Area Menu

Main Menu > **Inspection** > **Sensors** > **Area**

Use an Area sensor to ensure that a feature, or multiple features, are present on a part. When setting up the iVu for an Area inspection, a feature, such as a drilled hole, is identified as well as the size (area) expected. If there is more than one of the identified features on a part, the number expected can be set as well. During the inspection, the sensor verifies that each part or package includes the specified number of features.

Example applications include:

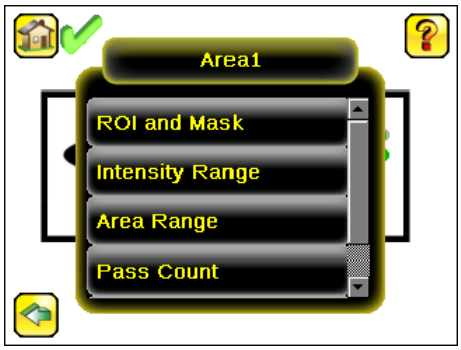
- Inspections that check for drilled holes on a part
- Inspections that check for correctly stamped parts
- Inspections that ensure proper packaging (for example, check that a packing slip exists in or on a box; test whether a vial is properly capped)
- Inspections of blister packs

To configure as an Area sensor, set the following parameters:

- **ROI and Mask**—Rectangle, elliptical, or circle
- **Intensity Range**—Range of grayscale values of a feature of interest
- **Area Range**—Size range of a feature of interest
- **Pass Count**—Number of features
- **Pass Total Area**—Total size of all features

To see a working example of the sensor configured as an Area sensor, see Demo Mode.

*Figure 42. **Area** Menu*



ROI and Mask

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **ROI and Mask**

Note: *Sensor Type* in the menu path above refers to the sensor you are configuring or updating.

The Region of Interest (ROI) is the user-defined area on the screen that the sensor analyzes. The ROI type can be rectangular, elliptical, or circular. From the drop-down list, select the ROI type to use for the inspection. Adjust the ROI as appropriate for the inspection. An ROI can be as large as the entire Field of View (FOV).

Select the **Enable Mask** checkbox to allow mask ROIs to be used with the inspection ROI.

Intensity Range

Main Menu > **Inspection** > **Sensors** > **Area** > **Intensity Range**

Intensity Range is the range of grayscale values the sensor should look for. To set the Intensity Range, use the eye dropper to select the target feature. Use the slider to fine tune the selection. As the slider is moved, green highlighted areas indicate the objects the sensor finds.

Note: Objects that are colored yellow are found, but filtered out. This is because these objects fall outside of the Area Range. See Area Range on p. 39 to adjust this setting.

Area Range

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Area Range**

Use Area Range to set the size limits of a feature of interest. Move the slider to select the range. Areas are measured by counting pixels. For example, a rectangular feature that is 100 pixels wide by 200 pixels tall has an area of roughly 20,000 pixels.

Pass Count

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Pass Count**

The **Minimum Pass Count** is the minimum number of parts, labels, or features expected to fall within the specified criteria. The **Maximum Pass Count** is the maximum number expected to fall within the specified criteria. These settings are used to determine the pass or fail result of the inspection.

Pass Total Area

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Pass Total Area**

Use **Pass Total Area** to set the desired total area of all features that the sensor must find in order to pass the inspection. Move the slider to select the range. Areas are measured by counting pixels. For example, a rectangular feature that is 100 pixels wide by 200 pixels tall has an area of roughly 20,000 pixels. Two features of this size have an area of roughly 40,000 pixels.

9.1.2 Blemish Menu

Main Menu > **Inspection** > **Sensor** > **Blemish**

Use a Blemish sensor to find flaws on a part (for example, scratches on a disc), or to make sure that a feature exists on a part. Although verifying whether a feature is present on a part is more commonly an Area sensor application, a Blemish sensor may be a better option when dealing with variable materials or uneven lighting.

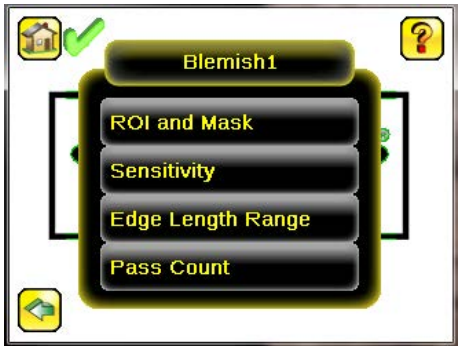
Example applications include:

- Inspections that check for scratches on a part, and reject parts where the scratches are too numerous or larger than acceptable
- Inspections that check for the presence of a label or marking on a part that may vary in color

To configure as a Blemish sensor, set the following parameters:

- **ROI and Mask**
- **Sensitivity**
- **Edge Length Range**
- **Pass Count**

*Figure 43. **Blemish** Menu*



ROI and Mask

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **ROI and Mask**

Note: *Sensor Type* in the menu path above refers to the sensor you are configuring or updating.

The Region of Interest (ROI) is the user-defined area on the screen that the sensor analyzes. The ROI type can be rectangular, elliptical, or circular. From the drop-down list, select the ROI type to use for the inspection. Adjust the ROI as appropriate for the inspection. An ROI can be as large as the entire Field of View (FOV).

Select the **Enable Mask** checkbox to allow mask ROIs to be used with the inspection ROI.

Sensitivity

Main Menu > **Inspection** > **Sensors** > **Blemish** > **Sensitivity**

Use **Sensitivity** to fine-tune how sensitive the sensor is to finding blemish or other edges within the ROI.

The sensitivity value helps account for light variations that might affect how well the sensor detects edges on inspected parts. The sensitivity scale is from 0 to 100, where 0 means least sensitive and 100 means most sensitive. If set near 0, the sensor only finds very sharp edges with strong contrast. If set near 100, the sensor finds very dim or blurry edges, and may be unstable due to noise within the image.

Edge Length Range

Main Menu > **Inspection** > **Sensors** > **Blemish** > **Edge Length Range**

The sensor counts all the edge pixels it detects in the ROI. The bar at the bottom of the **Edge Length Range** screen shows all the different contiguous edge segments found. Use the slider brackets to specify the edge length range in pixels. Edges found within this range are considered to calculate the Pass Count. Edge segments within the two brackets [ ] are highlighted in green and those outside the brackets are ignored and colored yellow. Move each bracket to add or remove more of the edge segments from consideration. Zoom in to refine the range.

Pass Count (Pixels)

Main Menu > **Inspection** > **Sensors** > **Blemish** > **Pass Count**

The sensor aggregates all of the edge pixels that fall within the Edge Length Range and indicates the value with a small colored bar at the bottom of the screen. If the result is within the range brackets, the bar is green, otherwise it is yellow.

The Minimum Pass Count is the minimum number of pixels expected to fall within the specified criteria. The Maximum Pass Count is the maximum number of pixels expected to fall within the specified criteria. These settings are used to determine the pass or fail result of the inspection.

9.1.3 Match Menu

Main Menu > **Inspection** > **Sensors** > **Match**

Use a Match sensor to verify that a pattern, shape, or part in any orientation matches a reference pattern. Teach the reference pattern during setup. A reference pattern might include alphanumeric characters, logos, or any other shapes. During an inspection, the sensor checks that each part or package being inspected matches the reference pattern. If there is more than one of the identified pattern, set the number of expected matches.

Example applications include:

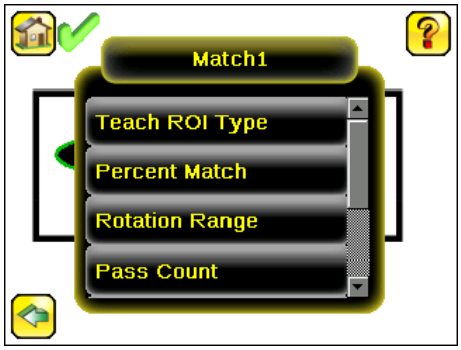
- Date/Lot code inspections
- Label inspections
- Part etching inspections
- Part orientation inspections
- Part shape inspections

To configure a Match sensor, set the following parameters:

- Teach ROI Type
- Percent Match
- Rotation Range
- Pass Count
- Edit Pattern
- Advanced
- Timeout

To see a working example of the sensor configured as a Match sensor, see Demo Mode.

*Figure 44. **Match** Menu*



Teach ROI Type

Main Menu > **Inspection** > **Sensors** > **Match** > **Teach ROI Type**

The Region of Interest (ROI) is the user-defined area on the screen that the sensor analyzes. The ROI type can be rectangular, elliptical, or circular. From the drop-down list, select the ROI type to use for the inspection. Adjust the ROI as appropriate for the inspection. An ROI can be as large as the entire Field of View (FOV).

Percent Match

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Percent Match**

Percent Match adjusts how closely the inspected part or label must match the reference part or label. The Percent Match scale is from 0 to 100, where 0 is the most tolerant and 100 is the least tolerant. Move the slider to adjust the tolerance.

Rotation Range

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Rotation Range**

Rotation Range sets the expected rotation of parts or labels during an inspection. For example, a value of 45 means that the part may rotate 45 degrees in either direction from the reference part and still pass. Move the slider from 0 to 180 degrees.

Note: The smaller the rotation range, the faster the inspection will run.

Pass Count

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Pass Count**

The **Minimum Pass Count** is the minimum number of parts, labels, or features expected to fall within the specified criteria. The **Maximum Pass Count** is the maximum number expected to fall within the specified criteria. These settings are used to determine the pass or fail result of the inspection.

Edit Pattern

Main Menu > **Inspection** > **Sensors** > **Match** > **Edit Pattern**

The **Edit Pattern** feature allows pixels in a taught pattern to be removed, or restored after being removed. Click **Eraser** to remove pixels from the pattern. Click **Draw** to restore removed pixels to the pattern.

Advanced

Main Menu > **Inspection** > **Sensors** > **Match** > **Advanced**

Use the **Advanced** menu to enable **Search ROI** and **Track with Motion**. These options apply to all Match sensors in the current inspection.

- **Search ROI**—Sets a custom region within the field of view to search for the pattern. When **Search ROI** is enabled, both Teach and Search ROIs display. The Teach ROI is blue. The Search ROI is green or red, depending on whether the sensor passes or fails.
- **Track with Motion**—Moves the ROIs with Motion. Motion must be enabled under **Inspection** > **Properties**.

Timeout

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Timeout**

When the sensor type is set as Match or Sort, use the **Timeout** screen to adjust the maximum time the inspection is allowed to execute. A timeout error is reported in the case the inspection runs out of time. If this value is set too high, the sensor can miss triggers while trying to detect a bad pattern.

9.1.4 Sort Menu

Main Menu > **Inspection** > **Sensors** > **Sort**

Use a Sort sensor to recognize and sort up to ten different patterns within the same inspection. Teach each reference pattern during setup. Store reference patterns in one of ten pattern memory locations. A reference pattern might include alphanumeric characters, logos, or any other shapes. The pass criteria can be set for any or all of the patterns.

Example application include:

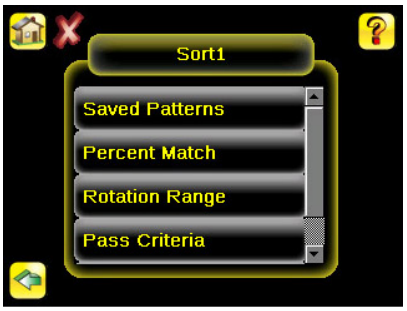
- Identify and sort parts on a production line
- Ensure that several different parts are present in a package

The Sort sensor is a single sensor inspection. It must be the only sensor in the inspection. Add a Sort sensor from **Main Menu** > **Inspection** > **Stored Inspections** > **Add New**.

Use the Sort sensor parameters to manage stored patterns and to configure Sort sensor inspection parameters:

- Saved Patterns
- Percent Match
- Rotation Range
- Pass Criteria
- Timeout

*Figure 45. **Sort** Menu*



Saved Patterns

Main Menu > **Inspection** > **Sensors** > **Sort** > **Saved Patterns**

Use the **Saved Patterns** screen to save a taught pattern to an empty pattern storage location or to overwrite an existing pattern. Ten pattern storage locations are available. Patterns can be deleted from a storage location, named, or renamed from this screen.

Percent Match

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Percent Match**

Percent Match adjusts how closely the inspected part or label must match the reference part or label. The Percent Match scale is from 0 to 100, where 0 is the most tolerant and 100 is the least tolerant. Move the slider to adjust the tolerance.

Rotation Range

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Rotation Range**

Rotation Range sets the expected rotation of parts or labels during an inspection. For example, a value of 45 means that the part may rotate 45 degrees in either direction from the reference part and still pass. Move the slider from 0 to 180 degrees.

Note: The smaller the rotation range, the faster the inspection will run.

Pass Criteria

Main Menu > **Inspection** > **Sensors** > **Sort** > **Pass Criteria**

Four options define the pass criteria for a Sort sensor inspection. The options are described below, using an example where there are two saved patterns.

- **Any Saved Pattern**—Pass condition if the sensor matches either Pattern_1, Pattern_2, or both
- **All Saved Patterns**—Pass condition if the sensor matches both Pattern_1 AND Pattern_2
- **Single Saved Pattern**—Pass condition if the sensor matches either Pattern_1 OR Pattern_2, but not both
- **Specific Saved Pattern**—Pass condition when the sensor matches only Pattern_2 (requires selecting a saved pattern to match, in this example, Pattern_2)

Timeout

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Timeout**

When the sensor type is set as Match or Sort, use the **Timeout** screen to adjust the maximum time the inspection is allowed to execute. A timeout error is reported in the case the inspection runs out of time. If this value is set too high, the sensor can miss triggers while trying to detect a bad pattern.

9.1.5 Average Color Menu

Available on iVu Color models only.

Main Menu > **Inspection** > **Sensors** > **AvgColor**

Use an Average Color sensor to visually inspect a part by analyzing all colors in the Region of Interest (ROI) and reducing them to a single set of color values, the average of the combined colors in the ROI. The Average Color sensor is used to report which color, on average, is being seen by the sensor.

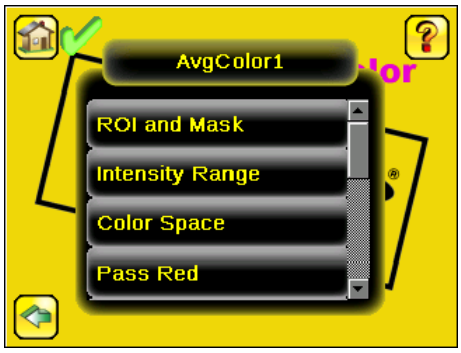
Example applications include:

- Differentiating between the colors of caps on bottles
- Sorting between dark blue and light blue items on an assembly line
- Matching burgundy trim pieces in automotive assembly

To configure as an Average Color sensor, set the following parameters:

RGBI Color Space Options	HSI Color Space Options
• **ROI and Mask** • **Intensity Range** • **Color Space** • **Pass Red**— Pass Color: Red, Green, Blue on p. 45 • **Pass Green**— Pass Color: Red, Green, Blue on p. 45 • **Pass Blue**— Pass Color: Red, Green, Blue on p. 45 • **Pass Intensity**— Pass Intensity on p. 45 • **Pass Red Std Dev**— Pass Color Standard Deviation: Red, Green, Blue on p. 45 • **Pass Green Std Dev**— Pass Color Standard Deviation: Red, Green, Blue on p. 45 • **Pass Blue Std Dev**— Pass Color Standard Deviation: Red, Green, Blue on p. 45 • **Pass Intensity Std Dev**— Pass Intensity Standard Deviation on p. 46	• **ROI and Mask** • **Intensity Range** • **Color Space** • **Pass Hue**— Pass Hue on p. 45 • **Pass Saturation**— Pass Saturation on p. 45 • **Pass Intensity**— Pass Intensity on p. 45 • **Pass Hue Std Dev**— Pass Hue Standard Deviation on p. 45 • **Pass Saturation Std Dev**— Pass Saturation Standard Deviation on p. 46 • **Pass Intensity Std Dev**— Pass Intensity Standard Deviation on p. 46

*Figure 46. **Average Color** Menu*



ROI and Mask

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **ROI and Mask**

Note: *Sensor Type* in the menu path above refers to the sensor you are configuring or updating.

The Region of Interest (ROI) is the user-defined area on the screen that the sensor analyzes. The ROI type can be rectangular, elliptical, or circular. From the drop-down list, select the ROI type to use for the inspection. Adjust the ROI as appropriate for the inspection. An ROI can be as large as the entire Field of View (FOV).

Select the **Enable Mask** checkbox to allow mask ROIs to be used with the inspection ROI.

Intensity Range

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Intensity Range**

Intensity Range allows a range of brightness in the image. In the other words, it can be used to exclude image that is too dark, too bright, or both.

To set the **Intensity Range**, adjust the bracket sliders.

Color Space

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Color Space**

Two color space options are available:

- **RGBI**—The average and standard deviation values for each of Red, Green, Blue, and Intensity within the ROI are calculated
- **HSI**—The average and standard deviation values for each of Hue, Saturation, and Intensity within the ROI are calculated

RGBI

For Red, Green, Blue, and Intensity (RGBI):

- Red—The average of the red color component, represented as a number from 0 to 255. Fully saturated red is a [255, 0, 0].
- Green—The average of the green color component, represented as a number from 0 to 255. Fully saturated green is a [0, 255, 0].
- Blue—The average of the blue color component, represented as a number from 0 to 255. Fully saturated blue is a [0, 0, 255].
- Intensity—The average brightness of a color, represented in a number from 0 (black) to 255 (white).

HSI

Hue, Saturation, and Intensity (HSI) is a representation of color space that is closer to human perception of color dynamics. The greater the range of colors of the pixels within the ROI, the higher the standard deviation will be. If all pixels are uniformly the same color, the standard deviation is zero.

For Hue, Saturation, and Intensity (HSI):

- Hue—The wavelength of predominant color. A representation of average hue as an angle in degrees around a circle, which will always be between 0 and 359: 0 = red, 120 = green, 240 = blue.
- Saturation— The amount of a specific Hue. A representation of average saturation as a distance from the center of the circle where 0 is the center of the circle (and could include the colors black, white, and gray) and 100 would be on the very edge of the color map circle. With a higher saturation number, the color represented is more vivid.
- Intensity—The average brightness of a color, represented in a number from 0 (black) to 255 (white).

Pass Color: Red, Green, Blue

Pass Red, **Pass Green**, and **Pass Blue** are available when the color space is set to RGBI.

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Pass [Color]**.

Use the sliders to set the range of color that will pass the inspection. The average of the color component is represented as a number from 0 to 255.

Pass Hue

Pass Hue is available when the color space is set to HSI.

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Pass Hue**

Use the sliders to set the desired hue range. The range is from 0 to 359.

Pass Saturation

Pass Saturation is available when the color space is set to HSI.

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Pass Saturation**

Use the sliders to set the desired saturation range. The range is from 0 to 100.

Pass Intensity

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Pass Intensity**.

Use the sliders to set the intensity that will pass the inspection. Intensity is the average brightness of a color, represented in a number from 0 to 255.

Pass Color Standard Deviation: Red, Green, Blue

Pass Red Standard Deviation, **Pass Green Standard Deviation**, and **Pass Blue Standard Deviation** are available when the color space is set to RGBI.

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Pass [Color] Std Dev**

Use the sliders to set the range of color standard deviation that will pass the inspection. The standard deviation is represented as a number from 0 to 128.

Standard deviation tests the variance of color. The greater the range of colors of the pixels within the ROI, the higher the standard deviation will be. If all pixels are uniformly the same color, the standard deviation will be zero.

Pass Hue Standard Deviation

Pass Hue Standard Deviation is available when the color space is set to HSI.

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Pass Hue Std Dev**

Use the sliders to set the desired hue standard deviation range. The range is from 0 to 180.

Standard deviation tests the variance of color. The greater the range of colors of the pixels within the ROI, the higher the standard deviation will be. If all pixels are uniformly the same color, the standard deviation will be zero.

Pass Saturation Standard Deviation

Pass Saturation Standard Deviation is available when the color space is set to HSI.

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Pass Saturation Std**

Use the sliders to set the desired saturation standard deviation range. The range is from 0 to 50.

Standard deviation in saturation tests the variance of the amount of the selected Hue in the color. The greater the variation in saturation among the pixels within the ROI, the higher the standard deviation will be. If all pixels are uniformly the same color, the standard deviation will be close to zero.

Pass Intensity Standard Deviation

Main Menu > **Inspection** > **Sensors** > **AvgColor** > **Pass Intensity Std Dev**

Use the sliders to set the intensity standard deviation that will pass the inspection. The available range is 0 to 128.

Standard deviation tests the variance of color. The greater the range of colors of the pixels within the ROI, the higher the standard deviation will be. If all pixels are uniformly the same color, the standard deviation will be zero.

9.1.6 Color Compare Menu

Available on iVu Color models only.

Main Menu > **Inspection** > **Sensors** > **ColorCmp**

Use a Color Compare sensor to verify that a part's color matches a reference color. The Color Compare sensor looks for a statistical match for both the specific hue(s) and relative abundance of colors seen within the ROI.

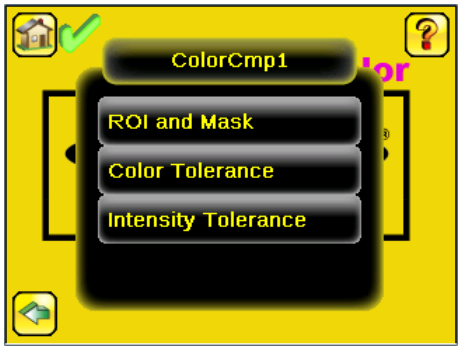
Example applications include:

- Verify healthy fruit color and ripeness
- Verify stain color on wood
- Verify product color in packaging applications

To configure as a Color Compare sensor, set the following parameters:

- **ROI and Mask**
- **Color Tolerance**
- **Intensity Tolerance**

*Figure 47. **Color Compare** Menu*



ROI and Mask

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **ROI and Mask**

Note: *Sensor Type* in the menu path above refers to the sensor you are configuring or updating.

The Region of Interest (ROI) is the user-defined area on the screen that the sensor analyzes. The ROI type can be rectangular, elliptical, or circular. From the drop-down list, select the ROI type to use for the inspection. Adjust the ROI as appropriate for the inspection. An ROI can be as large as the entire Field of View (FOV).

Select the **Enable Mask** checkbox to allow mask ROIs to be used with the inspection ROI.

Color Tolerance

Main Menu > **Inspection** > **Sensors** > **ColorCmp** > **Color Tolerance**

Use **Color Tolerance** to adjust the maximum acceptable difference (in %) between the taught color and the color detected in the live image.

The live value drawn inside the slider indicates the color difference for the current image. Move the slider to the right to increase the maximum acceptable difference.

Intensity Tolerance

Main Menu > **Inspection** > **Sensors** > **ColorCmp** > **Intensity Tolerance**

Intensity Tolerance defines the grayscale brightness level necessary to constitute a match. This value ranges from 0 to 255.

As the Intensity Tolerance value is changed, the acceptable minimum and maximum limits on either side of the Reference are calculated. When this tolerance is set to 0, only the taught intensity of each color is acceptable; that is, no change in intensity is allowed. Or, to say it another way, the intensity of illumination for a given color target cannot change.

9.1.7 Color Area Menu

Available on iVu Color models only.

Main Menu > **Inspection** > **Sensors** > **ColorArea**

Use a Color Area sensor to separate same color blobs, or Binary Large Objects, from the larger scene and to analyze parts with color variations that cannot accurately be detected by gray scale sensors. Use an Color Area sensor to ensure that a specific color feature, or multiple features, are present on a part. If there is more than one of the identified features on a part, the number expected can be set as well. During the inspection, the sensor verifies that each part or package includes the correct color and specified number of features.

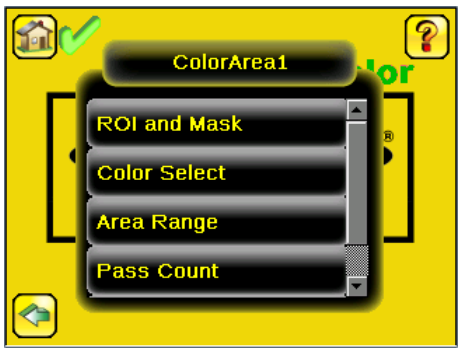
Example applications include:

- Verify a fuse and its color, such as dark blue or light blue
- Check how many red parts are present
- Verify the color and correct number of objects in a case

To configure as a Color Area sensor, set the following parameters:

- **ROI and Mask**
- **Color Select**
- **Area Range**
- **Pass Count**
- **Pass Total Area**
- **Tolerance**

*Figure 48. **Color Area** Menu*



ROI and Mask

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **ROI and Mask**

Note: *Sensor Type* in the menu path above refers to the sensor you are configuring or updating.

The Region of Interest (ROI) is the user-defined area on the screen that the sensor analyzes. The ROI type can be rectangular, elliptical, or circular. From the drop-down list, select the ROI type to use for the inspection. Adjust the ROI as appropriate for the inspection. An ROI can be as large as the entire Field of View (FOV).

Select the **Enable Mask** checkbox to allow mask ROIs to be used with the inspection ROI.

Color Select

Main Menu > **Inspection** > **Sensors** > **ColorArea** > **Color Select**

Use **Color Select** to select the color the **Color Area** sensor looks for. Click **Color Selector** then click the desired color in the ROI. Adjust the color tolerance using **+** and **-**.

Note: You can select a color that is outside of the ROI, but a BLOB of that color will only be detected within the ROI.

Area Range

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Area Range**

Use Area Range to set the size limits of a feature of interest. Move the slider to select the range. Areas are measured by counting pixels. For example, a rectangular feature that is 100 pixels wide by 200 pixels tall has an area of roughly 20,000 pixels.

Pass Count

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Pass Count**

The **Minimum Pass Count** is the minimum number of parts, labels, or features expected to fall within the specified criteria. The **Maximum Pass Count** is the maximum number expected to fall within the specified criteria. These settings are used to determine the pass or fail result of the inspection.

Pass Total Area

Main Menu > **Inspection** > **Sensors** > **[Sensor Type]** > **Pass Total Area**

Use **Pass Total Area** to set the desired total area of all features that the sensor must find in order to pass the inspection. Move the slider to select the range. Areas are measured by counting pixels. For example, a rectangular feature that is 100 pixels wide by 200 pixels tall has an area of roughly 20,000 pixels. Two features of this size have an area of roughly 40,000 pixels.

Tolerance

Main Menu > **Inspection** > **Sensors** > **ColorArea** > **Tolerance**

Adjust the tolerance for the color the sensor is looking for. Adjustments are made individually for hue, saturation, and intensity.

9.2 Motion Menu

Main Menu > **Inspection** > **Motion**

Enable Motion when the part being inspected is expected to move or rotate. Motion settings for **Edge** involve selecting the number of edges to locate, adjusting sensitivity, and selecting whether rotation is enabled. Motion settings for **Match** involve selecting the Teach ROI type, adjusting the percent match and rotation range, editing the taught pattern, and setting a timeout. These settings are available on the **Inspection Menu** after Motion is set to **Edge** or **Match**.

Motion is not available for Sort sensors.

Edge Options	Match Options
• Number of Edges • Sensitivity • Rotation Range	• Teach ROI Type • Percent Match • Rotation Range • Edit Pattern • Advanced • Timeout

*Figure 49. **Motion Menu** when Motion is set to **Edge***

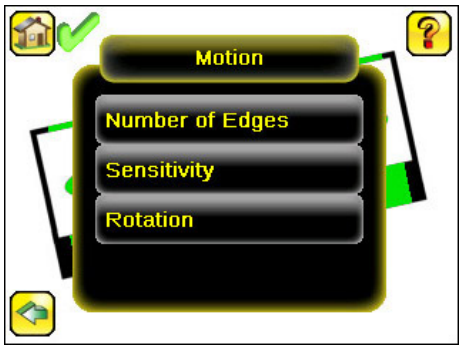
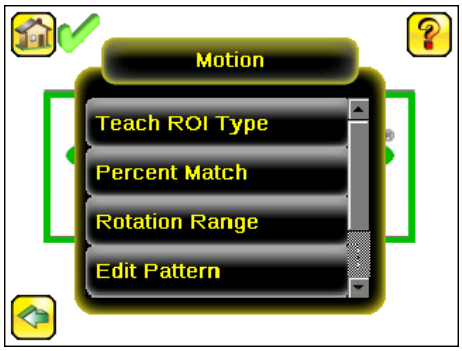


*Figure 50. **Motion Menu** when Motion is set to **Match***



9.2.1 Number of Edges

Main Menu > **Inspection** > **Motion** > **Number of Edges**

Number of Edges is available when Motion is set to **Edge**.

On the **Number of Edges** screen, use the option buttons to select **One Edge** or **Two Edges**. If **One Edge** is selected, motion is tracked in one direction (by default, horizontally). If **Two Edges** is selected, motion can be tracked horizontally and vertically.

9.2.2 Sensitivity

Main Menu > **Inspection** > **Motion** > **Sensitivity**

Sensitivity is available when Motion is set to **Edge**.

Use **Sensitivity** to fine-tune how sensitive the sensor is to finding a reference edge.

The sensitivity value helps account for light variations that might affect how well the sensor detects edges on inspected parts. The sensitivity scale is from 0 to 100, where 0 means least sensitive and 100 means most sensitive. If set near 0, the sensor only finds very sharp edges with strong contrast. If set near 100, the sensor finds very dim or blurry edges, and may be unstable due to noise within the image.

9.2.3 Rotation

Main Menu > **Inspection** > **Motion** > **Rotation**

Rotation is available when Motion is set to **Edge**.

Rotation can be enabled or disabled. Select **Enabled** if the part can be expected to rotate during the inspection.

9.2.4 Teach ROI Type

Set the shape of the ROI used to teach the reference pattern during setup.

Main Menu > **Inspection** > **Motion** > **Teach ROI Type**

Teach ROI Type is available when Motion is set to **Match**.

The Region of Interest (ROI) is the user-defined area on the screen that the sensor analyzes. The ROI type can be rectangular, elliptical, or circular. From the drop-down list, select the ROI type to use for the inspection. Adjust the ROI as appropriate for the inspection. An ROI can be as large as the entire Field of View (FOV).

9.2.5 Percent Match

Main Menu > **Inspection** > **Motion** > **Percent Match**

Percent Match is available when Motion is set to **Match**.

Percent Match adjusts how closely the inspected part or label must match the reference part or label. The Percent Match scale is from 0 to 100, where 0 is the most tolerant and 100 is the least tolerant. Move the slider to adjust the tolerance.

9.2.6 Rotation Range

Main Menu > **Inspection** > **Motion** > **Rotation Range**

Rotation Range is available when Motion is set to **Match**.

Rotation Range sets the expected rotation of parts or labels during an inspection. For example, a value of 45 means that the part may rotate 45 degrees in either direction from the reference part and still pass. Move the slider from 0 to 180 degrees.

Note: The smaller the rotation range, the faster the inspection will run.

9.2.7 Edit Pattern

Main Menu > **Inspection** > **Motion** > **Edit Pattern**

Edit Pattern is available when Motion is set to **Match**.

The **Edit Pattern** feature allows pixels in a taught pattern to be removed, or restored after being removed. Click **Eraser** to remove pixels from the pattern. Click **Draw** to restore removed pixels to the pattern.

9.2.8 Advanced

Main Menu > **Inspection** > **Motion** > **Advanced**

Advanced is available when Motion is set to **Match**.

Use the **Advanced** menu to enable **Search ROI** and **Track with Motion**. These options apply to all Match sensors in the current inspection.

- **Search ROI**—Sets a custom region within the field of view to search for the pattern. When **Search ROI** is enabled, both Teach and Search ROIs display. The Teach ROI is blue. The Search ROI is green or red, depending on whether the sensor passes or fails.
- **Track with Motion**—Moves the ROIs with Motion. Motion must be enabled under **Inspection** > **Properties**.

9.2.9 Timeout

Main Menu > **Inspection** > **Motion** > **Timeout**

Timeout is available when Motion is set to **Match**.

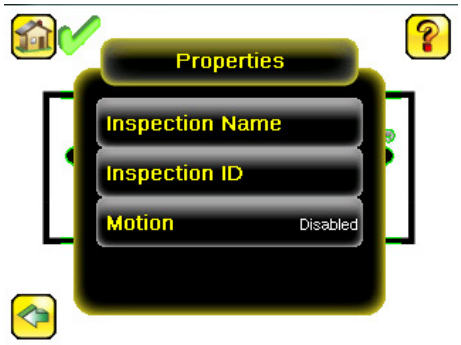
Use **Timeout** to adjust the maximum time the inspection is allowed to execute. A timeout error is reported in the case the inspection runs out of time.

9.3 Properties Menu

Main Menu > **Inspection** > **Properties**

Use the **Properties** menu to specify an Inspection Name, Inspection ID, and whether or not Motion is enabled. Motion is not available for the Sort sensor.

*Figure 51. **Properties** Menu*



9.3.1 Inspection Name

Main Menu > **Inspection** > **Properties** > **Inspection Name**

The **Inspection Name** screen displays the name of the current inspection. Edit the name of the inspection on this screen.

9.3.2 Inspection ID

Main Menu > **Inspection** > **Properties** > **Inspection ID**

Click the dropdown arrow to view a list of IDs assigned to all inspections on this device. Choose any unused ID to change the ID of this inspection. The original ID is marked as **Unused**.

Swap the ID of this inspection with another inspection by selecting that inspection on the list.

9.3.3 Motion

Main Menu > **Inspection** > **Properties** > **Motion**

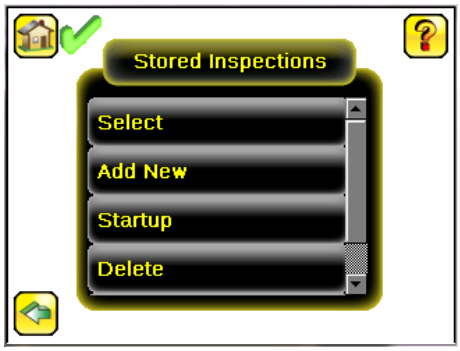
Enable **Motion** when the part being inspected is expected to move or rotate. **Motion** finds and marks the position of a reference point and positions related sensors consistently over a feature of interest. Select **Edge** or **Match** as the **Motion** reference point.

9.4 Stored Inspections Menu

Main Menu > **Inspection** > **Stored Inspections**

Use the **Stored Inspections** menu to manage stored inspections. Managing stored inspections includes adding or deleting inspections, and specifying which inspection is the startup inspection.

*Figure 52. **Stored Inspections** Menu*



From the **Stored Inspections** menu, click **Select**, **Add New**, **Startup**, **Delete**, or **Set Name/ID**.

9.4.1 Select

Main Menu > **Inspection** > **Stored Inspections** > **Select**

Use the **Select** screen to select a new running inspection. Click the name of the inspection to start, and click **Start Running**.

9.4.2 Add New

Main Menu > **Inspection** > **Stored Inspections** > **Add New**

Use **Add New** to add a new inspection. The iVu can store up to 30 inspections. When you add a new inspection, it begins running. Set the Sensor Type and the inspection name when adding a new inspection.

*Figure 53. **Add New** Screen*

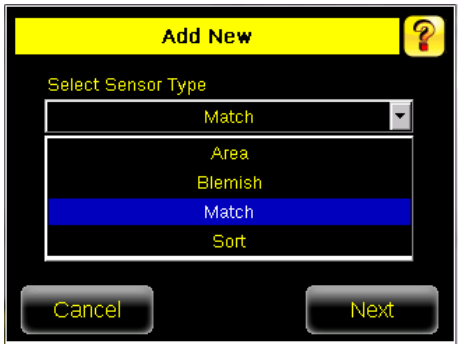
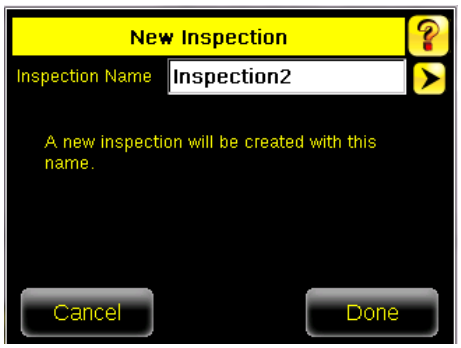


*Figure 54. **New Inspection** Screen*



9.4.3 Startup

Main Menu > **Inspection** > **Stored Inspections** > **Startup**

Click **Startup** to select the inspection to use as the startup inspection. The selected inspection automatically starts after the iVu powers up.

9.4.4 Delete Inspections

Main Menu > **Inspection** > **Stored Inspections** > **Delete**

Click **Delete** to delete stored inspections. Note that any running inspection, or the inspection marked as the Startup inspection, cannot be deleted.

9.4.5 Set Name/ID

Main Menu > **Inspection** > **Stored Inspections** > **Set Name/ID**

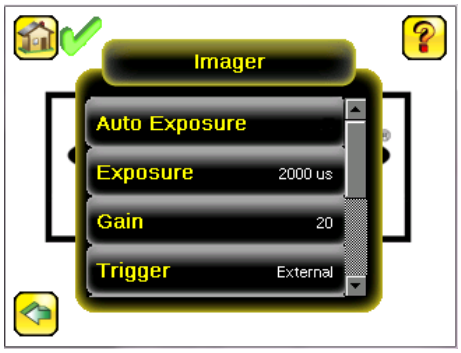
Use **Set Name/ID** to change the name or ID of an inspection. Sort the inspections in numeric or alphabetical order by clicking on the icon beside the Help icon. Click **Name** to edit the name of the inspection. Click **ID** to change the ID of the inspection.

10 Device Imager Menu

Main Menu > **Imager**

The **Imager** menu icon is on the **Main Menu**, and lists parameters that affect the characteristics of the captured image. Use **Imager** menu to access the auto exposure routine, manually adjust exposure and gain, set trigger and strobe options, as well as set the size of the Field of View (FOV).

*Figure 55. **Imager** Menu*



10.1 Auto Exposure

Main Menu > **Imager** > **Auto Exposure**

Auto Exposure optimizes the exposure time and gain for the current lighting conditions. Multiple triggers are required to complete this function.

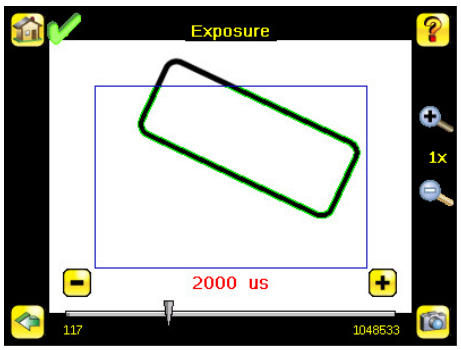
Note: The Auto Exposure option is not available on the Emulator.

10.2 Exposure

Main Menu > **Imager** > **Exposure**

Exposure is the amount of time the iVu allows light to energize the imager. Increasing the exposure time by moving the slider to the right allows more light to energize the imager, which brightens the image.

*Figure 56. **Exposure** Screen*



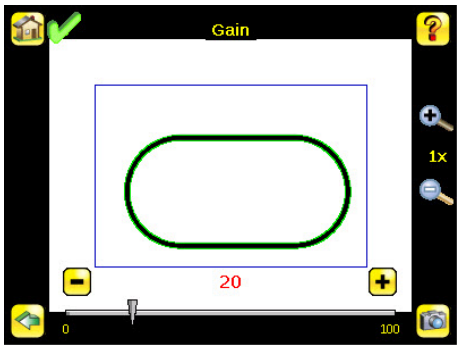
Note: This feature is not effective on the emulator.

10.3 Gain

Main Menu > **Imager** > **Gain**

Gain is an electronic boost to the image signal. Increasing Gain by using the '-' and '+' buttons or moving the slider to the right increases image brightness without increasing exposure time. Note that Gain brightens both the light pixels and dark pixels and may reduce the image quality.

*Figure 57. **Gain** Screen*



Note: This feature is not effective on the emulator.

10.4 Trigger

Main Menu > **Imager** > **Trigger**

A trigger is a signal that tells the iVu to capture an image and inspect it.

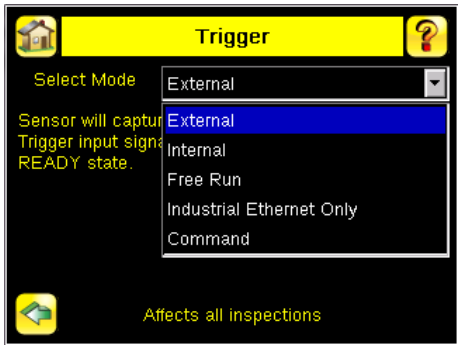
Five trigger options are available:

- **External Trigger**—inspections are triggered in response to an electrical signal on the Trigger input line
- **Internal Trigger** (default)—triggers are based on timed intervals. Select a trigger interval between 10 and 10000 milliseconds

Note: If the interval is less than the inspection time, missed triggers will occur.

- **Free Run**—the iVu automatically runs continuous inspections
- **Industrial Ethernet Only**— only Trigger commands from the Industrial Ethernet communications channel are accepted.
- **Command**—the command channel triggers the iVu from a remote device

*Figure 58. **Trigger** Screen*



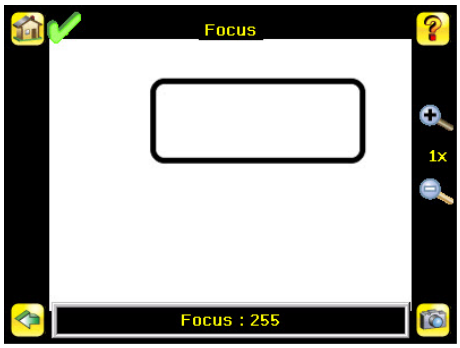
10.5 Focus

Main Menu > **Imager** > **Focus**

The Focus Number displayed at the bottom of this screen is used to fine-tune image focus. Loosen the lock on the lens cover, turn the focus ring on the iVu until the Focus Number peaks (or the image appears sharp), then lock the focus ring.

Note: For the Focus Number to work, the iVu must be triggering and the images must be similar over time.

*Figure 59. **Focus** Screen*

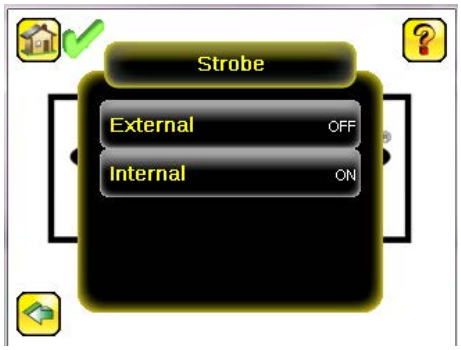


10.6 Strobe Menu

Main Menu > **Imager** > **Strobe**

The Internal Strobe configures the operation of the integrated ring light. The External Strobe configures the operation of an external light.

*Figure 60. **Strobe** Menu*



10.6.1 External

Main Menu > **Imager** > **Strobe** > **External**

The External Strobe is a 5 V dc output used for an external light. Setting options are **Always ON**, **Always OFF**, or **Exposure Based**. If **Exposure Based** is selected, the external light is on during the time the iVu is capturing an image.

This setting affects all inspections.

10.6.2 Internal

Main Menu > **Imager** > **Strobe** > **Internal**

The Internal Strobe setting configures the operation of the integrated ring light. Strobe options are **Always ON**, **Always OFF**, or **Exposure Based**. If **Exposure Based is selected**, the ring light is on during the time the iVu is capturing an image. For ultraviolet (UV) models, the **Always ON** option is not available.

This setting affects all inspections.

10.7 FOV (Field of View)

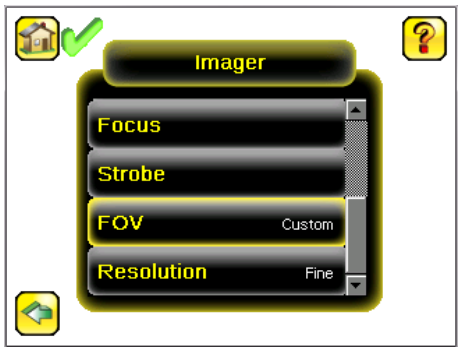
Main Menu > **Imager** > **FOV**

The Field of View (FOV) is the area that the iVu can see at a given working distance. The working distance is the distance from the lens cover to the part being inspected. The effective FOV can be reduced to speed up the processing time of an inspection or to decrease background noise.

10.7.1 Adjust the Field of View (Grayscale Models only)

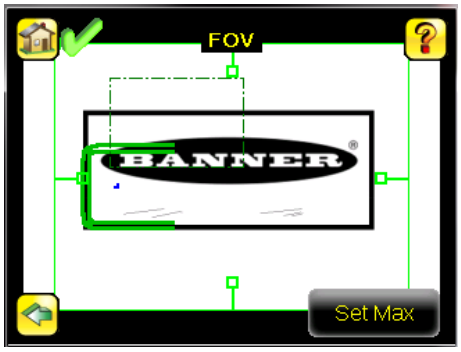
Select the resize icons to adjust the FOV. After pressing the back button, the **Imager** menu **FOV** button updates to say "Custom" to indicate that a custom FOV is in use.

*Figure 61. **Imager** Menu*



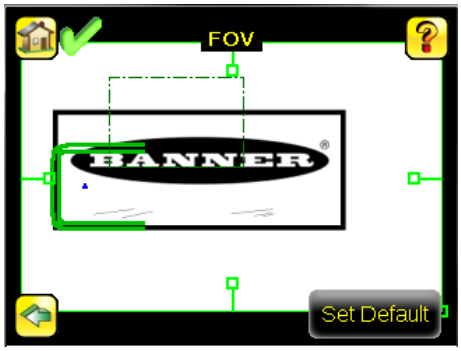
If the FOV has been modified and you want to return to the default, click **Set Default**. The green box representing the FOV moves and the button changes to **Set Max**. The default for Fine resolution is 640×480 pixels and the default for Coarse resolution is 320×240 pixels.

Figure 62. Set Maximum FOV



The maximum FOV is 752×480 for Fine resolution and 376×240 for Coarse resolution. To set the FOV to the maximum, click **Set Max**. The green box representing the FOV expands to fill the screen and the button changes to **Set Default**.

Figure 63. Set Default FOV



10.8 Resolution

System > **Imager** > **Resolution**

Resolution is available for iVu TG models. It is not available on iVu color models.

Two resolution options are available on the iVu: Fine and Coarse.

*Figure 64. **Resolution** Screen*



Coarse resolution has a maximum FOV of 376×240 pixels, and Fine resolution has a maximum FOV of 752×480 pixels. Fine resolution has four times more pixels than Coarse resolution. Inspection performance may be affected when using Fine resolution, depending on the application. By default, the FOV is set to the default FOV size (320×240) in Coarse resolution mode.

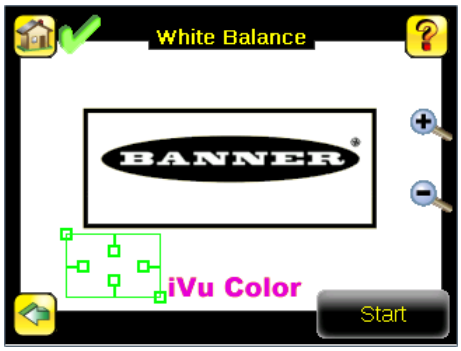
When a new resolution is selected, Match and Sort patterns must be taught again. A trigger is required before any on-screen data is updated.

Any sensor within the inspection will use the selected resolution. Only one resolution is used per inspection.

10.9 White Balance

Use **White Balance** to adjust the intensities of the colors in the image so that the colors most closely match the actual objects. The **White Balance** setting is stored with each inspection. **White Balance** is an automatic process that is only available on color models.

*Figure 65. **White Balance** Screen*

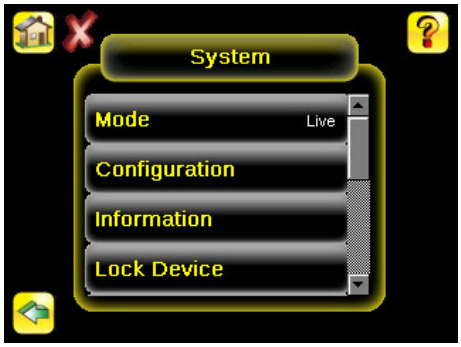


11 Device System Menu

Main Menu > **System**

The **System** menu icon is on the **Main Menu**, and is used to manage the iVu device. From the **System** menu, select the **Mode**, update the device firmware, back up or restore the device configuration, and perform other general system level operations.

*Figure 66. **System** Menu*



11.1 Mode

Main Menu > **System** > **Mode**

The iVu has two operating modes:

- Live Mode, which is the normal operating mode where the iVu captures live images, scans, and verifies inspections
- Demo Mode, where inspections are run on stored images and inspection parameters

The first time the iVu is powered up, it starts in Demo Mode. You can choose whether to stay in Demo Mode or exit to Live Mode. Demo Mode uses stored images and inspection parameters that demonstrate how the iVu is set up, without having to worry about focus, lighting, or triggers. In this mode, practice making adjustments while working with the different sensor types and observing how the adjustments affect the results. To exit Demo Mode, go to **Main Menu** > **System** > **Mode** and select **Exit Demo Mode**. Upon exit, the iVu restarts in the normal operating mode with the default settings.

Note: Switch between Live Mode and Demo Mode any time by going to **Main Menu** > **System** > **Mode**.

11.2 System Configuration Menu

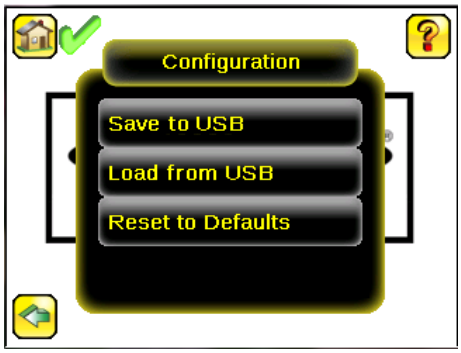
Main Menu > **System** > **Configuration**

The **Configuration** screen allows users to save configurations, load new configurations, or reset the device to default values.

The configuration options are:

- **Save to USB**—Save the device configuration to a USB flash drive
- **Load from USB**—Load the device configuration from the USB flash drive
- **Reset to Defaults**—Reset the device configuration to defaults

*Figure 67. **Configuration** Menu*



11.2.1 Save to USB

Main Menu > **System** > **Configuration** > **Save to USB**

The **Save to USB** screen allows the device configuration to be saved to a USB flash drive. The saved configuration information can be used as a backup or to clone configuration information for other devices.

Note: On the Emulator, this option is **Save Configuration.**

11.2.2 Load from USB

Main Menu > **System** > **Configuration** > **Load from USB**

The **Load from USB** screen allows the device configuration to be restored from a USB flash drive. This operation removes all existing inspections and replaces them with inspections contained in the configuration file on the USB flash drive.

Note: On the Emulator, this option is **Load Configuration**.

11.2.3 Reset to Defaults

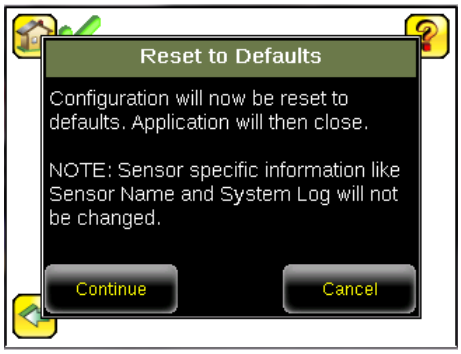
Main Menu > **System** > **Configuration** > **Reset to Defaults**

Resets the device to factory default state:

- All existing inspections are deleted
- All imager and system settings are reset to factory defaults
- For color models, white balance settings are reset to the factory defaults
- Device-specific information such as the sensor name and Ethernet settings are not changed
- System Log information is retained

The device reboots after this operation is complete.

*Figure 68. **Reset to Defaults** Screen*



11.3 System Information

Main Menu > **System** > **Information**

The **Information** screen displays device information:

- Serial Number
- Firmware Version
- Boot Number
- Up Timer—the time elapsed since last boot up of the device
- Hour Count—the total hours of operation in the device's lifetime
- Model Number
- Device Name

Click the right-arrow next to **Device Name** to display a keyboard that allows you to change the name of the device. You may set the device name in English on the device. To set the device name in any other language, use the Emulator.

11.4 Lock Device

Main Menu > **System** > **Lock Device**

Lock the device to prevent accidental modification of settings. When locked, the device only provides access to pass/fail statistics, as well as the ability to view logs and to save them to a USB device. A lock icon in the upper left corner of the display indicates that the device is locked.

The device can be locked with or without a password. If a password is not used, click **Unlock Device** to unlock the device. When a password is used, it must be 4 digits entered using the keypad. If the password is lost, contact Banner Engineering to obtain a Reset Key.

Note: This menu option is not available in the Emulator.

11.5 Communications Menu

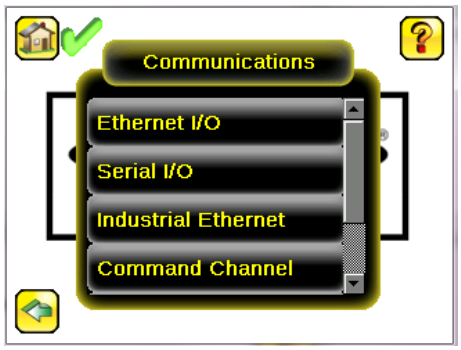
Main Menu > **System** > **Communications**

Use the **Communications** menu to configure the serial I/O channel. There are six menu options:

- **Ethernet I/O** for configuring the Ethernet port
- **Serial I/O** for configuring the Serial port
- **Industrial Ethernet** settings
- **Command Channel** for sending commands to get specific data through Serial or Ethernet channels.
- **Data Export Channel** for enabling or disabling the channel for data export only
- **Image Export Channel** for enabling or disabling the channel for image export only

Note: Serial I/O can be configured either for Data Export or Command Channel. Image Export is only available on Ethernet.

*Figure 69. **Communications** Menu*

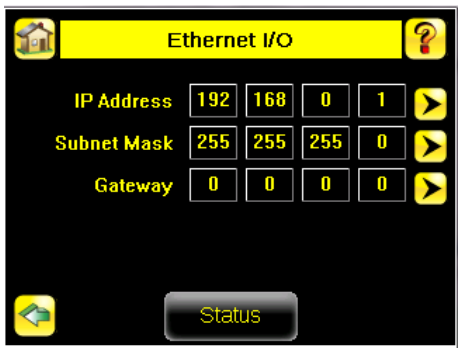


11.5.1 Ethernet I/O

Main Menu > **System** > **Communications** > **Ethernet I/O**

Use Ethernet communications to send data out the Ethernet port as part of an inspection, and so that remote devices can communicate with the iVu. Configure the IP Address, Subnet Mask, and Gateway settings from the **Ethernet I/O** screen. Use the expand arrow next to each field to display a keypad to enter values for each field. Click **Status** to verify communications as you connect to remote devices.

*Figure 70. **Ethernet I/O** Screen*

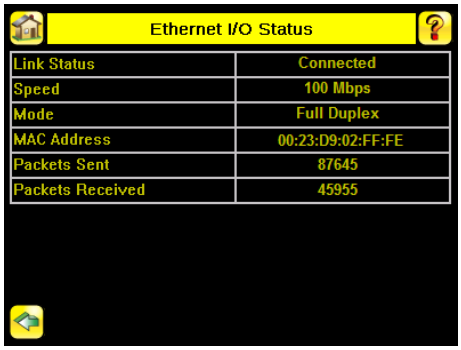


Ethernet I/O Status

Main Menu > **System** > **Communications** > **Ethernet I/O** > **Status**

Use the **Ethernet I/O Status** screen to verify that the Ethernet wiring is correct. In addition to determining whether the link has been established, incoming and outgoing traffic can be monitored.

*Figure 71. **Ethernet I/O Status** Screen*



11.5.2 Serial I/O

Main Menu > **System** > **Communications** > **Serial I/O**

Use the **Serial I/O** screen to adjust the settings for Baud Rate, Data Bits, Parity Control, and Stop Bits. Click **Status** to display recent bytes transmitted through this channel.

*Figure 72. **Serial I/O** Screen*

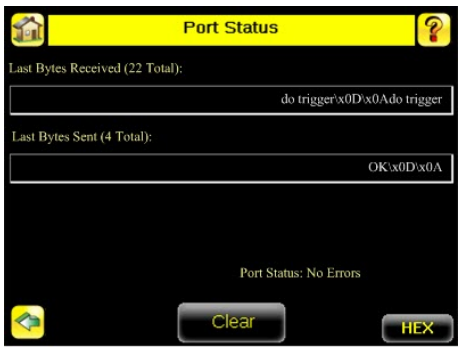


Port Status

Main Menu > **System** > **Communications** > **Serial I/O** > **Status**

Use the **Port Status** screen to make sure that data is entering and exiting the device. This can be useful for debugging issues such as improper wiring, mismatched baud rates, or other serial I/O issues.

*Figure 73. **Port Status** Screen*



11.5.3 Industrial Ethernet

Main Menu > **System** > **Communications** > **Industrial Ethernet**

The iVu device can be controlled or monitored over Industrial Ethernet using Ethernet/IP™, Modbus/TCP, PCCC, or PROFINET® protocols. This document will help you to set up the iVu in the desired configuration and provide you with information you will need to connect to the master device (PLC, HMI, etc.).

Connection

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Connection**

Use the **Connection** to enable Ethernet/IP, PROFINET, Modbus or or PCCC protocols on the Industrial Ethernet channel. Select **Disable** to completely disable the Industrial Ethernet channel.

Map

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Map**

The Map setting (Default/Custom) affects only I/O Assembly 0×65 or MODBUS/PCCC registers 30001 to 30240 at offset 55-166.

Default Map

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Map** > **Default**

The default map automatically maps sensor data for each inspection and is recommended when the execution order of sensor types is the same across inspections. When an inspection includes multiple sensors, the first five sensor results are shown starting at offset 55. Each sensor result occupies 20 words.

Table 6: I/O Assembly Instance 101 (0×65): DEFAULT MAP

WORD #	WORD NAME	Data Type
0	Input Bits ACK Register (see Input and Output Flags Bits on p. 139)	16-bit integer
1	Output Bits Register (see Input and Output Flags Bits on p. 139)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	*reserved*	16-bit integer
30-52	Inspection Name	2-Word Length + 20-Unicode characters
53-54	Frame Number	32-bit integer
55	**Sensor Type ID (Sensor 1)**	**16-bit integer**
56-74	**Sensor 1 Specific Data**	**16-bit integer**
75	**Sensor Type ID (Sensor 2)**	**16-bit integer**
76-94	**Sensor 2 Specific Data**	**16-bit integer**
95	**Sensor Type ID (Sensor 3)**	**16-bit integer**
96-114	**Sensor 3 Specific Data**	**16-bit integer**
115	**Sensor Type ID (Sensor 4)**	**16-bit integer**
116-134	**Sensor 4 Specific Data**	**16-bit integer**
135	**Sensor Type ID (Sensor 5)**	**16-bit integer**
136-154	**Sensor 5 Specific Data**	**16-bit integer**
155-170	*reserved*	16-bit integer
171	Command Status	16-bit integer

WORD #	WORD NAME	Data Type
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100-Byte Array
229-239	*reserved*	16-bit integer

Note: If the inspection contains more than five sensors, any sensors after the fifth sensor are not included on the map.

Table 7: Area Sensor ID = 2

Sensor Specific Data	Data Size
Area Count	32-bit integer
Area Range Minimum	32-bit integer
Area Range Maximum	32-bit integer

Table 8: Blemish Sensor ID = 3

Sensor Specific Data	Sensor Location
Blemish Count	32-bit integer
Blemish Minimum Edge Length	32-bit integer
Blemish Maximum Edge Length	32-bit integer

Table 9: Match Sensor ID = 4

Sensor Specific Data	Sensor Location
Match Count	32-bit integer
Match Minimum Percent	16-bit integer
Match Maximum Percent	16-bit integer

Table 10: Sort Sensor ID = 5

Sensor Specific Data	Sensor Location
Sort Pattern Map	16-bit integer
Sort Pattern Count	16-bit integer
Sort Pattern 1 Count	16-bit integer
Sort Pattern 2 Count	16-bit integer
Sort Pattern 3 Count	16-bit integer
Sort Pattern 4 Count	16-bit integer
Sort Pattern 5 Count	16-bit integer
Sort Pattern 6 Count	16-bit integer
Sort Pattern 7 Count	16-bit integer
Sort Pattern 8 Count	16-bit integer
Sort Pattern 9 Count	16-bit integer

Sensor Specific Data	Sensor Location
Sort Pattern 10 Count	16-bit integer
Sort Minimum Percent Match	16-bit integer
Sort Maximum Percent Match	16-bit integer

Table 11: Average Color Sensor ID = 6

Sensor-Specific Data	Data Size
Average Red	16-bit Integer
Average Green	16-bit Integer
Average Blue	16-bit Integer
Average Hue	16-bit Integer
Average Saturation	16-bit Integer
Average Intensity	16-bit Integer
Standard Deviation Red	32-bit float
Standard Deviation Green	32-bit float
Standard Deviation Blue	32-bit float
Standard Deviation Hue	32-bit float
Standard Deviation Saturation	32-bit float
Standard Deviation Intensity	32-bit float

Note: Average Color Sensor data that does not apply to the selected color space has a result of 0. For example, if the HSI color space is selected, the Red, Green, and Blue data will have a result of 0.

Table 12: Color Compare Sensor ID = 7

Sensor-Specific Data	Data Size
Color Difference	16-bit Integer
Intensity Difference	16-bit Integer

Table 13: Color Area Sensor ID = 8

Sensor-Specific Data	Data Size
Area Count	32-bit Integer
Area Range Minimum	32-bit Integer
Area Range Maximum	32-bit Integer

Custom Map

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Map** > **Custom**

The custom map allows for the customization of sensor data on the map. The user selects data items of interest for each sensor type. This is recommended when the execution order of sensor types varies across inspections or when using more than five sensors.

A system-level custom map is supported for additional flexibility. When **Custom** map is selected, a customizable space is used in the offset range (55 to 166) on I/O Assembly 101 (0×65) registers.

Table 14: I/O Assembly Instance 101 (0×65): CUSTOM MAP

WORD #	WORD NAME	Data Type
0	Input Bits ACK Register (see Input and Output Flags Bits on p. 139)	16-bit integer
1	Output Bits Register (see Input and Output Flags Bits on p. 139)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	*reserved*	16-bit integer
30-52	Inspection Name	2-Word Length + 20-unicode characters
53-54	Frame Number	32-bit integer
55-166	**Customizable Space (112 reg)**	**16-bit integer**
167-170	*reserved*	16-bit integer
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100-Byte Array
229-239	*reserved*	16-bit integer

Custom Map Export

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Map** > **Custom** > **(Save icon)**

To export the custom map, click  to save a text listing of the map to an attached USB flash drive (Filename: iVuIEMap.csv). The Emulator also supports this operation. iVuIEMap.csv will be saved on the application folder.

Status

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Status**

The **Status** screen displays information about the current connection. This information is protocol specific.

View Logs

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **View Logs**

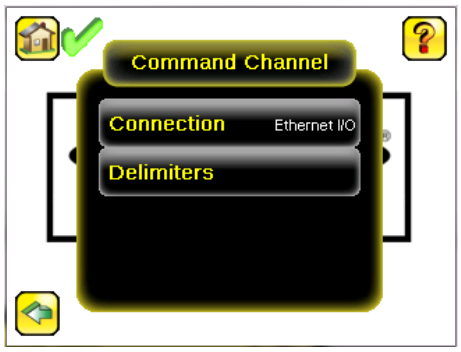
The **View Logs** screen displays the list of recent events on Industrial Ethernet channel. When troubleshooting, select detailed logs under **Setup**.

11.5.4 Command Channel

Main Menu > **System** > **Communications** > **Command Channel**

The iVu command channel is a bi-directional communication protocol that currently supports ASCII via the RS-232 serial interface or Ethernet interface, and enables other devices to remotely control the iVu and to access device information and inspection results.

*Figure 74. **Command Channel** Menu*

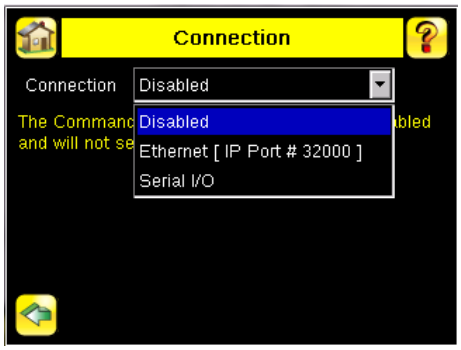


Connection

Main Menu > **System** > **Communications** > **Command Channel** > **Connection**

Use the **Connection** screen to enable or disable the Command Channel.

*Figure 75. **Connection** Screen*



Delimiters

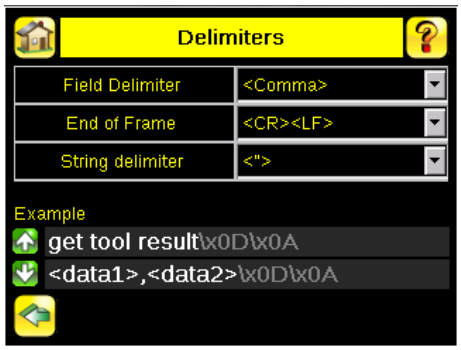
Main Menu > **System** > **Communications** > **Command Channel** > **Delimiters**

Three delimiter options are available from the **Delimiters** screen:

- **Field Delimiter**—Determines what is used to separate data that the iVu is sending out to a remote device.
- **End of Frame**—Determines the delimiter used to indicate the end of a frame.
- **String Delimiter**—Determines what is used to enclose a string field during both input and output operations.

Use the drop-down lists to select the appropriate delimiter. The example at the lower part of the screen displays how the data will look in the output or input streams.

*Figure 76. **Delimiters** Screen*

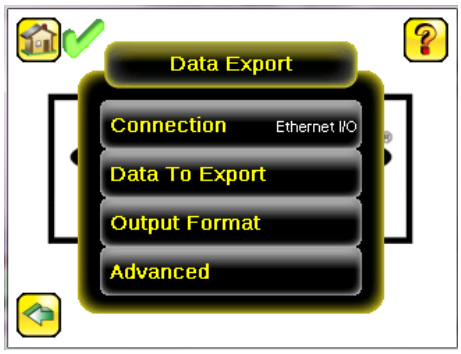


11.5.5 Data Export Menu

Main Menu > **System** > **Communications** > **Data Export**

When **Data Export** is enabled, the iVu transmits selected inspection data when triggered.

*Figure 77. **Data Export** Menu*



Connection

Main Menu > **System** > **Communications** > **Data Export** > **Connection**

Use the **Connection** screen to enable or disable the Data Export.

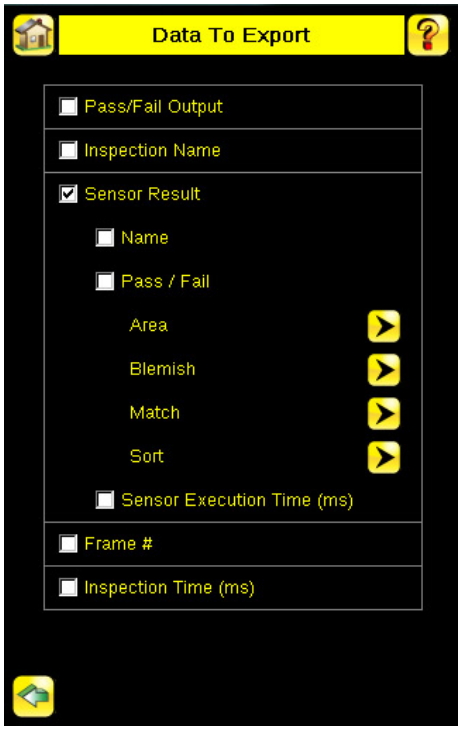
Data To Export

Main Menu > **System** > **Communications** > **Data Export** > **Data To Export**

Use the **Data To Export** screen to determine the information included in a data export. Data outputs in the order displayed on the screen.

Note: Grab the edge of the **Data To Export** screen and pull down to allow all information to show.

*Figure 78. **Data to Export** Screen*

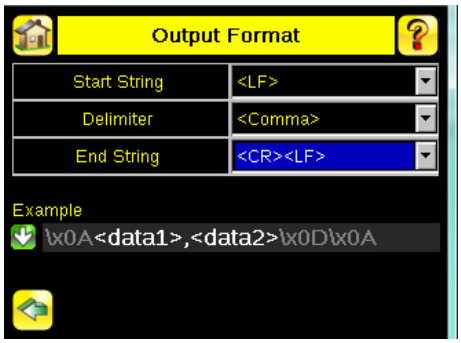


Output Format

Main Menu > **System** > **Communications** > **Data Export** > **Output Format**

In the **Output Format** screen, use the drop-down lists to select Start and End Strings as well as Delimiter. The **Example** field shows how the data will look when it is output.

*Figure 79. **Output Format** Screen*



Data Export Advanced

Main Menu > **System** > **Communications** > **Data Export** > **Advanced**

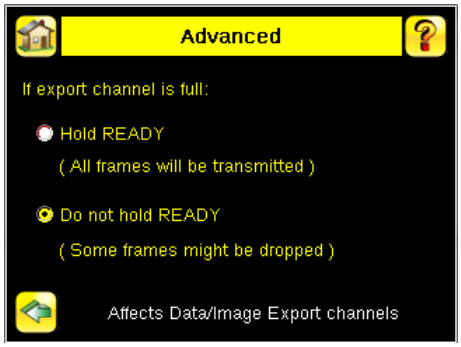
During the Data and Image export operation, the iVu output channels might become full. This can occur if the iVu is producing export data (frames) faster than the data can be exported from the device or faster than the client is reading the channel export data (due to bandwidth limitations).

The **Advanced** setting affects how the iVu behaves in this situation.

Select **Hold READY** to ensure that all frames are transmitted. In this case, the READY signal remains inactive (iVu is busy) until the new frame has been added to the channel for transmission. Triggers might be missed during this time.

Select **Do not hold READY** to cause the iVu to discard the new frame if the channel is full and thus activate the READY signal immediately after the current inspection is complete. In this case, the discarded frames are not transmitted.

*Figure 80. **Advanced** Screen*



Note: This setting affects both the Data Export Channel and Image Export Channel.

11.5.6 Image Export

Main Menu > **System** > **Communications** > **Image Export**

When the Image Export Channel is enabled, the iVu transmits the acquired image on every trigger. The image is transmitted as a bitmap (.bmp) file. This operation is only available over Ethernet I/O.

Connection

Main Menu > **Communications** > **Image Export** > **Connection**

Use the **Connection** screen to enable or disable the Image Export.

Image Type

Main Menu > **System** > **Image Export** > **Image Type**

On the **Image Type** screen, choose between .jpg or .bmp format for the exporting image file.

Image Export Advanced

Main Menu > **System** > **Communications** > **Image Export** > **Advanced**

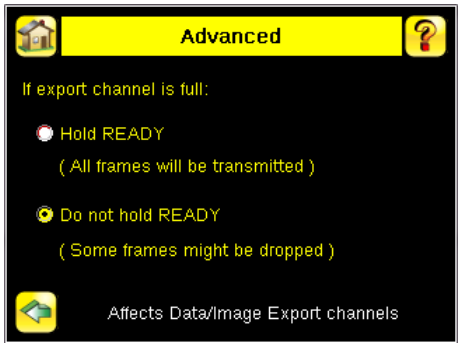
During the Data and Image export operation, the iVu output channels might become full. This can occur if the iVu is producing export data (frames) faster than the data can be exported from the device or faster than the client is reading the channel export data (due to bandwidth limitations).

The **Advanced** setting affects how the iVu behaves in this situation.

Select **Hold READY** to ensure that all frames are transmitted. In this case, the READY signal remains inactive (iVu is busy) until the new frame has been added to the channel for transmission. Triggers might be missed during this time.

Select **Do not hold READY** to cause the iVu to discard the new frame if the channel is full and thus activate the READY signal immediately after the current inspection is complete. In this case, the discarded frames are not transmitted.

*Figure 81. **Advanced** Screen*



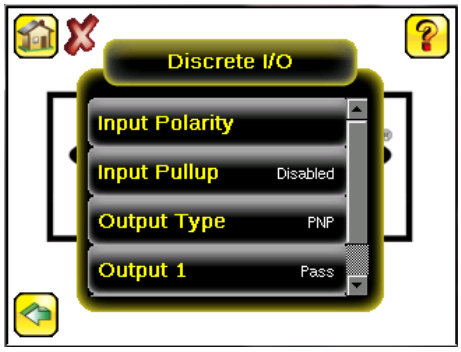
Note: This setting affects both the Data Export Channel and Image Export Channel.

11.6 Discrete I/O Menu

Main Menu > **System** > **Discrete I/O**

Use the **Discrete I/O** menu to adjust iVu input and output settings.

*Figure 82. **Discrete I/O** Menu*



11.6.1 Input Polarity

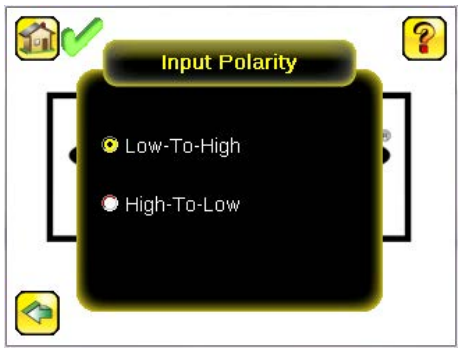
Main Menu > **System** > **Discrete I/O** > **Input Polarity**

The iVu has two input signals—Trigger and Remote Teach. Both of these signals are edge sensitive. The operation of these signals is dependent on the Input Polarity setting.

- **Low-To-High**—The Trigger and Remote Teach are detected on a low to high transition of the signal
- **High-To-Low**—The Trigger and Remote Teach are detected on a high to low transition of the signal

The default setting for a PNP device is Low-To-High, and for an NPN device it is High-To-Low. Change the setting on the **Input Polarity** screen.

*Figure 83. **Input Polarity** Screen*



11.6.2 Input Pullup

Main Menu > **System** > **Discrete I/O** > **Input Pullup**

By default, the Input Pullup is disabled. If the device used to trigger and remote teach the iVu is a NPN device, enable Input Pullup here if that device does not have its own pullup resistor. Otherwise, this should be disabled.

11.6.3 Output Type

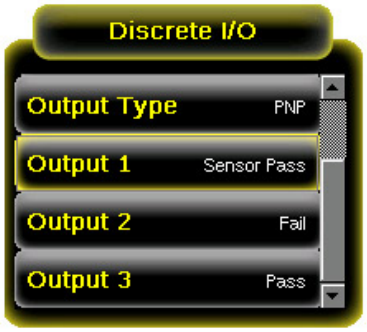
Main Menu > **System** > **Discrete I/O** > **Output Type**

Select NPN to configure the device's outputs to sink current. Select PNP to configure the device's output for source current.

11.6.4 Output 1, 2, and 3

Main Menu > **System** > **Discrete I/O** > **Output (#)**

*Figure 84. **Discrete I/O** Menu*



Output 1, 2, and 3 are set up separately to improve flexibility and simplicity.

Output can be configured for **Inspection Pass**, **Inspection Fail**, **Sensor Pass**, **Sensor Fail**, **Sort Pattern #1**, **Missed Trigger** or **System Error**.

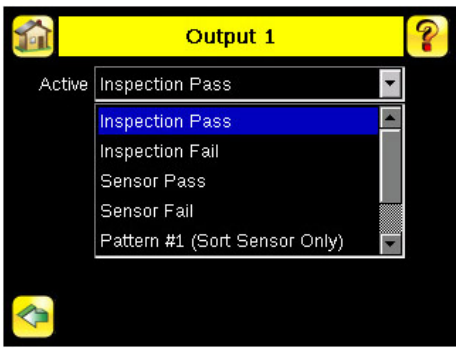
A Missed Trigger condition occurs when a trigger is received while the iVu is busy inspecting the previous image. This output signal is set to active state. This signal will be reset upon resetting the History on the statistics screen.

A System Error condition occurs when a fatal error is detected on the device. This output signal will be set to active state. This signal can be reset upon resetting the History on the statistics screen, or executing a **ClearSystemError** command through command channel.

The default setting is **Inspection Pass** and **Latched** for Output 1. If Pulsed is selected, the default Pulse width is 50 ms.

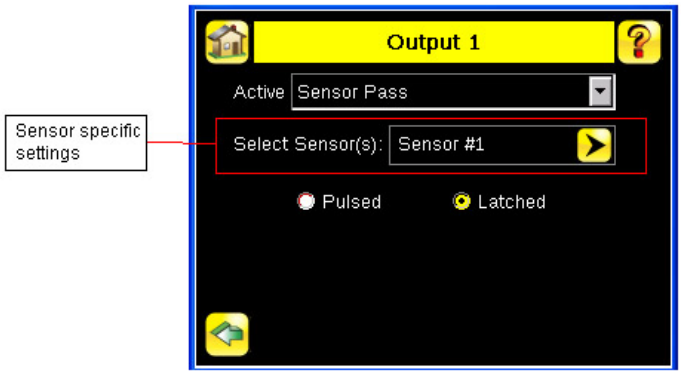
Note: For Latched, the signal is active until the results of an inspection cause a change in the signal output.

*Figure 85. **Output #** Screen*



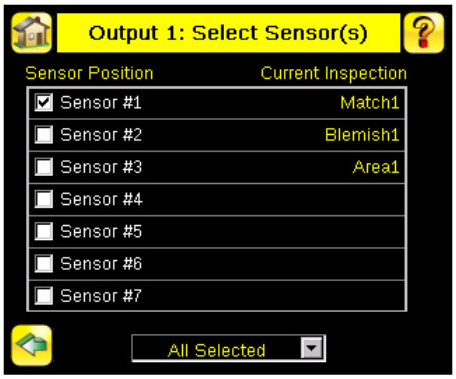
When either **Sensor Pass** or **Sensor Fail** is selected, additional settings become available as shown in Figure 86 on p. 71.

*Figure 86. **Output #** Screen with Additional Settings*



Click the yellow arrow to access the **Select Sensor** screen.

*Figure 87. **Select Sensor(s)** Screen*



On the **Select Sensor** screen, the check box allows sensor position to be part of the logic that activates the output. One or more sensor positions can be added. The right column shows the sensor name(s) and their respective position from the current inspection for reference.

The drop-drop list has two settings:

- **All Selected**—All checked sensor positions must meet the setting criteria (Pass/Fail) to activate the output
- **Any Selected**—Any checked sensor position that meets the setting criteria (Pass/Fail) will activate the output

When a selected sensor position is missing on the current inspection, the missing sensor(s) will not be part of the logic to activate the output. For example, when only 2 sensors are included on the current inspection and the **Output** > **Select Sensor(s)** has Sensor #1, Sensor #2, and Sensor #3 checked, only Sensor #1 and Sensor #2 are used to determine the output state. This is because Sensor #3 is not defined by the current inspection.

11.7 Display Settings

Main Menu > **System** > **Display Settings**

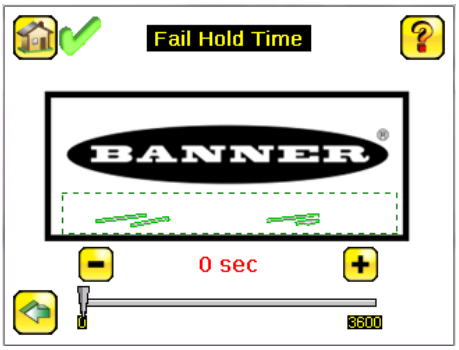
Use the **Display Settings** menu to set the **Fail Hold Time**, **LCD Timeout**, and to perform a **Touch Calibration** for the touchscreen display. Enable display optimization from the **Advanced** menu.

11.7.1 Fail Hold Time

Main Menu > **System** > **Display Settings** > **Fail Hold Time**

The **Fail Hold Time** determines how long a failed image is shown on the display so that you can see what failed. The iVu continues to process any triggers and the inspection continues normally. This time delay is only for the touchscreen display. Set this parameter from 0 seconds to 3600 seconds using the slider.

*Figure 88. **Fail Hold Time** Screen*



11.7.2 LCD Timeout

Main Menu > **System** > **Display Settings** > **LCD Timeout**

When the device is not being used, the display dims after a user-selectable period of time. Use the arrow keys or the slider to set the display time out.

Note: This screen is not available in the Emulator.

11.7.3 Touch Calibration

Main Menu > **System** > **Display Settings** > **Touch Calibration**

Touchscreen calibration may be necessary if the software does not correctly respond when an icon on the screen is pressed. The calibration routine aligns the touchscreen's coordinates to the display behind it. Follow the prompts on the screen when executing the touchscreen calibration function.

Note: This screen is not available in the Emulator.

11.7.4 Advanced

Main Menu > **System** > **Display Settings** > **Advanced**

The **Advanced Display** screen allows you to enable advanced display features.

Optimize Display Response

This feature helps make the display more responsive when the iVu is busy (either inspection times are long and/or no idle time exists between inspections). Disable this feature if missed triggers occur due to touchscreen presses. With this setting disabled, the display may become sluggish when the iVu is busy.

Invert Display

This feature rotates the display 180 degrees for applications where the device is mounted upside down.

11.8 Reboot Sensor

Main Menu > **System** > **Reboot Sensor**

The **Reboot Sensor** screen allows you to force a reboot of the device.

Note: This option is not available on the Emulator.

11.9 Firmware Update

Main Menu > **System** > **Firmware Update**

Use the **Firmware Update** screen to load the latest device firmware. The **Firmware Update** screen lists the firmware versions it finds in the `BANNER\FIRMWARE` folder on the USB flash drive. When you receive a firmware update from Banner Engineering, be sure to put it in the `BANNER\FIRMWARE` folder on the USB flash drive.

Note: The **Firmware Update** menu is not available in the Emulator.

11.10 Set the Language

Set the device display and/or the Vision Manager software iVu interface to one of several languages as needed.

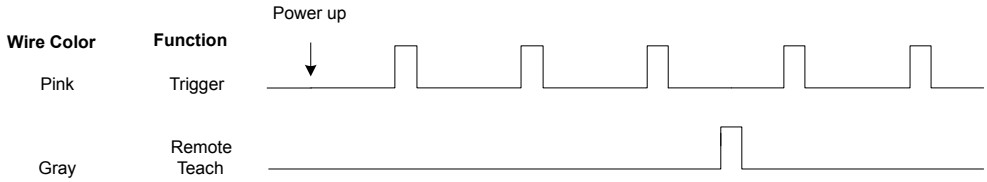
1. Go to **Main Menu** > **System**.
2. Click **Language**.
3. Click the desired language.
   A message displays that the program needs to close to change the language.
4. Click **Yes**.
5. If you are changing the language in the Vision Manager software, re-open the program.

Note: In the Vision Manager software, there is a also a language setting under **User Preferences** on the **Home** screen. This changes the language for the VE product interface and not for the iVu product interface.

11.11 iVu Trigger, Remote Teach, and I/O Waveforms

The iVu has two input signals—Trigger and Remote Teach. The default setting is to detect the low to high transition. To change this setting, go to **Main Menu** > **System** > **Discrete I/O** > **Input Polarity** on the iVu.

11.11.1 PNP (Low-to-High) Trigger and Remote Teach Input Waveforms



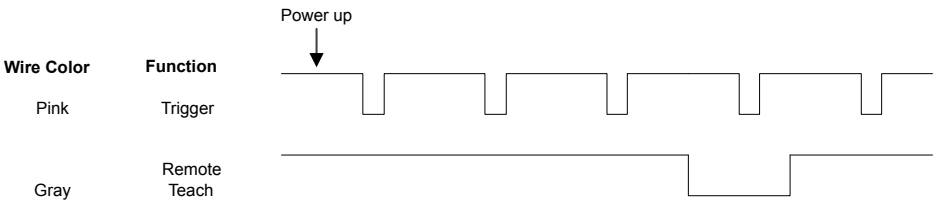
The iVu triggers from low to high, and Remote Teach behaves electrically like trigger.

Note:

Table 15: Required iVu Input Signal Voltage

	ON	OFF
PNP	+10 V dc to 30 V dc	< 2 V dc

11.11.2 NPN (High-to-Low) Trigger and Remote Teach Input Waveforms



The iVu triggers from high to low, and Remote Teach behaves electrically like trigger.

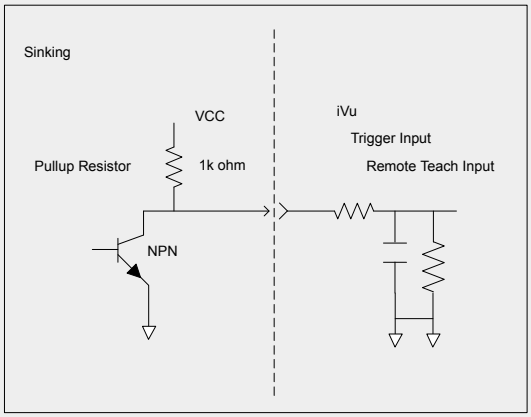
Note:

Table 16: Required iVu Input Signal Voltage

	ON	OFF
NPN	< 2 V dc	+10 V dc to 30 V dc

Note: If the device used to trigger or remote teach the iVu is a sinking device, these are the options regarding the use of a pull-up resistor:

Option 1: Put a pull-up resistor, rated approximately 1 kΩ, between the device's positive (+) voltage and the device's input as shown below.



Option 2: Enable the Input Pullup. Go to iVu **Main Menu** > **System** > **Discrete I/O** > **Input Pullup**.

11.11.3 iVu Output Waveforms

Figure 89. PNP Outputs

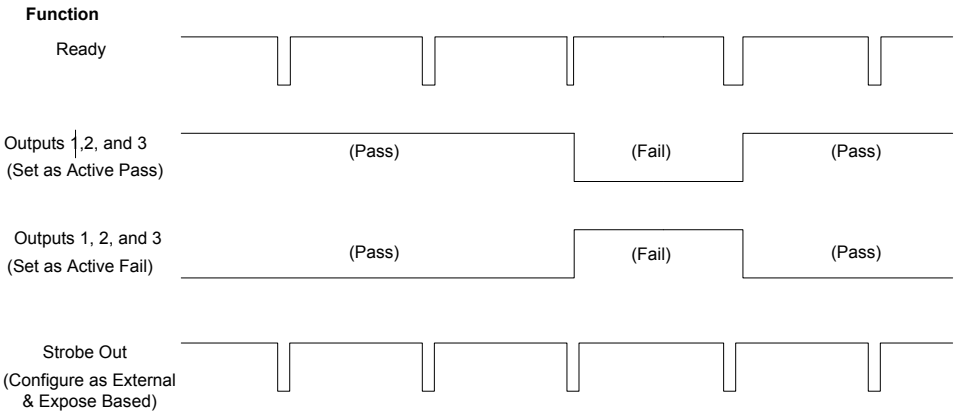
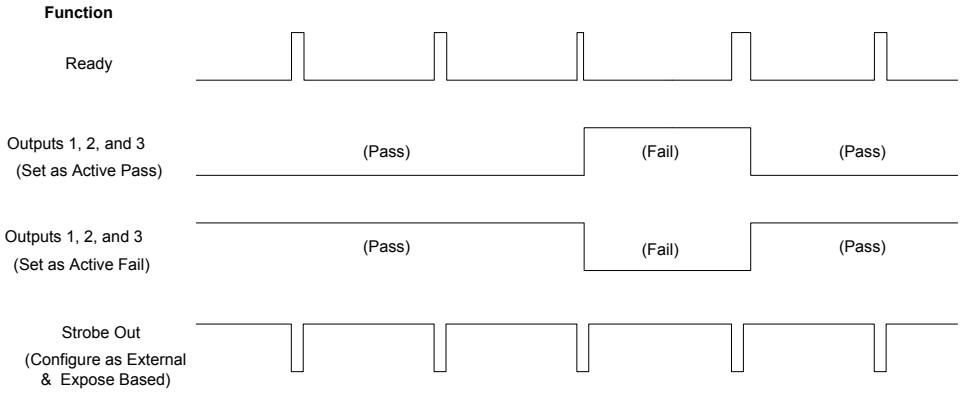


Figure 90. NPN Outputs



Note:

Table 17: Expected iVu Output Signal Voltage

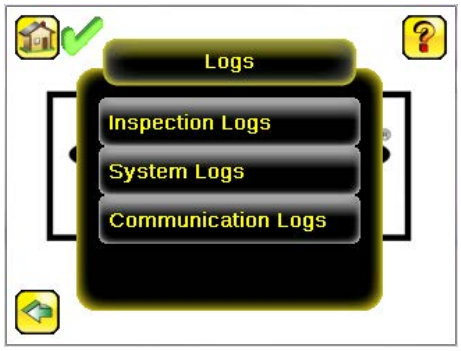
	ON	OFF
PNP	+ V	0 V
NPN	+1 V	+V

12 Device Logs Menu

Main Menu > **Logs**

The **Logs menu** icon is on the **Main Menu**, and is used to set up, view, and save **Inspection Logs**, **Communication Logs**, and **System Logs**.

*Figure 91. **Logs** Menu*

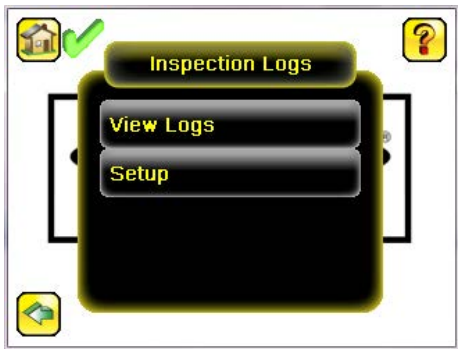


12.1 Inspection Logs Menu

Main Menu > **Logs** > **Inspection Logs**

Configure and view inspection logs from the **Inspection Logs** menu. Inspection Logs are stored inspection records that include a captured image, the parameters used to inspect it, and the results of that inspection. Up to ten Inspection Logs can be held in memory on the device. The next ten logs overwrite the previous ten logs. Save Inspection Logs to the USB flash drive so that the logs can be imported to the emulator.

*Figure 92. **Inspection Logs** Menu*

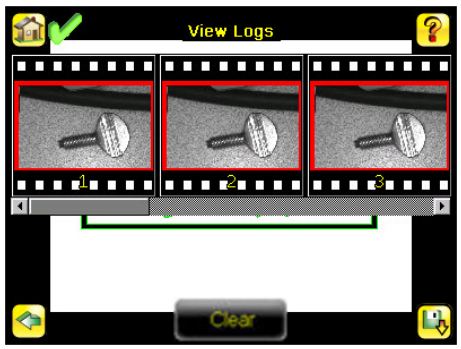


12.1.1 View Logs

Main Menu > **Logs** > **Inspection Logs** > **View Logs**

Inspection Logs appear as a strip of film. Select a frame to view a specific image in the **Frame** screen. Click **Save** to save the logs to the USB flash drive. Logs saved to the USB flash drive can be imported into the emulator. Click **Clear** to clear Inspection Logs.

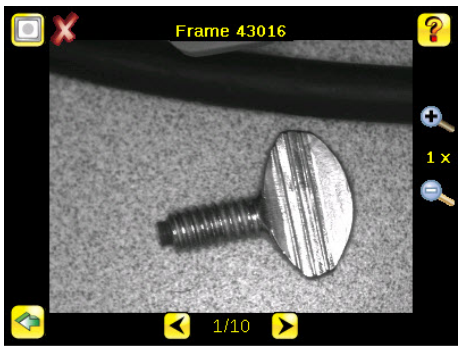
*Figure 93. **View Logs** Screen*



Use the **Frame** screen to debug an inspection. The screen shows one inspection in read-only mode. Click the upper-left icon to cycle through views: image with annotations, image without annotations, and inspection statistics. When in the **Statistics** view, the table title has arrows to switch between the **Inputs** and the **Results** of the inspection.

Use the left and right arrow keys at the bottom of the screen to navigate through all of the stored inspection logs.

*Figure 94. **Frame** Screen*

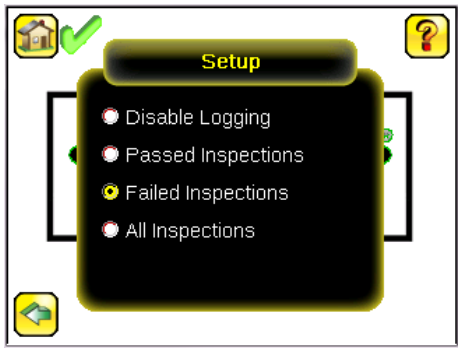


12.1.2 Setup

Main Menu > **Logs** > **Inspection Logs** > **Setup**

On the **Setup** menu, use the option buttons to Disable Logging, or to log Passed Inspections, Failed Inspections, or All Inspections.

*Figure 95. **Setup** Screen*



12.2 System Logs

Main Menu > **Logs** > **System Logs**

The System Log contains configuration change information, other notifications, and any errors or warnings that were encountered. The list is sorted in descending order with respect to time. The time associated with each event consists of the Hour Count (lifetime hours of operation) and the Up Timer (time elapsed since last boot).

In the log, "(D)" indicates a change made by the device, "(I)" indicates a change made through Industrial Ethernet, "(C)" indicates a change made through Command Channel, and "(VM)" indicates a change made through Vision Manager, such as changing the device name or the IP address using the Vision Manager button.

Click the icon in the upper left corner of the screen to show/hide the time column.

Click **Clear Log** at the bottom of the screen to clear the System Log.

Click **Save** to save the System Log to the USB flash drive.

Note: System log will not log changes while in Demo mode. Additionally, the Emulator does not log changes.

12.3 Communication Logs Menu

Main Menu > **Logs** > **Communication Logs**

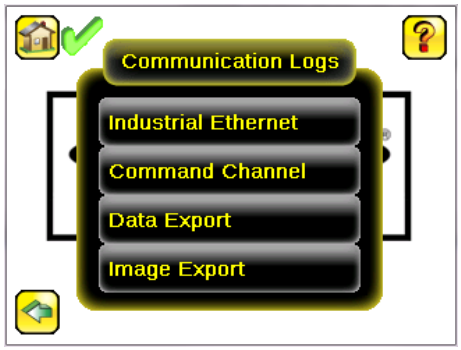
The Communication Log contains logs for the four communications channels: **Industrial Ethernet**, **Command Channel**, **Data Export**, and **Image Export**.

The following features are available for each of the logs:

- Click the icon in the upper left corner of the screen to show/hide the time column
- Click **Clear Log** at the bottom of the screen to clear the log
- Click **Save** to save the Log to the USB flash drive

Note: Communication log does not log changes while in Demo mode. Additionally, the Emulator does not log changes.

*Figure 96. **Communications Logs** Menu*



12.3.1 Industrial Ethernet Log

Main Menu > **Logs** > **Communication Logs** > **Industrial Ethernet Log**

The **Industrial Ethernet Log** includes the most recent Industrial Ethernet activity.

12.3.2 Command Channel Log

Main Menu > **Logs** > **Communication Logs** > **Command Channel**

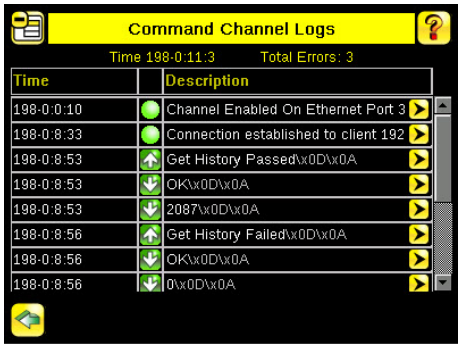
The **Command Channel Log** includes the most recent Command communication activity. Each entry in the log includes a status indicator for the operation. A green indicator displays when the channel is enabled or disabled—light green when the channel is enabled and dark green when the port is disabled.

An up-arrow displays for incoming requests from a remote device. A down-arrow displays for outgoing responses from the iVu. The up- and down-arrows are green when everything is okay and red if there is an error. The up-arrow is yellow if the command is incomplete (for example, waiting for an end-of-frame delimiter).

Note: An hourglass displays if an operation takes a particularly long time to complete, for example, during a long trigger.

Each log entry includes a log detail button (arrow icon on right side of log entry) to display a detail view of the log entry. Use the buttons at the bottom of the screen to refresh the display and to clear the log. Save the communication log to the USB flash drive so that the communication log can be imported to the emulator.

*Figure 97. **Command Channel Logs** Screen*



12.3.3 Image Export Log

Main Menu > **Logs** > **Communication Logs** > **Image Export**

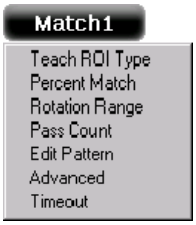
The **Image Export** log is an output log; there is no receive (input) activity. Image Export is only available over Ethernet. When Image Export is enabled, the log shows an Enabled entry that indicates the port is being monitored. When a client application connects or disconnects, a log entry indicates which IP address has connected or disconnected. If data is dropped, the logs indicate the number of frames that have been dropped.

13 Configuring Sensors

Each sensor type has a parameters shortcut menu available from the inspection menu.

From the **Home** screen, click inside the Region of Interest (ROI). The ROI is the visual area indicated by a dotted line on the inspection. In the Demo mode this is the Banner Engineering logo. The dotted line becomes bold and has rotation and size icons in the corners. At the top of the display *Inspection Name* changes to a black button called *Sensor Name*. Click **Sensor Name** and a dropdown list displays.

Figure 98. Example Shortcut Menu



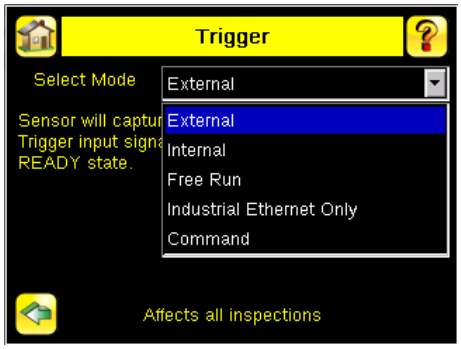
No matter what parameter you are setting, if you click inside the ROI it will highlight into a bold dotted line that can be resized.

13.1 Setting the Trigger

By default, the **Trigger** is set to **Internal**, and will continuously trigger based on a time interval setting. This may make it more difficult to make adjustments while setting up the iVu. The best practice is:

1. Go to **Main Menu** > **Imager** > **Trigger** menu and select **External**.

*Figure 99. **Trigger** Screen*

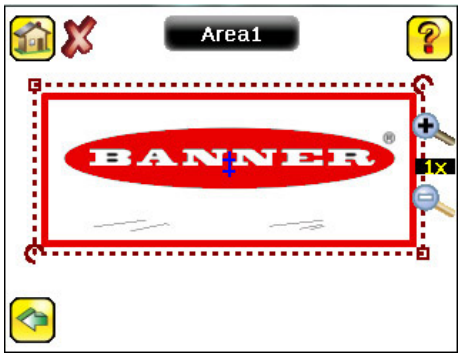


2. Make sure there is no external trigger input.
3. Use the **Trigger** icon in the lower-right of the display to manually trigger the iVu to capture an image as you set up and test.
4. Capture images of a range of samples to set up from the "worst" good part to the "best" bad part.

13.2 Configuring an Area Sensor

1. Begin the setup with a good part.
2. Center the part to be tested in the Field of View (FOV).
3. Adjust the Region of Interest (ROI) so that it surrounds the feature of interest. In the Demo example, the feature of interest is the Banner logo. The ROI is red because the parameters need to be set.

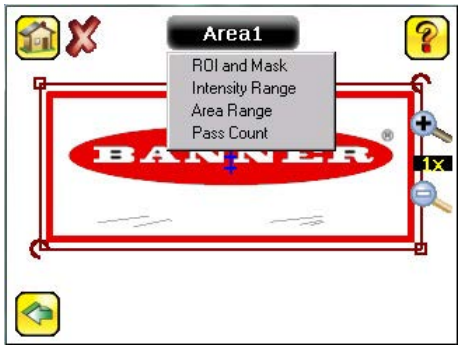
Figure 100. Adjust the ROI



Note: When running an Area inspection, the sensor finds objects only within the ROI.

4. Click the **[Sensor Name]** to open the sensor parameters menu.

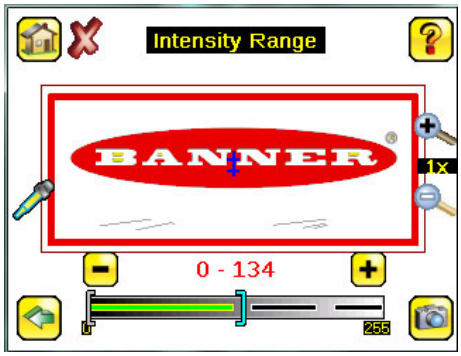
Figure 101. Open the Parameters Menu



5. Set the sensor parameters.
   - Adjust the **Intensity Range**.

     Intensity Range is the range of grayscale values the sensor should look for. To set the Intensity Range, use the eye dropper to select the target feature. Use the slider to fine tune the selection. As the slider is moved, green highlighted areas indicate the objects the sensor finds.

*Figure 102. **Intensity Range** Screen*

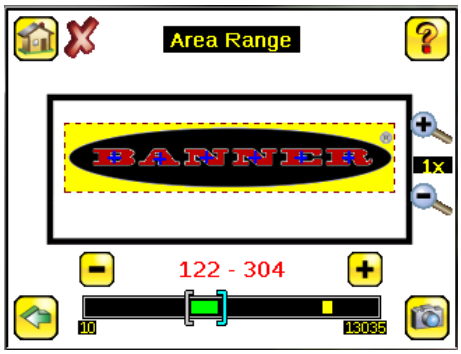


   - Adjust the **Area Range**.

     Use Area Range to set the size limits of a feature of interest. Move the slider to select the range. Areas are measured by counting pixels. For example, a rectangular feature that is 100 pixels wide by 200 pixels tall has an area of roughly 20,000 pixels.

     Figure 103 on p. 81 indicates that the areas that are white are now within range of the inspection. As the range narrows, the highlighted area turns yellow. In the Demo example, the Area Range is adjusted so that each letter is identified as a found object (indicated by the red highlight and the blue +).

*Figure 103. **Area Range** Screen*

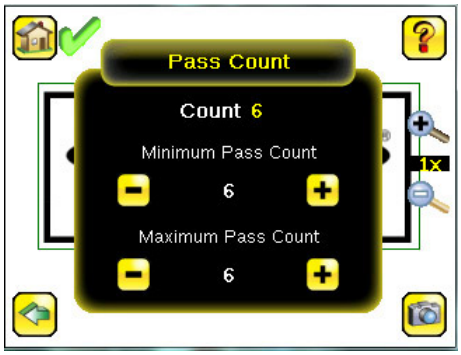


   - Set the **Pass Count** parameter.

     The **Minimum Pass Count** is the minimum number of parts, labels, or features expected to fall within the specified criteria. The **Maximum Pass Count** is the maximum number expected to fall within the specified criteria. These settings are used to determine the pass or fail result of the inspection.

In the Demo, both the **Minimum Pass Count** and the **Maximum Pass Count** are set to 6, because the inspection should find six letters. The letters turn green to indicate that the inspection passed.

*Figure 104. **Pass Count** Screen*



6. Test a complete range of good and bad samples to make sure that the sensor accepts good parts and rejects bad parts.
7. To complete the Area application setup, adjust the trigger setting as appropriate for the application.

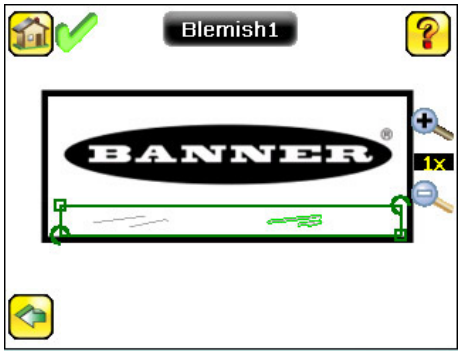
Note: Remote Teach does not work with the Area sensor.

13.3 Configuring a Blemish Sensor

The Demo Mode application shows how the sensor, when configured as a Blemish sensor, can accept or reject parts based on the range of edge pixels the sensor detects in the ROI.

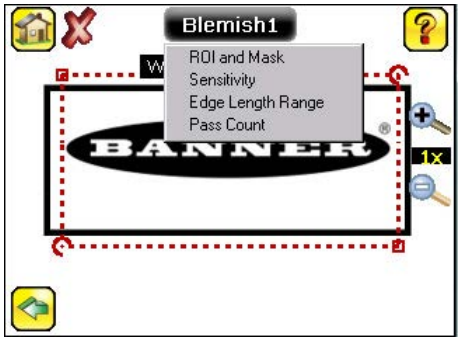
1. Begin the setup with a good part.
2. Center the part to be tested in the Field of View (FOV).
3. Adjust the Region of Interest (ROI) so that it surrounds the feature of interest. In the Demo example, the feature of interest includes the two irregular shapes below the Banner logo.

Figure 105. Adjust the ROI



4. Click the **[Sensor Name]** to open the sensor parameters menu.

Figure 106. Parameters Menu



5. Set the sensor parameters.

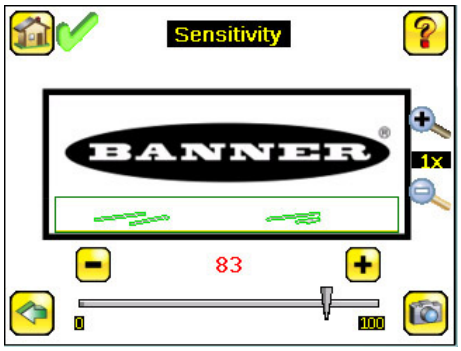
- Adjust the **Sensitivity** parameter.

  Use **Sensitivity** to fine-tune how sensitive the sensor is to finding blemish or other edges within the ROI.

  The sensitivity value helps account for light variations that might affect how well the sensor detects edges on inspected parts. The sensitivity scale is from 0 to 100, where 0 means least sensitive and 100 means most sensitive. If set near 0, the sensor only finds very sharp edges with strong contrast. If set near 100, the sensor finds very dim or blurry edges, and may be unstable due to noise within the image.

  Use the slider to adjust the sensitivity, watching as the sensor detects more or fewer edges.

*Figure 107. **Sensitivity** Screen*



- Adjust the **Edge Length Range**.

  The sensor counts all the edge pixels it detects in the ROI. The bar at the bottom of the **Edge Length Range** screen shows all the different contiguous edge segments found. Use the slider brackets to specify the edge length range in pixels. Edges found within this range are considered to calculate the Pass Count. Edge segments within the two brackets [ ] are highlighted in green and those outside the brackets are ignored and colored yellow. Move each bracket to add or remove more of the edge segments from consideration. Zoom in to refine the range.

Figure 108. Segments in Yellow are Ignored

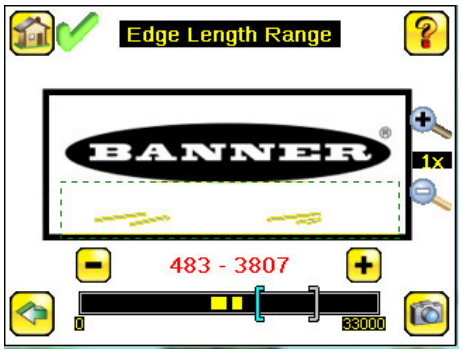
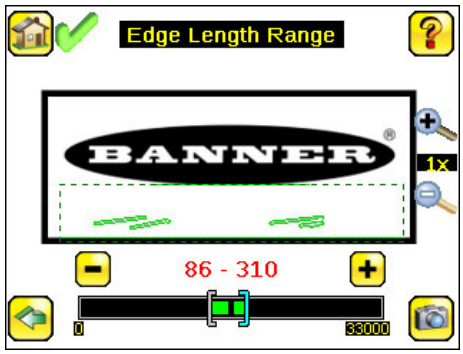


Figure 109. Segments in Green are Included

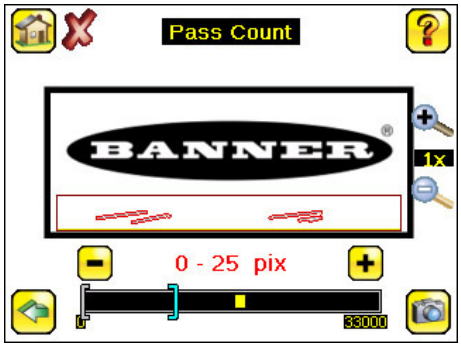


- Set the **Pass Count** parameter.

  The sensor aggregates all of the edge pixels that fall within the Edge Length Range and indicates the value with a small colored bar at the bottom of the screen. If the result is within the range brackets, the bar is green, otherwise it is yellow.

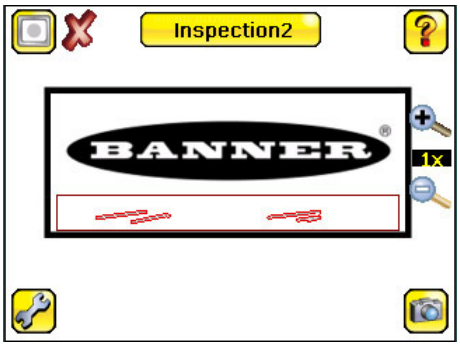
  The **Minimum Pass Count** is the minimum number of parts, labels, or features expected to fall within the specified criteria. The **Maximum Pass Count** is the maximum number expected to fall within the specified criteria. These settings are used to determine the pass or fail result of the inspection.

*Figure 110. **Pass Count** Screen*



Use the brackets to set a tolerance for the pass/fail.

Figure 111. Blemishes Found During the Inspection



Now the inspection for the blemish sensor is sensitive enough to find blemishes under the logo and fail the inspection.

6. Test a complete range of good and bad samples to make sure that the sensor accepts good parts and rejects bad parts.
7. To complete the Blemish application setup, adjust the trigger setting as appropriate for the application.

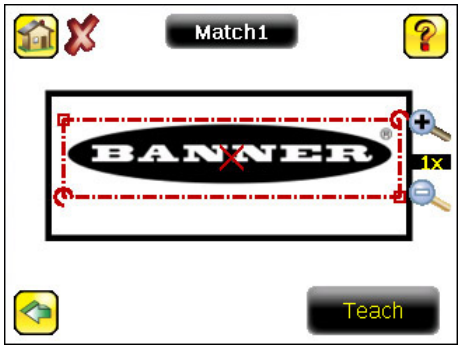
Note: Remote Teach does not work with the Blemish sensor.

13.4 Configuring a Match Sensor

Teach the sensor a good reference part.

1. Begin the setup with a good part.
2. Center the part to be tested in the Field of View (FOV).
3. Adjust the Region of Interest (ROI) so that it surrounds the feature of interest. In the Demo example, the feature of interest is the Banner logo.The ROI type can be rectangular, elliptical, or circular.

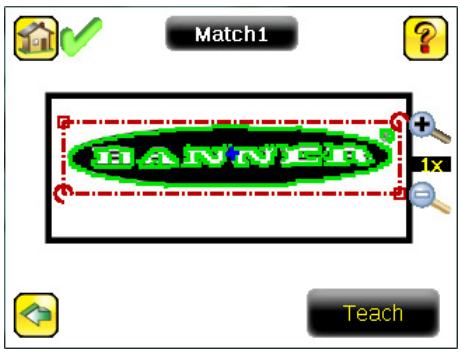
Figure 112. Adjust the ROI



Note: If **Search ROI** is enabled (**Main Menu** > **Inspection** > **Sensors** > **Match** > **Advanced**), the Teach ROI appears in blue.

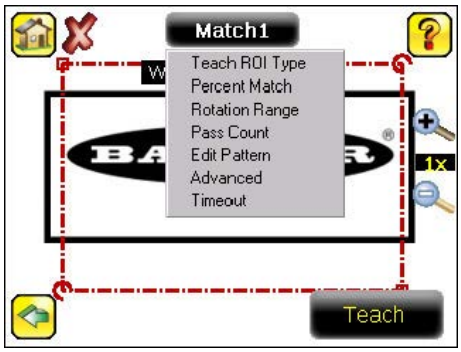
4. Click **Teach** to teach the sensor this good reference part.

Figure 113. Teach the Reference Part



5. Click **[Sensor Name]** to open the sensor parameters menu.

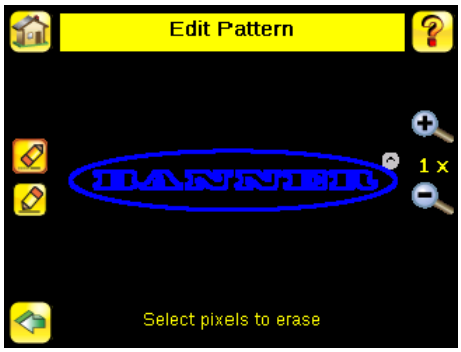
Figure 114. Parameters Menu



6. If needed, click **Edit Pattern** and adjust the taught pattern.

   a. Click **Eraser**, then click the desired pixels to remove from the pattern.

Figure 115. Erase Pixels from Pattern



   The pixels that have been erased appear in gray and changes are saved automatically.

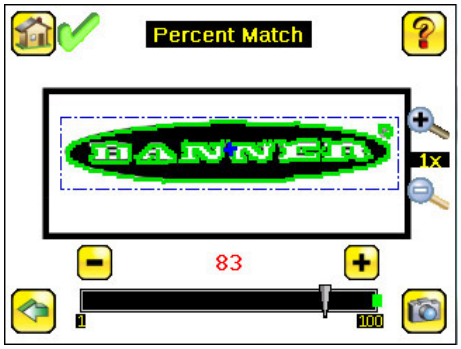
   b. If needed, click **Draw**, then click the desired gray pixels to restore to the pattern.

Note: Return to **Edit Pattern** at any time to erase or restore pixels from the taught pattern.

7. Set the sensor parameters.
   - Adjust the **Percent Match** parameter.

     Percent Match adjusts how closely the inspected part or label must match the reference part or label. The Percent Match scale is from 0 to 100, where 0 is the most tolerant and 100 is the least tolerant. Move the slider to adjust the tolerance.

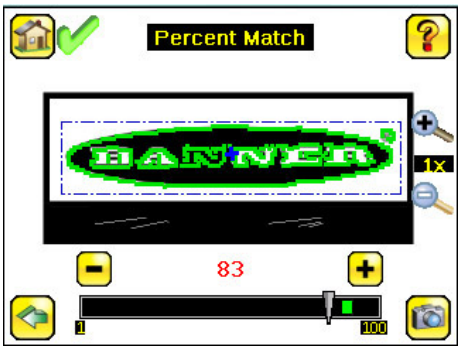
*Figure 116. **Percent Match** Screen*



Note: When running a Match inspection with annotations enabled, the sensor highlights in green any pattern matches that meet or exceed the value specified for **Percent Match**. Patterns that are below the specified value for **Percent Match** (down to approximately 20%), or out of the **Rotation Range** (see below), are colored yellow.

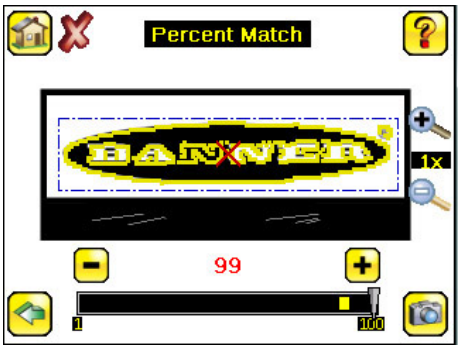
1. Using a bad part, click **Manual Trigger** to capture an image. For this example, one of the stored images is missing the letter "N," yet the sensor initially sees this as a good label.

*Figure 117. **Percent Match** Screen*



2. On the adjustment at the bottom of the display, move the slider and click **Manual Trigger**. When adjusted correctly, the annotations turn yellow, and the icon in the upper-left of the display indicates that the inspection failed.

Figure 118. Failed Inspection



- Adjust the **Rotation Range**.

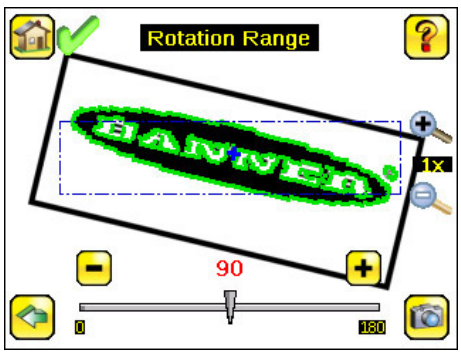
  Rotation Range sets the expected rotation of parts or labels during an inspection. For example, a value of 45 means that the part may rotate 45 degrees in either direction from the reference part and still pass. Move the slider from 0 to 180 degrees.

  Note: The smaller the rotation range, the faster the inspection will run.

  To verify that a label is correctly applied to a container (that is, on straight), set a small rotation. To verify that the correct label is present no matter how the part is oriented in the Field of View, set the rotation range to the maximum (180°, which is the setting for Demo Mode).

  Note: Rotations Range and Percent Match work together. The higher the Percent Match, the lower the Rotation Range to pass. In the previous example a 99% match is too high for any rotation. In the next graphic the Percent Match has been lowered to 92% which still fails a missing letter.

*Figure 119. **Rotation Range** Screen*

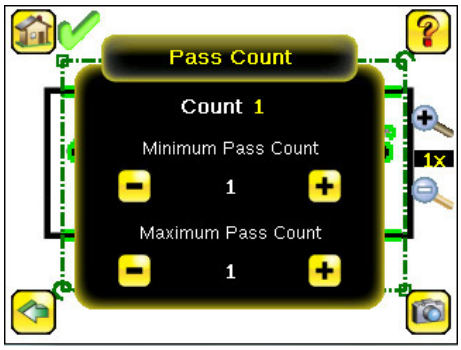


- Set the **Pass Count** parameter as appropriate.

  The **Minimum Pass Count** is the minimum number of parts, labels, or features expected to fall within the specified criteria. The **Maximum Pass Count** is the maximum number expected to fall within the specified criteria. These settings are used to determine the pass or fail result of the inspection.

  In the Demo, both the **Minimum Pass Count** and **Maximum Pass Count** are set 1. If the count is more than 1 or less than 1, the sensor will fail.

*Figure 120. **Pass Count** Screen*



8. If **Search ROI** is enabled, adjust the Search ROI as desired to set a custom region within the field of view to search for the pattern.
9. Test a complete range of good and bad samples to make sure that the sensor accepts good parts and rejects bad parts.
10. To complete the Match application setup, adjust the trigger setting as appropriate for the application.

Note: When running a Match inspection, the sensor looks for any possible patterns to match anywhere within the Field of View.

13.4.1 Remote Teach

The Remote Teach function is a method of remotely updating inspection parameters while the iVu is running. Remote Teach is only available when the iVu is configured as a Match sensor. The sequence of events for executing a Remote Teach are:

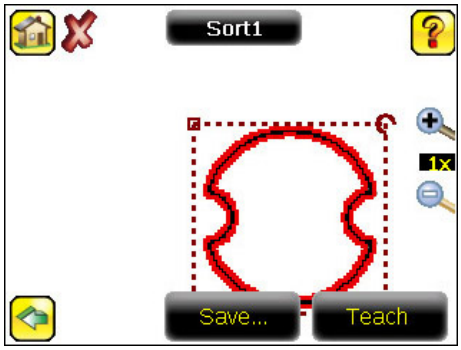
1. With the device Ready (see Installation Instructions on p. 17), pulse the Remote Teach line.
2. The iVu recognizes that the Remote Teach line has been pulsed and waits for the next valid trigger.
3. At the next valid trigger, Ready goes inactive (the Green Ready LED shuts OFF), and the iVu acquires a new image.
4. The iVu learns the new pattern and performs the analysis.

13.5 Configuring a Sort Sensor

When running a Sort inspection, the sensor looks for any possible patterns to match anywhere within the field of view.

1. Begin the setup with good parts.
2. Center the first part to be tested in the Field of View (FOV).
3. For the first part, adjust the Region of Interest (ROI) so that it surrounds the feature of interest.

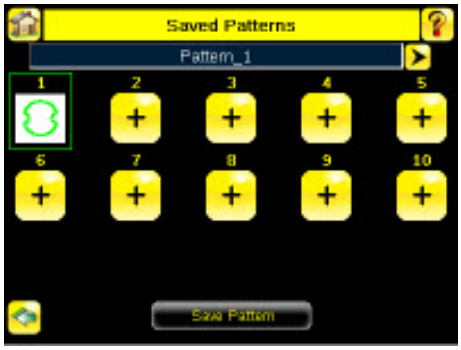
Figure 121. Adjust the ROI



Tip: For better results, make sure that the ROI bounds the image of the pattern as tightly as possible.

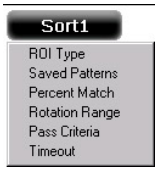
4. Click **Teach**. The feature is highlighted in green.
5. Click **Save** to save the pattern to the first empty pattern storage slot.

*Figure 122. **Saved Patterns** Screen*



6. Click the **sensor name** to open the sensor parameters menu.

*Figure 123. **Parameters** Menu*



7. Set the sensor parameters:
   - Adjust the **Percent Match**. This setting adjusts how closely the inspected part or label needs to match any of the ten stored patterns. The Percent Match scale is from 0 to 100, where 0 is the most tolerant and 100 is the least tolerant. Move the slider to adjust the setting. For the best results, use a value from 50 to 90.

     Note: When running a Sort inspection, the sensor highlights in green any pattern matches that are within the specified Rotation Range and meet or exceed the value specified for Percent Match. Patterns that are within the specified Rotation Range and within approximately 20% below the specified value for Percent Match are colored yellow.

   - Adjust the **Rotation Range**. This sets the expected rotation of parts or labels during an inspection. For example, a value of 45 means that the part may rotate 45 degrees in either direction from the reference part and still pass. Move the slider from 0 to 180 degrees. Note that the smaller the rotation range, the faster the inspection will run.
8. Repeat these steps for subsequent patterns and store each pattern in an empty pattern storage slot.
9. Set the **Pass Criteria**. This example uses only two stored patterns:
   - **Any Saved Pattern**—Pass condition if the sensor matches either Pattern_1, Pattern_2, or both
   - **All Saved Patterns**—Pass condition if the sensor matches both Pattern_1 AND Pattern_2
   - **Single Saved Pattern**—Pass condition if the sensor matches either Pattern_1 OR Pattern_2, but NOT both
   - **Specific Save Pattern** (Must also select the saved pattern to match, for example, select Pattern_2)—Pass condition any time the sensor matches Pattern_2
10. Test a complete range of good and bad samples to make sure that the sensor accepts good parts and rejects bad parts.
11. To complete the Sort application setup, adjust the trigger setting as appropriate for the application.

13.6 Configuring Motion

Main Menu > **Inspection** > **Motion**

The **Motion** menu is available when **Motion** is enabled under the **Inspection Properties** menu.

Enable Motion when the part being inspected is expected to move or rotate. Motion settings for **Edge** involve selecting the number of edges to locate, adjusting sensitivity, and selecting whether rotation is enabled. Motion settings for **Match** involve selecting the Teach ROI type, adjusting the percent match and rotation range, editing the taught pattern, and setting a timeout. These settings are available on the **Inspection Menu** after Motion is set to **Edge** or **Match**.

Motion is not available for Sort sensors.

*Figure 124. **Motion Menu** when Motion is set to **Edge***

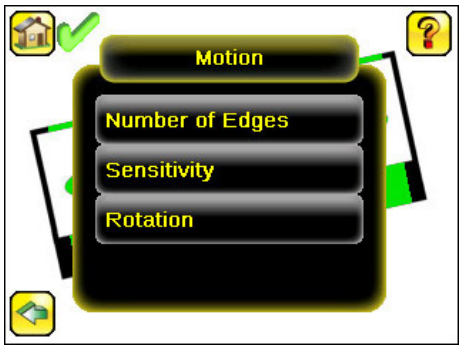
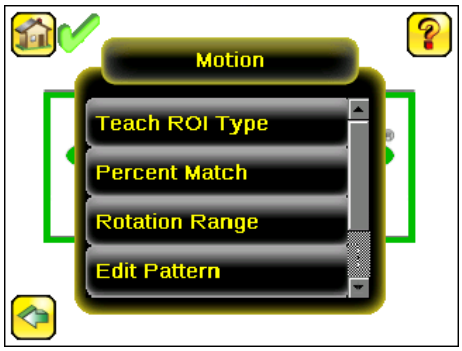


*Figure 125. **Motion Menu** when Motion is set to **Match***



Note: For a Match sensor, enable **Track with Motion** at **Main Menu** > **Inspection** > **Sensors** > **Match** > **Advanced**.

13.6.1 Number of Edges

Main Menu > **Inspection** > **Motion** > **Number of Edges**

Number of Edges is available when Motion is set to **Edge**.

On the **Number of Edges** screen, use the option buttons to select **One Edge** or **Two Edges**. If **One Edge** is selected, motion is tracked in one direction (by default, horizontally). If **Two Edges** is selected, motion can be tracked horizontally and vertically.

13.6.2 Sensitivity

Main Menu > **Inspection** > **Motion** > **Sensitivity**

Sensitivity is available when Motion is set to **Edge**.

Use **Sensitivity** to fine-tune how sensitive the sensor is to finding a reference edge.

The sensitivity value helps account for light variations that might affect how well the sensor detects edges on inspected parts. The sensitivity scale is from 0 to 100, where 0 means least sensitive and 100 means most sensitive. If set near 0, the sensor only finds very sharp edges with strong contrast. If set near 100, the sensor finds very dim or blurry edges, and may be unstable due to noise within the image.

13.6.3 Rotation

Main Menu > **Inspection** > **Motion** > **Rotation**

Rotation is available when Motion is set to **Edge**.

Rotation can be enabled or disabled. Select **Enabled** if the part can be expected to rotate during the inspection.

13.6.4 Teach ROI Type

Set the shape of the ROI used to teach the reference pattern during setup.

Main Menu > **Inspection** > **Motion** > **Teach ROI Type**

Teach ROI Type is available when Motion is set to **Match**.

The Region of Interest (ROI) is the user-defined area on the screen that the sensor analyzes. The ROI type can be rectangular, elliptical, or circular. From the drop-down list, select the ROI type to use for the inspection. Adjust the ROI as appropriate for the inspection. An ROI can be as large as the entire Field of View (FOV).

13.6.5 Percent Match

Main Menu > **Inspection** > **Motion** > **Percent Match**

Percent Match is available when Motion is set to **Match**.

Percent Match adjusts how closely the inspected part or label must match the reference part or label. The Percent Match scale is from 0 to 100, where 0 is the most tolerant and 100 is the least tolerant. Move the slider to adjust the tolerance.

13.6.6 Rotation Range

Main Menu > **Inspection** > **Motion** > **Rotation Range**

Rotation Range is available when Motion is set to **Match**.

Rotation Range sets the expected rotation of parts or labels during an inspection. For example, a value of 45 means that the part may rotate 45 degrees in either direction from the reference part and still pass. Move the slider from 0 to 180 degrees.

Note: The smaller the rotation range, the faster the inspection will run.

13.6.7 Timeout

Main Menu > **Inspection** > **Motion** > **Timeout**

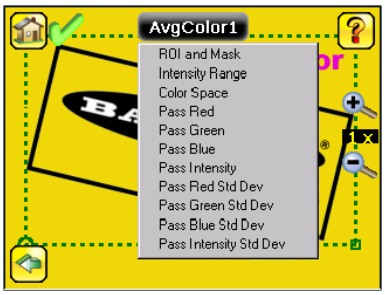
Timeout is available when Motion is set to **Match**.

Use **Timeout** to adjust the maximum time the inspection is allowed to execute. A timeout error is reported in the case the inspection runs out of time.

13.7 Configuring an Average Color Sensor

1. Begin the setup with a good part.
2. Center the part to be tested in the Field of View (FOV).
3. Adjust the Region of Interest (ROI) so that it surrounds the feature of interest. In the Demo example, the ROI covers the Banner logo, even when the logo is rotated.
4. Click the **[Sensor Name]** to open the sensor parameters menu.

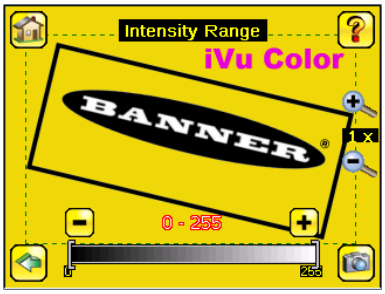
*Figure 126. Open the **Parameters** Menu—RBGI Menu Shown*



5. Set the sensor parameters.
   - Adjust the **Intensity Range**.

     Intensity Range allows a range of brightness in the image. In the other words, it can be used to exclude image that is too dark, too bright, or both.

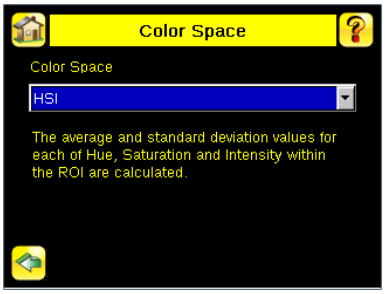
     *Figure 127. **Intensity Range** Screen*

     In the Demo example, the **Intensity Range** is 0 – 255.
   - Set the **Color Space**.

     Two color space options are available:
     - **RGBI**—The average and standard deviation values for each of Red, Green, Blue, and Intensity within the ROI are calculated
     - **HSI**—The average and standard deviation values for each of Hue, Saturation, and Intensity within the ROI are calculated

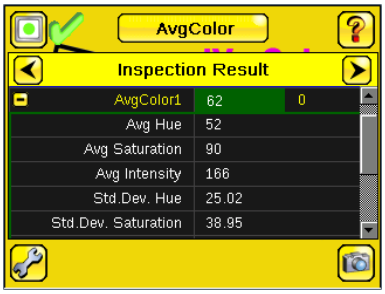
*Figure 128. **Color Space** Screen*



In the Demo example, the **Color Space** is HSI.

6. Click **Display Mode** to access the Inspection Statistics and view the Average Color.

*Figure 129. **Color Space** Screen*



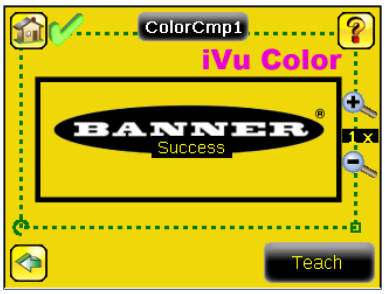
7. To complete the Average Color application setup, adjust the trigger setting as appropriate for the application.

Note: Remote Teach does not work with the Average Color sensor.

13.8 Configuring a Color Compare Sensor

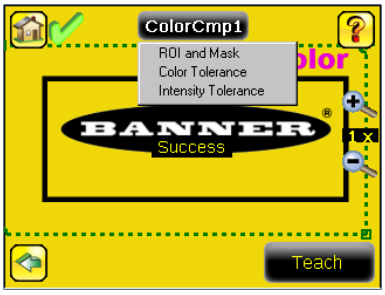
1. Begin the setup with a good part.
2. Center the part to be tested in the Field of VIew (FOV).
3. Adjust the Region of Interest (ROI) so that it surrounds the feature of interest. In the Demo example, the ROI covers the Banner logo, even when the logo is rotated.
4. Click **Teach**. The sensor learns the color.

Figure 130. Teach Successful



5. Click the **[Sensor Name]** to open the sensor parameters menu.

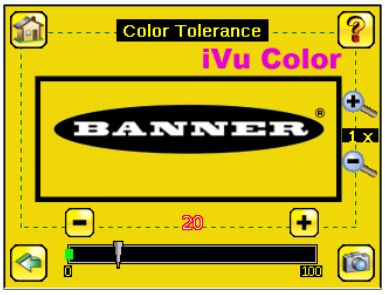
*Figure 131. Open the **Parameters** Menu*



6. Set the sensor parameters.
   - Adjust the **Color Tolerance** parameter.

     Use **Color Tolerance** to adjust the maximum acceptable difference (in %) between the taught color and the color detected in the live image.

     *Figure 132. **Color Tolerance** Screen*

     In the Demo example, the **Color Tolerance** is 20.
   - Adjust the **Intensity Tolerance**.

     Intensity Tolerance defines the grayscale brightness level necessary to constitute a match. This value ranges from 0 to 255.

     *Figure 133. **Intensity Tolerance** Screen*

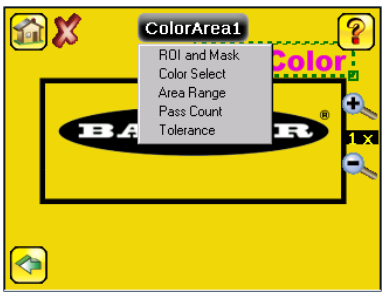
     In the Demo example, the **Intensity Tolerance** is set to 30.
7. Test a complete range of good and bad samples to make sure that the sensor accepts good parts and rejects bad parts.
8. To complete the Color Compare application setup, adjust the trigger setting as appropriate for the application.

Note: Remote Teach does not work with the Color Compare sensor.

13.9 Configuring a Color Area Sensor

1. Begin the setup with a good part.
2. Center the part to be tested in the Field of View (FOV).
3. Adjust the Region of Interest (ROI) so that it surrounds the feature of interest. In the Demo example, the feature of interest is the pink text, "iVu Color".
4. Click the **[Sensor Name]** to open the sensor parameters menu.

   *Figure 134. Open the **Parameters** Menu*

5. Set the sensor parameters.

- Select the **Color Select**.

  Use **Color Select** to select the color the **Color Area** sensor looks for. Click **Color Selector** then click the desired color in the ROI. Adjust the color tolerance using **+** and **-**.

  Note: You can select a color that is outside of the ROI, but a BLOB of that color will only be detected within the ROI.

  In the Demo example, the desired color is pink.

  If needed, zoom in to better select the desired color.

*Figure 135. **Color Select** Screen*

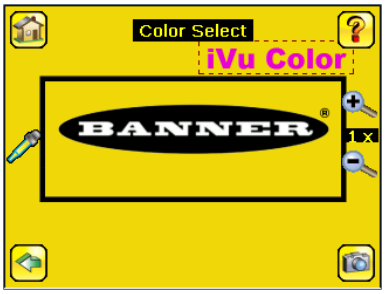
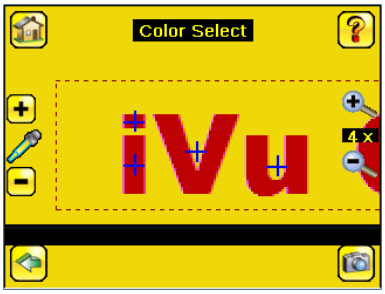


*Figure 136. **Color Select** Screen—Color Selected*

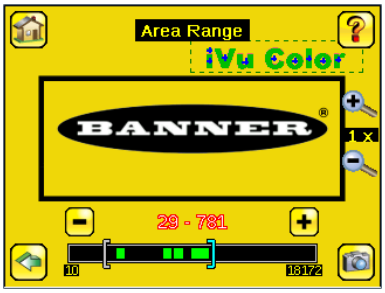


  After the color is selected, **+** and **-** buttons display. Click these buttons to fine-tune the selection.

- Adjust the **Area Range**.

  Use Area Range to set the size limits of a feature of interest. Move the slider to select the range. Areas are measured by counting pixels. For example, a rectangular feature that is 100 pixels wide by 200 pixels tall has an area of roughly 20,000 pixels.

*Figure 137. **Area Range** Screen*



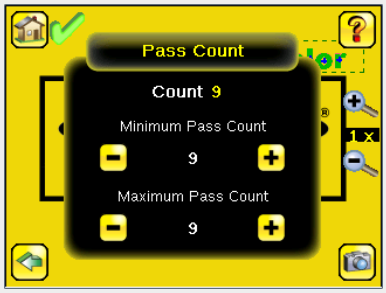
  In the Demo example, the **Area Range** is 29 – 782.

- Set the **Pass Count** parameter.

  The **Minimum Pass Count** is the minimum number of parts, labels, or features expected to fall within the specified criteria. The **Maximum Pass Count** is the maximum number expected to fall within the specified criteria. These settings are used to determine the pass or fail result of the inspection.

Note: Start with the Maximum Pass Count—the Minimum will not allow it to be more than the maximum.

*Figure 138. **Pass Count** Screen*

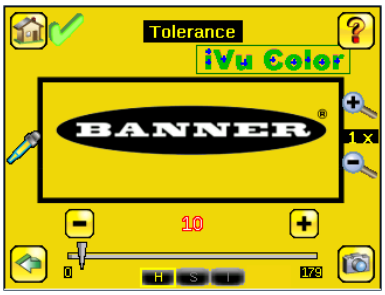


In the Demo, set the Minimum Pass Count and Maximum Pass Count to 9. If the count is more than 9 or less than 9, the sensor will fail.

- Adjust the **Tolerance**.

  Adjust the tolerance for the color the sensor is looking for. Adjustments are made individually for hue, saturation, and intensity.

*Figure 139. **Tolerance** Screen*



In the Demo example, the **Tolerance** is set to 10.

6. Test a complete range of good and bad samples to make sure that the sensor accepts good parts and rejects bad parts.
7. To complete the Color Area application setup, adjust the trigger setting as appropriate for the application.

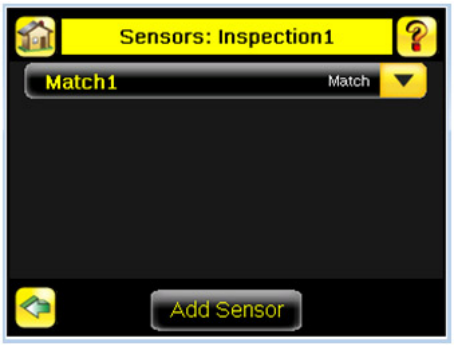
Note: Remote Teach does not work with the Color Area sensor.

13.10 Configuring Multiple Sensors in the Inspection

Main > **Inspection** > **Sensors** > **Add Sensor**

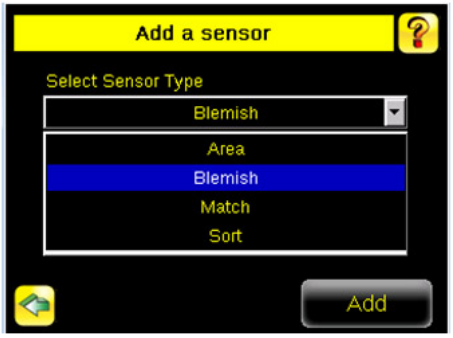
Some applications require more than one sensor. New sensors can be added after an inspection has been created. Input parameters for each sensor can be configured individually.

*Figure 140. **Sensors** Screen*



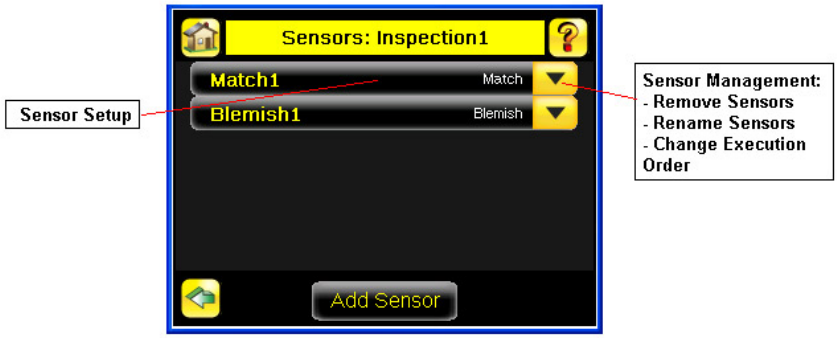
1. Click **Add a Sensor** to display the list of sensor types that can be added into the inspection.

*Figure 141. **Add a Sensor** Screen*



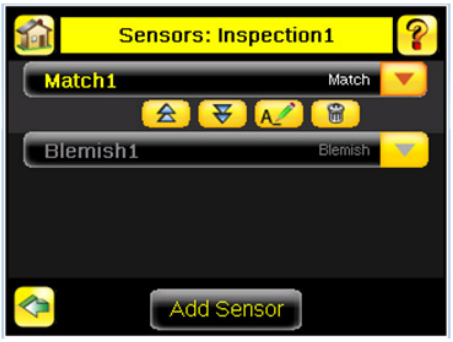
2. Click **Add** to add the selected sensor.

Figure 142. The New Sensor is Added to the Inspection



3. Click in the Sensor Setup area (black button) to display the input parameter menu for that sensor.

*Figure 143. **Input Parameter** Menu*



4. Click the yellow down-arrow to access sensor management functions.

Icon	Function
	Move the selected sensor up in the execution order
	Move the selected sensor down in the execution order
	Edit the name of the selected sensor
	Delete the selected sensor

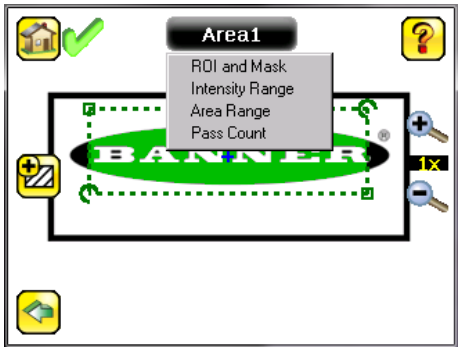
After all of the sensors are configured as required for the application, the inspection Pass/Fail criteria is determined by considering the results of the individual sensors. An inspection is considered as PASS if all sensors in the inspection pass. If any sensor fails, the inspection is marked as FAIL.

13.11 Configuring a Mask

A mask created for a sensor does not apply to any other sensors in the inspection. The mask ROI type can be rectangular, elliptical, or circular. Use up to ten masks per sensor.

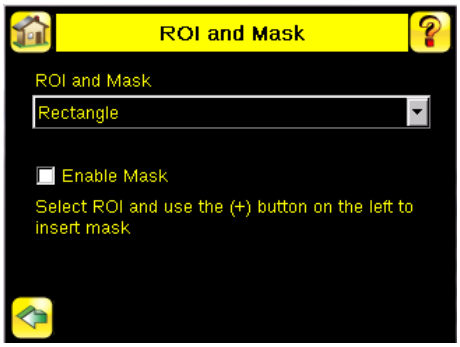
1. Select the desired ROI. When selected, the ROI has resize and rotation icons in the corners.
2. Click **[Sensor Name]** to open the sensor parameters menu.

*Figure 144. **Parameters** Menu*



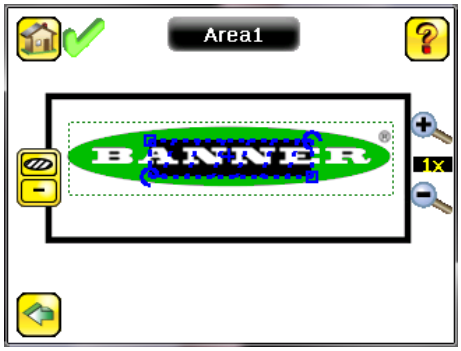
3. Select **ROI and Mask**.
4. Select the **Enable Mask** checkbox.

*Figure 145. **ROI and Mask** Screen*



5. Click  to return to the **Home** screen.
6. Re-select the ROI from step 1.
7. Click  to insert the mask. The mask displays in blue with a diagonal line pattern in the region.

Figure 146. Mask (in blue)



8. To change the shape of the mask ROI, click , , and  to cycle through the shape options.
9. Adjust the mask ROI as appropriate for the application.
10. To delete a mask, select it and click .

14 Communications Guide

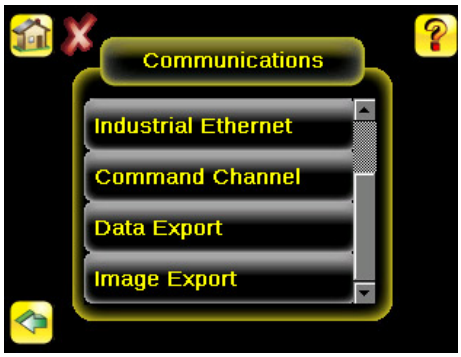
14.1 iVu Plus Communication Summary of Ethernet and Serial

The iVu communicates with other devices via Ethernet or a UART serial communications port (RS-232). To establish an Ethernet connection to the iVu, configure the external device with the correct IP address and TCP port. To use the serial communications connection, configure the port settings for baud rate, data bits, parity, and stop bits on the iVu to match the settings of the external device.

14.1.1 Communication Channels

The iVu supports up to four communications channels. To access the channels, go to **Main Menu** > **System** > **Communications**.

*Figure 147. **Communications** Menu*



- Command Channel—A bi-directional communication protocol that currently supports ASCII and enables other devices to remotely control the iVu and access device information and inspection results
- Industrial Ethernet—A bi-directional communication channel that allows the user to control the device and access device results using Ethernet/IP™, Modbus/TCP, PCCC, or PROFINET® protocol
- Data Export—Used to export selected inspection data to a remote device
- Image Export—Used to export inspection images to a remote device

Data export and command channel can be configured for either Ethernet or Serial I/O, but not both. Image export is only available over Ethernet. The following table summarizes valid communication channel configuration options.

Command Channels	Scenario #1		Scenario #2		Scenario #3	
	Ethernet	Serial I/O	Ethernet	Serial I/O	Ethernet	Serial I/O
Command Channel	Yes	No	No	Yes	Yes	No
Industrial Ethernet	Yes	No	Yes	No	Yes	No
Data Export	Yes	No	Yes	No	No	Yes
Image Export	Yes	No	Yes	No	Yes	No

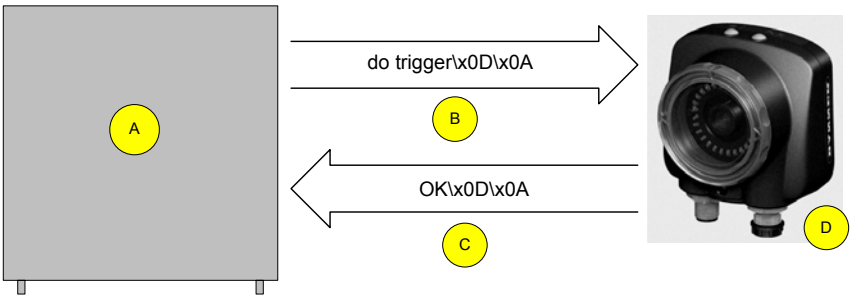
14.1.2 Industrial Ethernet

Main Menu > **System** > **Communications** > **Industrial Ethernet**

The iVu device can be controlled or monitored over Industrial Ethernet using Ethernet/IP™, Modbus/TCP, PCCC, or PROFINET® protocols. This document will help you to set up the iVu in the desired configuration and provide you with information you will need to connect to the master device (PLC, HMI, etc.).

14.1.3 Command Channel

The iVu command channel is a bi-directional communication protocol that currently supports ASCII via either Ethernet or the RS-232 serial interface, and enables other devices to remotely control the iVu sensor and access sensor results.



A	Control Device, such as a PLC, PC program, or a terminal	**C**	Response Frame
B	Request Frame	**D**	iVu Device

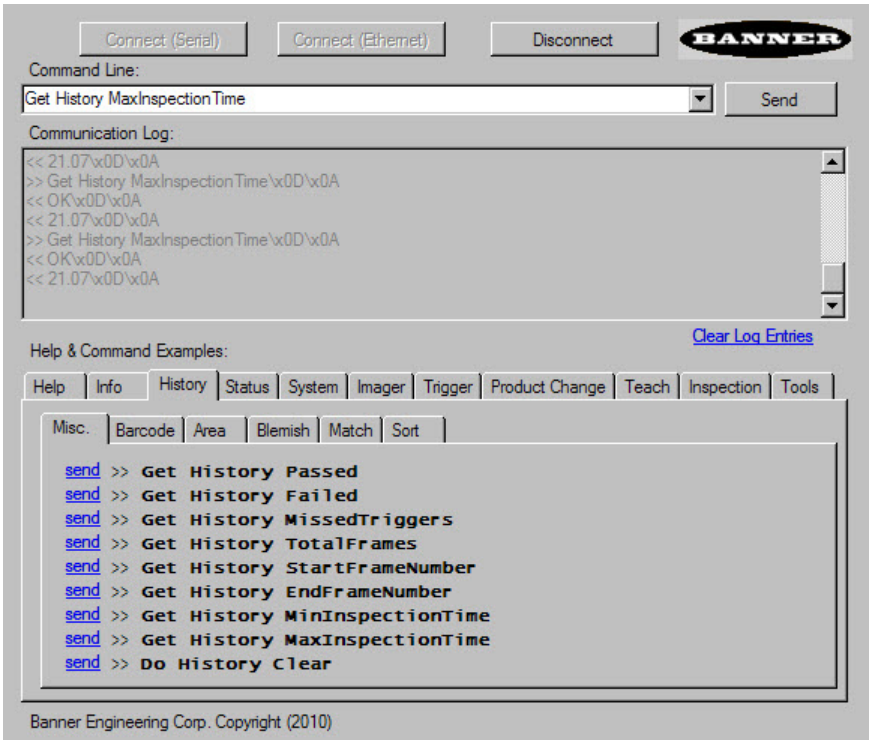
The following are some of the functionality available via the command channel:

- Get device information (such as version and device name)
- Control discrete I/O (such as trigger and teach)
- Get sensor results (such as sensor status)
- Change the running inspection

Command Channel Sample Application

The iVu installation package has a Command Channel sample application that provides an easy interface to execute commands. In a production environment, you will need to create your own application for bi-directional communication with the iVu.

Figure 148. Command Channel Sample Application



14.1.4 Data Export

Export user-selected inspection data via either Ethernet or the RS-232 serial interface. Inspection data that can be exported includes:

- Pass/Fail Output
- Inspection Name
- Sensor Result
  - Name
  - Pass/Fail
  - Sensor Result (see Table 18 on p. 99 for additional information)
- Inspection Time (ms)

Table 18: Sensor Results

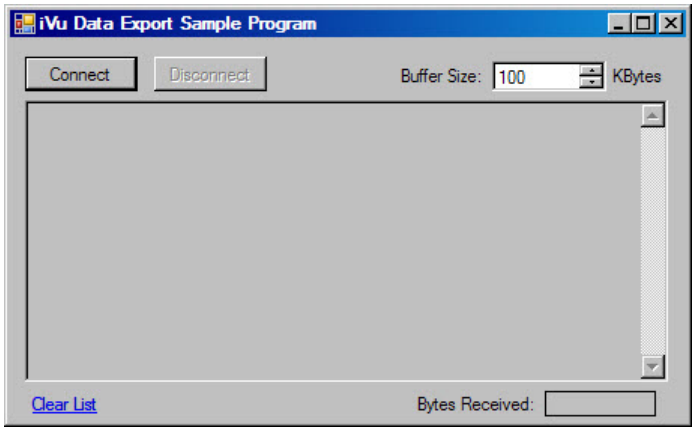
Sensor Type	Data to Export	Sensor Type	Data to Export
Area	Count	Average Color (Color models only)	Average Red (RGBI color space)
	Area Range		Average Green (RGBI color space)
Blemish	Count		Average Blue (RGBI color space)
	Edge Length Range		Average Hue (HSI color space only)
Match	Count		Average Saturation (HSI color space only)
	Percent Match		Average Intensity
Sort	Count		Standard Deviation Red (RGBI color space)
	Percent Match		Standard Deviation Green (RGBI color space)
	All Found Pattern Numbers		Standard Deviation Blue (RGBI color space)
	All Found Pattern Names		Standard Deviation Hue (HSI color space only)
Color Compare (Color models only)	Percent Match		Standard Deviation Saturation (HSI color space only)
	Intensity		Standard Deviation Intensity
Color Area (Color models only)	Count		
	Area Range		

Data export settings apply to all inspections on the device. If items are selected that are not part of the current inspection, those items are ignored.

Data Export Sample Application

The iVu installation package has a Data Export sample application that allows you to view exported data while setting up the sensor, etc. In a production environment, you need to create your own application to process data exported from the inspection.

Figure 149. Data Export Sample Application



14.1.5 Image Export

Image export is only supported on Ethernet ports. Inspection images are in bitmap (.bmp) format and are the same size as the current Field of View (FOV) setting. The images represent all the data in a full FOV.

Each exported image is comprised of a header (64 bytes) followed by the image data. All 16- and 32-bit numeric entries are little endian.

The header includes the following information:

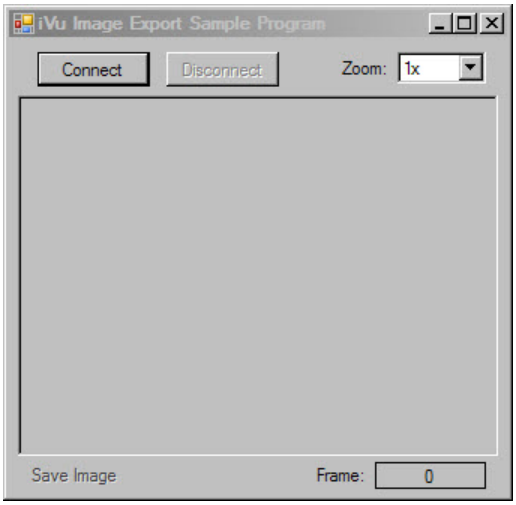
Byte Offset	Field	Size in Bytes	Data Type	Description
0-15	Header Prefix	16	char	TG: "IVU PLUS IMAGE" TC: "TC IMAGE"
16-19	Header Version	4	UInt32	2
20-23	Image Size	4	UInt32	Total number of bytes for exported image
24-27	Image Frame Number	4	UInt32	Image frame number
28-29	Image Width	2	UInt16	752 (maximum)
30-31	Image Height	2	UInt16	480 (maximum)
32-33	Image Format	2	UInt16	0: Bitmap, 1: JPEG
34-63	Reserved	30	byte	Reserved for future use

Note: If FOV's are adjusted so that they are smaller, the bitmaps will also be smaller.

Image Export Sample Application

The iVu installation package has an Image Export sample application that provides a way to save exported images. In a production environment, you need to write your own application to process exported images, for example to display them on an HMI or to save them to disk.

Figure 150. Image Export Sample Application



14.2 Enabling Communications

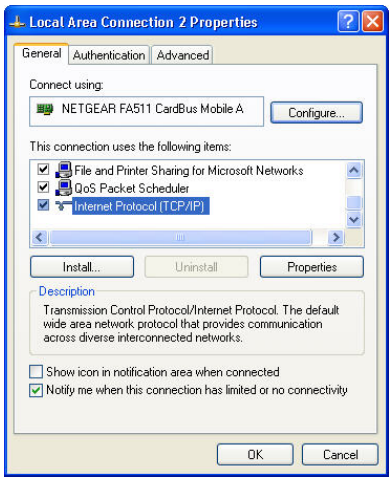
14.2.1 Setting Up Ethernet Communications

Configure both the PC and the iVu using the following instructions.

Windows XP

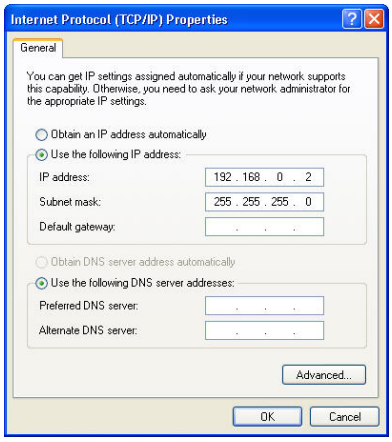
1. Open **Network Properties** on the Windows XP [9] PC (right-click on the **Network Neighborhood** icon).
2. On the Local Area Connection, right-click on **Properties**.
3. In the dialog, click **Internet Protocol (TCP/IP)** and click **Properties**.

*Figure 151. **Local Area Connection Properties** Screen*



4. In the **Internet Protocol (TCP/IP) Properties** dialog, select **Use the following IP address** and make sure that the IP address is 192.168.0.2, and the subnet mask is 255.255.255.0.

*Figure 152. **Internet Protocol (TCP/IP) Properties** Screen*



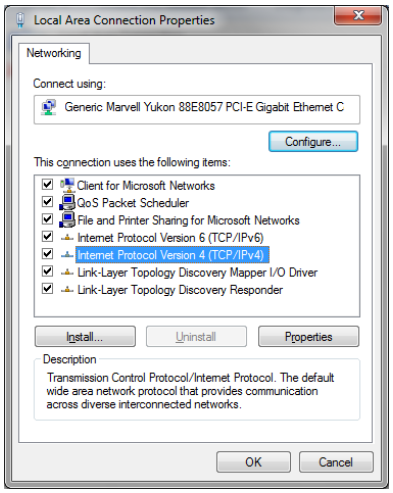
Windows 7

1. On the Windows 7 [10] PC, click the **Start** button, then on the **Start** menu, click **Control Panel**.
2. In **Control Panel**, click **Network and Internet**, then click **Network and Sharing Center**, and then click **Change adapter settings**.
3. Right-click on the connection that you want to change, then click **Properties**.

   If you are prompted for an administrator password or confirmation, enter the password or provide confirmation.
4. In the connection properties, click **Internet Protocol Version 4 (TCP/IPv4)**, and then click **Properties**.

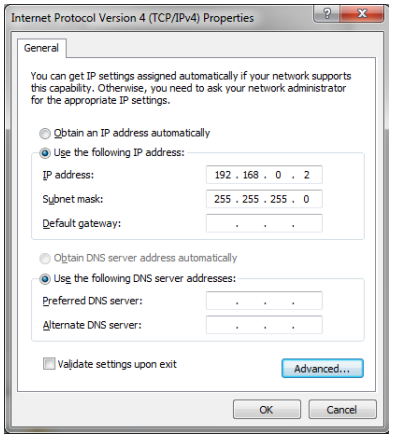
[9] Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.
[10] Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.

*Figure 153. **Local Area Connection Properties** Screen*



5. In **Internet Protocol (TCP/IPv4) Properties**, select **Use the following IP address**.
6. Make sure that the IP address is 192.168.0.2, and the subnet mask is 255.255.255.0.

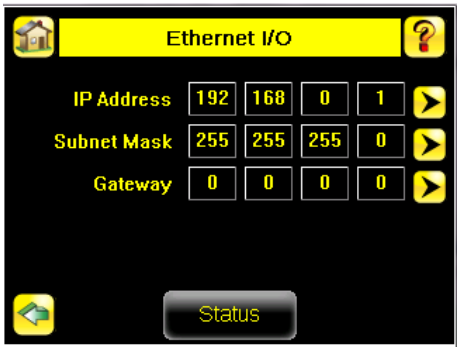
*Figure 154. **Internet Protocol (TCP/IPv4) Properties** Screen*



iVu Setup for Ethernet Communications

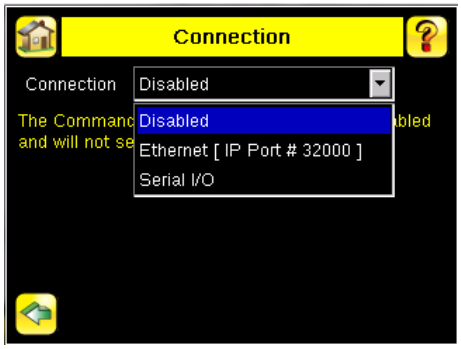
1. Go to **Main Menu** > **System** > **Communications** > **Ethernet I/O** and make sure that the iVu is configured as shown.

*Figure 155. **Ethernet I/O** Screen*



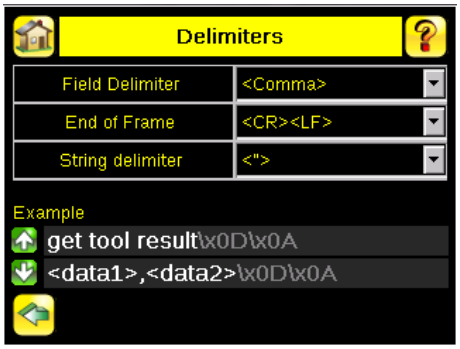
2. Enable the command channel over Ethernet.
    a. Go to **Main Menu** > **System** > **Communications** > **Command Channel** > **Connection**, and select Ethernet [IP Port # 32000].

*Figure 156. **Connection** Screen*



b. Configure the field and end-of-frame delimiters. Go to **Main Menu** > **System** > **Communications** > **Command Channel** > **Delimiters**.

*Figure 157. **Delimiters** Screen*

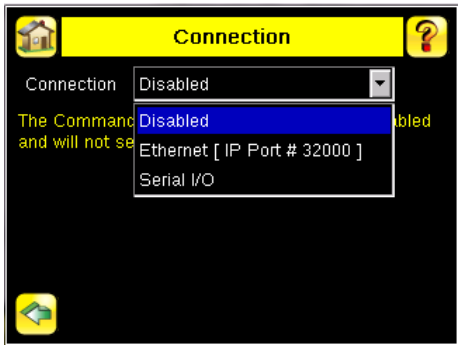


Valid end-of-frame delimiters are: <comma>, <colon>, <semicolon>, <CR>, <CR><LF>, <LF><CR>, or <ETX>.

c. Verify that the iVu receives and transmits data correctly.

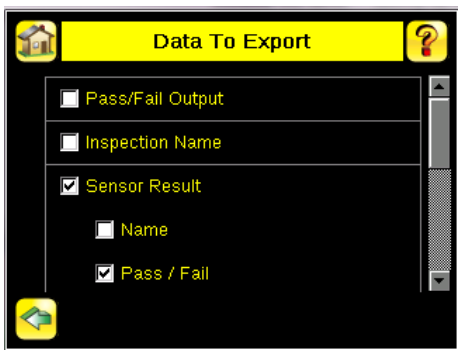
3. Enable Data Export over Ethernet.
   a. Go to **Main Menu** > **System** > **Communications** > **Data Export** > **Connection** and select Ethernet from the drop-down.

*Figure 158. **Connection** Screen*



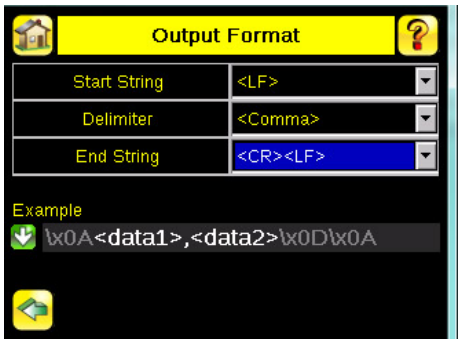
   b. Go to **Main Menu** > **System** > **Communications** > **Data Export** > **Data To Export** and select the inspection data to export.

*Figure 159. **Data to Export** Screen*



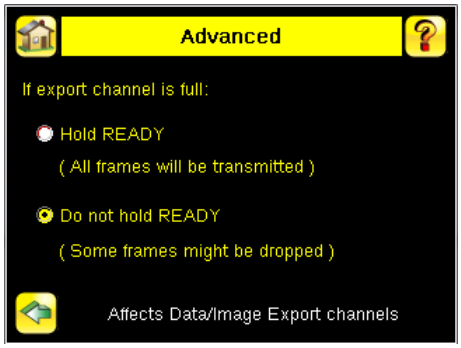
c. Go to **Main Menu** > **System** > **Communications** > **Data Export** > **Output Format** and select the Start String, Delimiter, and End String.

*Figure 160. **Output Format** Screen*



d. Go to **Main Menu** > **System** > **Communications** > **Data Export** > **Advanced**.

*Figure 161. **Advanced** Screen*



During the Data and Image export operation the sensor's output channels might become full. This can occur if the sensor is producing export data (frames) faster than the data can be exported from the device (due to bandwidth limitations) or faster than the client is reading the channel export data.

This setting affects how the sensor will behave in this situation.

- Select **Hold READY** to ensure that all frames are transmitted. In this case, the READY signal remains inactive (sensor is busy) until the new frame has been added to the channel for transmission. Triggers might be missed during this time.
- Select **Do not hold READY** to cause the sensor to discard the new frame if the channel is full and activate the READY signal immediately after the current inspection is complete. In this case, the discarded frames are not transmitted.

Communications Channel Ports

The following are the default Ethernet port settings for the communications channels:

- Command Channel — 32200
- Data Export — 32100
- Image Export — 32000

14.2.2 Setting Up Serial Communications

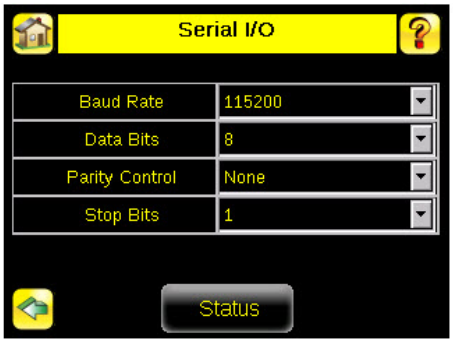
1. Electrically connect the control device and the iVu device. On the iVu, the pins/wire colors used for serial communications via RS-232 are shown in the following table.

   Table 19: iVu RS-232 Connections

Pin #	Wire Color	Description
10	Light-Blue	TX
11	Black	Signal Ground
12	Violet	RX

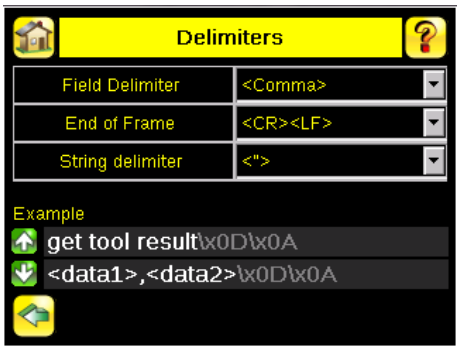
2. Configure the port settings (baud rate, data bits, parity, and stop bits) on the iVu to match the settings on the control device. Go to **Main Menu** > **System** > **Communications** > **Serial I/O**.

*Figure 162. **Serial I/O** Screen*



3. Enable the command channel over the serial connection.
    a. Go to **Main Menu** > **System** > **Communications** > **Command Channel** > **Connection** and select Serial I/O.
    b. Configure the field and end-of-frame delimiters. Go to **Main Menu** > **System** > **Communications** > **Command Channel** > **Delimiters**.

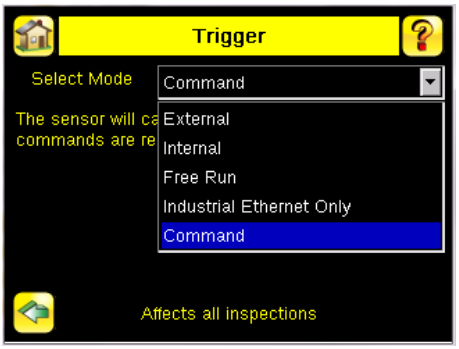
*Figure 163. **Delimiters** Screen*



Valid end-of-frame delimiters are: <comma>, <colon>, <semicolon>, <CR>, <CR><LF>, <LF><CR>, or <ETX>.

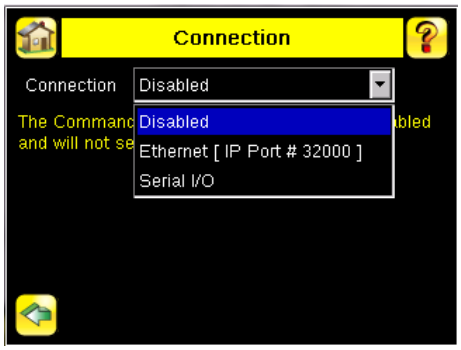
    c. If you want to trigger the iVu from the control device, set the trigger mode to Command. Go to **Main Menu** > **Imager** > **Trigger** and select Command from the drop-down list.

*Figure 164. **Trigger** Screen*



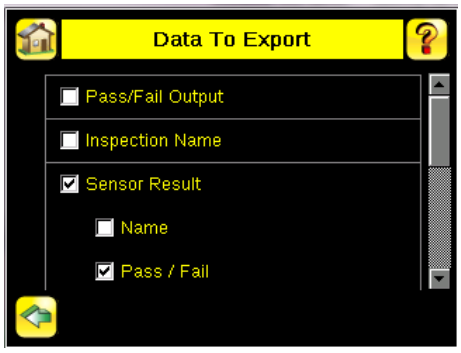
    d. Verify that the iVu receives and transmits data correctly.
4. Enable Data Export over the serial connection.
    a. Go to **Main Menu** > **System** > **Communications** > **Data Export** > **Connection** and select Serial I/O from the drop-down.

*Figure 165. **Connection** Screen*



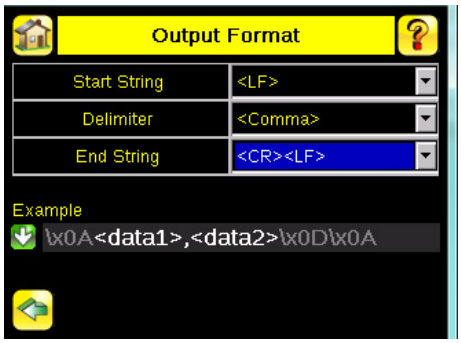
b. Go to **Main Menu** > **System** > **Communications** > **Data Export** > **Data To Export** and select the inspection data to export.

*Figure 166. **Data to Export** Screen*



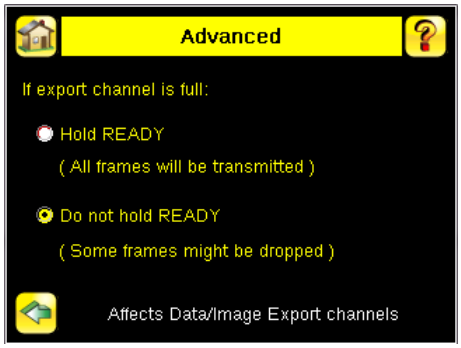
c. Go to **Main Menu** > **System** > **Communications** > **Data Export** > **Output Format** and select the Start String, Delimiter, and End String.

*Figure 167. **Output Format** Screen*



d. Go to **Main Menu** > **System** > **Communications** > **Data Export** > **Advanced**.

*Figure 168. **Advanced** Screen*



During the Data and Image export operation the sensor's output channels might become full. This can occur if the sensor is producing export data (frames) faster than the data can be exported from the device (due to bandwidth limitations) or faster than the client is reading the channel export data.

This setting affects how the sensor will behave in this situation.

- Select **Hold READY** to ensure that all frames are transmitted. In this case, the READY signal remains inactive (sensor is busy) until the new frame has been added to the channel for transmission. Triggers might be missed during this time.
- Select **Do not hold READY** to cause the sensor to discard the new frame if the channel is full and activate the READY signal immediately after the current inspection is complete. In this case, the discarded frames are not transmitted.

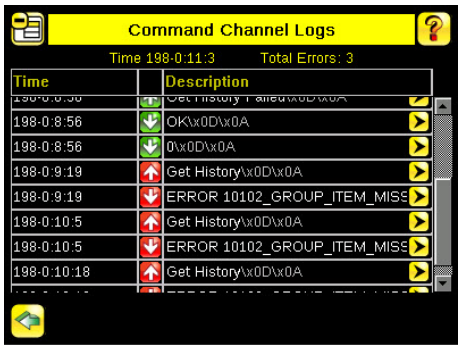
14.3 Testing and Troubleshooting iVu Communications

14.3.1 Understanding the Communication Log

The iVu includes the following Communication Logs:

- Command Channel Log—Ensures that commands are properly formed (syntax is correct), and provides a history of commands issued along with responses to these commands. To access the Command Channel Log, go to **Main Menu** > **Logs** > **Communication Logs** > **Command Channel**
- Data Export and Image Output logs—These logs are purely output logs (that is, there is no receive activity to log)

*Figure 169. **Command Channel Logs** Screen*



Some notes about the logs:

- To see an expanded view of each entry, click the small right-triangle control on each entry
- To save the log, click the save icon. The saved communication log can be loaded into the emulator for troubleshooting offline

The following table describes the icons used in the Communication Log. The up-arrow indicates an incoming request to the iVu from the control device. The down-arrow indicates an outgoing response from the iVu to the control device.

Icon	Description
	Port open.
	Port closed.
	Indicates that the command has been processed without errors.
	Indicates that the incoming entry is stalled (no new bytes), or end-of-frame delimiter was not received, or client is not reading data on Ethernet.
	Indicates whether the response frame contains an error or is dropped, the log entry icons for the request and the response frames are red, and the displayed error count increments by one.
	If the command takes a long time to process, the last long entry changes to an hourglass (for example, during trigger of long inspections).

For Ethernet channels:

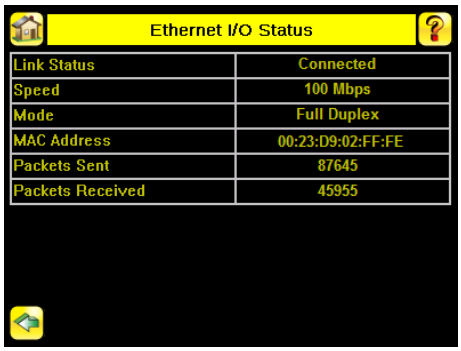
- The channel's log shows an Enabled entry that indicates which port is being listened to
- When a client connects, a log entry is added that indicates which IP address connected
- When a client closes the connection, a log entry indicates that the channel is no longer being listened to

14.3.2 Ethernet I/O

Ethernet I/O Status

Use the **Ethernet I/O Status** screen to verify that the Ethernet wiring was correctly set up. In addition to determining if the link has been established, incoming and outgoing traffic can be monitored.

*Figure 170. **Ethernet I/O Status** Screen*



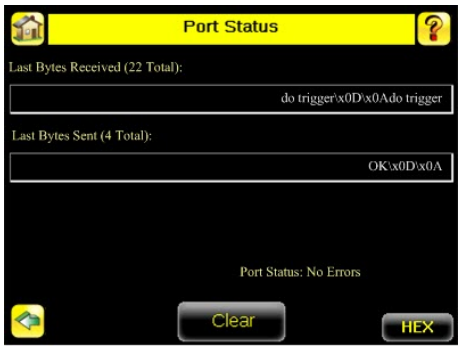
14.3.3 Serial I/O

Using the Port Status Screen for Testing RS-232 Communications

Use **Port Status** screen to ensure data is entering and exiting the iVu. This can be useful for debugging issues such as improper wiring, mismatched baud rates, or other serial I/O issues. To access the **Port Status** screen, go to **Main Menu** > **System** > **Communications** > **Serial I/O** and click **Status**.

- The upper field shows the bytes received (request frame) on the iVu from the control device
- The lower field shows the bytes sent (response frame) from the iVu to the control device

*Figure 171. **Port Status** Screen*



Port Errors

The **Port Errors** screen can help to debug communications channel issues: Parity, Break, and Framing indicate mismatched port settings or, in the case of Break, incorrect cabling.

Using the iVu Command Channel Sample Application or a Terminal Program for Testing

The easiest way to test that the iVu command channel is correctly receiving and transmitting data is to use either the iVu Command Channel Sample App (available in the iVu installation package) or to use a terminal program running on a PC.

If you are using a terminal program, in the terminal program's configuration:

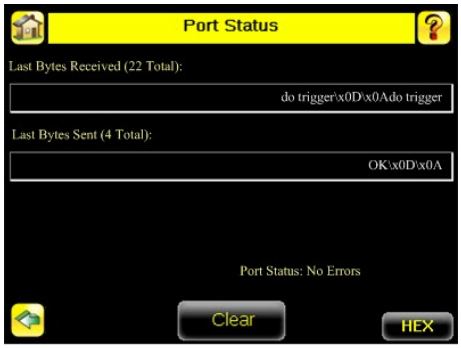
- Set new-line transmit to <CR><LF> (and set the end-of-frame delimiters on the iVu to match)
- Enable local echo
- Set the Serial port so that the PC port number's baud rate, data, parity, and stop bits match those set up on the iVu

Verifying Basic Receive Functionality

Use the following instructions to verify that the iVu can receive request frames from the requesting device:

1. On the iVu, go to **Main Menu** > **System** > **Communications** > **Serial I/O** > **Port Status** .

*Figure 172. **Port Status** Screen*



2. On the requesting device, transmit one or more bytes to the iVu.
    - If the data byte values appear correct and the number sent by the requesting device matches the number received by the iVu, then the transmit/receive functionality is working properly.
    - If the connection is incorrect (electrically) or if the baud rate is mismatched, no bytes will appear in the upper field on the **Port Status** screen.
    - If the connection is correct (electrically), bytes will appear in the upper field of the **Port Status** screen in the order they were received.
    - If the Port Status: Errors at the bottom of the **Port Status** screen highlights red, then the connection is correct electrically but there is likely a settings mismatch between the iVu and the requesting device. Verify the settings on both devices.
    - If the bytes appear with no errors but appear incorrect or there are too many or too few, then the port settings (for example, baud rate) are likely mismatched in a way that does not generate serial hardware errors. Verify the settings on both devices match exactly.

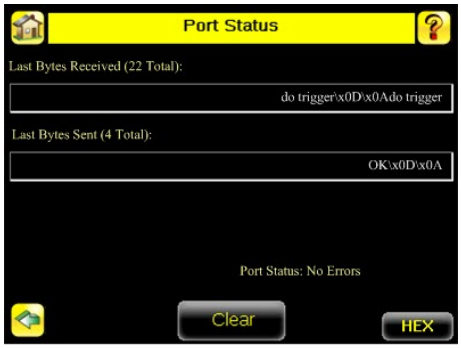
Verifying Basic Transmit Functionality

The iVu command channel only sends response frames to the requesting device if it receives a valid end-of-frame delimiter from the requesting device. To verify transmit functionality:

1. Transmit an end-of-frame delimiter sequence from the requesting device to the iVu. For example, in a terminal program, press **Enter**.

    If a valid end-of-frame delimiter is received, the iVu immediately transmits a short error message back to the requesting device (for example, ERROR 10000_COMMAND_MISSING).
2. Verify that the number of bytes sent by the requesting device are the same as the number shown in the lower field of the **Port Status** screen on the iVu. Go to **Main Menu** > **System** > **Communications** > **Serial I/O** > **Port Status** .

*Figure 173. **Port Status** Screen*



3. If the byte count does not match, re-verify that the settings on both devices match exactly. If no bytes are received, re-check the wiring.

If the correct response frame is received, then basic electrical and port settings are correct.

14.4 Command Channel Primer

14.4.1 Command Channel Commands

All iVu command channel request command frames use the following syntax:

```
>> command group item value<EOF>
```

Notes

<EOF> is the end-of-frame delimiter. See below for a description.

All commands are in ASCII and are case-insensitive.

command

An action to be performed on an iVu group. For example, get, set, do, login, or logout.

group

Identifies the iVu group that the command should act upon. For example, info, system, or trigger.

item

Further qualifies the action by specifying an item within the identified group. For example, comparedata or status.

value

For set commands, this identifies the data that must be set for the specified group item.

Note: Item is not used with get commands.

<EOF>

Identifies the end-of-frame for the command so that the iVu knows to begin processing. The iVu will return a response that includes the end-of-frame delimiter. The options for the <EOF> are set in the iVu **Serial I/O** screen, and are:

- <comma>
- <colon>
- <semicolon>
- <CR>
- <CR><LF>
- <LF><CR>
- <ETX>

Note: When data displays on iVu screens, such as the **Port Status** screen, printable delimiters display as expected. Non-printable characters, such as <CR> are displayed in hex notation (\x0D).

Command Flow

The command flow should be such that a new command request should not be issued until the iVu command channel acknowledges the previous command request.

For example, the following is a series of command requests and responses. The first request sets the trigger mode to command and, once the iVu responds with an "OK," the next command request is issued to do (or execute) the trigger.

```
>>  set trigger mode command\x0D\x0A
<<  OK\x0D\x0A
>>  do trigger\x0D\x0A
<<  OK\x0D\x0A
```

String Delimiters and Escaping

By default, all strings used in commands are enclosed in quotation marks (""). All text in quotes is part of the command. Quotes (") or back-slashes (\) that are part of the string must be escapted with a back-slash. For example:

```
"abc\"def\"ghi\\jkl"
```

Set the String Delimiter parameters to 'None' if strings should not be enclosed in quotation marks.

Command Channel Command Synopsis

There are a number of general types of commands to do, set, and get sensor data.

Command Channel Response Frames

The iVu responds to all request frames with one or two responses, depending on the type of command.

Do commands

All do commands are followed by one response that identifies the command status. For example:

```
>>  do trigger\x0D\x0A
<<  OK\x0D\x0A
```

Get commands

All get commands are followed by two responses: the first identifies the status of the command, and the second contains the retrieved information. For example:

```
>>  get info serialnumber\x0D\x0A
<<  OK\x0D\x0A
<<  "012345ABCDEF"\x0D\x0A
```

Set commands

All set commands are followed by one response that identifies the command status. For example:

```
>>  set imager gain 20\x0D\x0A
<<  OK\x0D\x0A
```

Command Channel Command Status

The command status is either OK or ERROR. If OK, then the command has fully and successfully completed. If an error is returned it is in the form *ERROR nnnnn_ERROR_IDENTIFIER* (for example ERROR 10001_COMMAND_NOT_RECOGNIZED). Refer to Command Channel Error Codes on p. 122 for a list of errors.

14.4.2 Conventions Used for Examples

Some command channel examples are included here. The following are the conventions used in the examples:

- All examples use <CR><LF> for the end-of-frame delimiter, and this delimiter is always denoted in hex (\x0D\x0A) because that is what is displayed in the iVu logs and, for example, the **Port Status** screen
- All commands are in **bold** text
- For each example, a command request to the iVu device is prefaced with a **>>**, and a command response frame from the iVu device is prefaced by a **<<** as shown below. These are only used to make the documentation clearer

```
>>  get info companyname\x0D\x0A
<<  OK\x0D\x0A
<<  "Banner Engineering Corp."\x0D\x0A
```

14.4.3 Examples

How to Trigger the iVu and Retrieve Inspection Data using the Command Channel

This example is based on a sort inspection. To trigger the iVu and retrieve inspection data, do the following:

1. Make sure that the Command Channel is enabled using either Ethernet or Serial I/O (**Main Menu** > **System** > **Communications** > **Command Channel** > **Connection**).
2. Set Trigger to Command. Go to **Main Menu** > **Imager** > **Trigger** , and from the drop-down list select **Command**.
3. Issue a trigger command as follows:

```
>>  do trigger\x0D\x0A
<<  OK\x0D\x0A
```

4. Check that the inspection passed.

```
>>  get inspection status\x0D\x0A
<<  OK\x0D\x0A
<<  Pass\x0D\x0A
```

5. Get the pattern names that are stored in the iVu device.

```
>>  get sort_result patternnames\x0D\x0A
<<  OK\x0D\x0A
<<  "pattern_1","pattern_2"x0D\x0A
```

How to Execute a Product Change Using the Command Channel

1. Make sure that the Command Channel is enabled using either Ethernet or Serial I/O (**Main Menu** > **System** > **Communications** > **Command Channel** > **Connection**).
2. Get all the stored inspection names.

```
>>  get productchange inspectionnames\x0D\x0A
<<  OK\x0D\x0A
<< "Inspection 1", "Inspection 2", "Inspection 3"\x0D\x0A
```

3. Execute a product change.

```
>>  do productchange "inspection2"\x0D\x0A
<<  OK\x0D\x0A
```

4. Check that the inspection passed.

```
>>  get inspection status\x0D\x0A
<<  OK\x0D\x0A
<<  Pass\x0D\x0A
```

How to Reboot the iVu Using the Command Channel

1. Make sure that the Command Channel is enabled using either Ethernet or Serial I/O (**Main Menu** > **System** > **Communications** > **Command Channel** > **Connection**).
2. Issue a reboot command as follows:

```
>>  do system reboot\x0D\x0A
<<  (No response received)
```

Note: It is normal to not get a response in this case. If the command was issued incorrectly, the response would be an error.

14.4.4 Command Channel Reference

Info Command Group

Command	Group	Item	Description
Get	Info	CompanyName	The company name as a string.
Get	Info	ModelNumber	The device model number as a string.
Get	Info	FirmwareVersion	The device firmware version as a string.
Get	Info	SerialNumber	The device serial number as a string.
Get	Info	Name	The device name as a string.
Get	Info	BootNumber	The number of device bootups.
Get	Info	UpTimer	The elapsed time the device has been running. The format is hh:mm:ss:msec.
Get	Info	HourCount	The number of hours the device has been running.
Get	Info	RemoteConnected	The remote display connected status as a Boolean value (true or false).
Get	Info	RemoteModelNumber	The model number of the remote display as a string.
Get	Info	RemoteSerialNumber	The serial number of the remote display as a string.

Examples

```
>>  get info companyname\x0D\x0A
<<  OK\x0D\x0A
<<  "Banner Engineering Corp."\x0D\x0A
```

```
>>  get info bootnumber\x0D\x0A
<<  OK\x0D\x0A
<<  42\x0D\x0A
```

```
>>  get info uptimer\x0D\x0A
<<  OK\x0D\x0A
<<  4:42:42:324\x0D\x0A
```

System Command Group

Command	Group	Item	Description
Do	System	Reboot	Reboots the device. Pre-empts other commands except Save.
Do	System	Save	Saves inspection and configuration parameters. Blocks until finished. Should be used sparingly.
Get	Ethernet	IPAddress	Get the current active IP address of the device as a string.
Get	Ethernet	SubnetMask	Get the current active subnet mask of the device as a string.
Get	Ethernet	Gateway	Get the current active Gateway address of the device as a string.
Set	Ethernet	IPAddress	Set the IP address of the device. A valid IP address must be supplied as a string (for example: 192.168.0.1). A Reboot command from the command channel must follow to make the new IP address effective. You may also set new Subnet Mask and Gateway address as required before a Reboot command is sent to the device.
Set	Ethernet	SubnetMask	Set a new subnet mask. A Reboot command is required to be sent from the command channel to make the new mask effective.
Set	Ethernet	Gateway	Set a new Gateway IP address. A Reboot command is required to be sent from the command channel to make the new address effective.

Examples

```
>>  Do System Reboot\x0D\x0A
<<  (No response received)
```

```
>>  Get Ethernet IP Address\x0D\x0A
<<  OK\x0D\x0A
<<  "192.168.0.115"\x0D\x0A
```

```
>>  Set Ethernet IPAddress 192.168.0.114\x0D\x0A
<<  OK\x0D\x0A
```

Status Command Group

Command	Group	Item	Description
Get	Status	Ready	Flag indicating whether the system is ready to trigger (true) or busy (false).
Get	Status	SystemError	Flag indicating whether a system error is active (true) or cleared (false).
Do	Status	ClearSystemError	Clears the system error LED and sets the internal flag to false.

Examples

```
>>  get status ready\x0D\x0A
<<  OK\x0D\x0A
<<  True\x0D\x0A
```

```
>>  get status systemerror\x0D\x0A
<<  OK\x0D\x0A
<<  False\x0D\x0A
```

```
>>  do status clearsystemerror\x0D\x0A
<<  OK\x0D\x0A
```

Trigger Command Group

Command	Group	Item	Description
Get	Trigger	Mode	Get the trigger mode.
Set	Trigger	Mode	Sets the trigger mode to one of the valid trigger modes for the device.
Do	Trigger		Initiates a single trigger. The device does not transmit a response until the device has completed the action.

Examples

```
>>  get trigger mode\x0D\x0A
<<  OK\x0D\x0A
<<  Command\x0D\x0A
```

```
>>  set trigger mode command\x0D\x0A
<<  OK\x0D\x0A
```

```
>>  do trigger\x0D\x0A
<<  OK\x0D\x0A
```

Imager Command Group

Command	Group	Item	Description
Get	Imager	Gain	Get the device's value used to electronically brighten all image pixels. This remotely modified value is not persisted to the device's permanent memory. The Save command is required to persist this value.
Set	Imager	Gain	The device's value used to electronically brighten all image pixels. This remotely modified value is not persisted to the device's permanent memory. The Save command is required to persist this value.
Get	Imager	Exposure	Get the device's value used to control the amount of time the imager gathers light for the image. This remotely modified value is not persisted to the device's permanent memory. The Save command is required to persist this value.
Set	Imager	Exposure	The device's value used to control the amount of time the imager gathers light for the image.This remotely modified value is not persisted to the device's permanent memory. The Save command is required to persist this value.

Examples

```
>>  get imager exposure\x0D\x0A
<<  OK\x0D\x0A
<<  Command\x0D\x0A
```

```
>>  set imager exposure"11900"\x0D\x0A
<<  OK\x0D\x0A
```

Teach Command Group

Command	Group	Item	Description
Do	Teach	NextTrigger	Forces the device to perform the Remote Teach operation on the next trigger. This command can be performed using the device's display.

Examples

```
>>  do teach\x0D\x0A
<<  OK\x0D\x0A
```

ProductChange Command Group

Command	Group	Item	Description
Do	ProductChange	[*Name*]	Forces the device to switch to the specified inspection. The device does not transmit a response until it has completed the action. Inspections results will be invalid until the next trigger.
Get	ProductChange	InspectionNames	List of all inspections stored in the device.

Examples

```
>>  get productchange inspectionnames\x0D\x0A
<<  OK\x0D\x0A
```

```
>>  do productchange "inspection2"\x0D\x0A
<<  OK\x0D\x0A
```

History Command Group

Command	Group	Item	Description
Get	History	Passed	The number of passed inspections.
Get	History	Failed	The number of failed inspections.
Get	History	MissedTriggers	The number of missed triggers.
Get	History	TotalFrames	The total number of inspections since the history was last cleared.
Get	History	MinInspectionTime	The minimum elapsed time (ms) of the inspection.
Get	History	MaxInspectionTime	The maximum elapsed time (ms) of the inspection.
Do	History	Clear	Clears all history fields (for example pass, fail, sensor history, etc.).

Examples

```
>>  get history passed\x0D\x0A
<<  OK\x0D\x0A
<<  13\x0D\x0A
```

```
>>  get history startframenumber\x0D\x0A
<<  OK\x0D\x0A
<<  3\x0D\x0A
```

```
>>  do history clear\x0D\x0A
<<  OK\x0D\x0A
```

Inspection Command Group

Command	Group	Item	Description
Get	Inspection	Status	The status of the most recent inspection either Pass, Fail, or Idle (no triggers).
Get	Inspection	Name	The name of the active inspection.
Get	Inspection	FrameNumber	The most recent inspection frame number.
Get	Inspection	ExecutionTime	The most recent inspection execution time in milliseconds.

Examples

```
>>  get inspection status\x0D\x0A
<<  OK\x0D\x0A
<<  Fail\x0D\x0A
```

```
>>  get inspection executiontime\x0D\x0A
<<  OK\x0D\x0A
<<  37.739\x0D\x0A
```

AREA_RESULT Command Group

Command	Group	Item	Description
Get	AREA_RESULT	Count	The number of detected areas.
Get	AREA_RESULT	MinArea	The size of the smallest detected area.
Get	AREA_RESULT	MaxArea	The size of the largest detected area.

Examples

```
>>  get area_result count\x0D\x0A
<<  OK\x0D\x0A
<<  2\x0D\x0A
```

```
>>  get area_result minarea\x0D\x0A
<<  OK\x0D\x0A
<<  7665\x0D\x0A
```

AREA_HISTORY Command Group

Command	Group	Item	Description
Get	AREA_HISTORY	MinCount	The minimum number of detected areas since the history was last cleared.
Get	AREA_HISTORY	MaxCount	The maximum number of detected areas since the history was last cleared.
Get	AREA_HISTORY	MinArea	The minimum detected area value since the history was last cleared.
Get	AREA_HISTORY	MaxArea	The maximum detected area value since the history was last cleared.

Examples

```
>>  get area_history mincount\x0D\x0A
<<  OK\x0D\x0A
<<  1\x0D\x0A
```

```
>>  get area_history minarea\x0D\x0A
<<  OK\x0D\x0A
<<  7665\x0D\x0A
```

BLEMISH_RESULT Command Group

Command	Group	Item	Description
Get	BLEMISH_RESULT	Count	The number of detected blemishes.
Get	BLEMISH_RESULT	MinEdgeLength	The minimum detected blemish edge length.
Get	BLEMISH_RESULT	MaxEdgeLength	The maximum detected blemish edge length.

Examples

```
>>  get blemish_result count\x0D\x0A
<<  OK\x0D\x0A
<<  4\x0D\x0A
```

```
>>  get blemish_result minedgelength\x0D\x0A
<<  OK\x0D\x0A
<<  22\x0D\x0A
```

BLEMISH_HISTORY Command Group

Command	Group	Item	Description
Get	BLEMISH_HISTORY	MinCount	The minimum number of detected blemishes since the history was last cleared.
Get	BLEMISH_HISTORY	MaxCount	The maximum number of detected blemishes since the history was last cleared.
Get	BLEMISH_HISTORY	MinEdgeLength	The minimum detected blemish edge length since the history was last cleared.
Get	BLEMISH_HISTORY	MaxEdgeLength	The maximum detected blemish edge length since the history was last cleared.

Examples

```
>>  get blemish_history count\x0D\x0A
<<  OK\x0D\x0A
<<  1\x0D\x0A
```

```
>>  get blemish_history maxcount\x0D\x0A
<<  OK\x0D\x0A
<<  6\x0D\x0A
```

MATCH_RESULT Command Group

Command	Group	Item	Description
Get	MATCH_RESULT	Count	The number of detected matches.
Get	MATCH_RESULT	MinPercentMatch	The minimum detected match percentage.
Get	MATCH_RESULT	MaxPercentMatch	The maximum detected match percentage.

Examples

```
>>  get match_result count\x0D\x0A
<<  OK\x0D\x0A
<<  1\x0D\x0A
```

```
>>  get match_result maxpercentmatch\x0D\x0A
<<  OK\x0D\x0A
<<  6\x0D\x0A
```

MATCH_HISTORY Command Group

Command	Group	Item	Description
Get	MATCH_HISTORY	MinCount	The minimum number of detected matches since the history was last cleared.
Get	MATCH_HISTORY	MaxCount	The maximum number of detected matches since the history was last cleared.
Get	MATCH_HISTORY	MinPercent	The minimum detected match percentage since the history was last cleared.
Get	MATCH_HISTORY	MaxPercent	The maximum detected match percentage since the history was last cleared.

Examples

```
>>  get match_history count\x0D\x0A
<<  OK\x0D\x0A
<<  1\x0D\x0A
```

```
>>  get match_history maxcount\x0D\x0A
<<  OK\x0D\x0A
<<  6\x0D\x0A
```

SORT_RESULT Command Group

Command	Group	Item	Description
Get	SORT_RESULT	Count	The number of detected sort patterns.
Get	SORT_RESULT	MinPercentMatch	The minimum detected sort pattern match percentage.
Get	SORT_RESULT	MaxPercentMatch	The maximum detected sort pattern match percentage.
Get	SORT_RESULT	PatternNumbers	Listing of detected patterns by pattern number.
Get	SORT_RESULT	PatternNames	Listing of detected patterns by pattern name.

SORT_HISTORY Command Group

Command	Group	Item	Description
Get	SORT_HISTORY	MinCount	The minimum number of detected sort patterns since the history was last cleared.
Get	SORT_HISTORY	MaxCount	The maximum number of detected sort patterns since the history was last cleared.
Get	SORT_HISTORY	MinPercent	The minimum detected sort pattern match percentage since the history was last cleared.
Get	SORT_HISTORY	MaxPercent	The maximum detected sort pattern match percentage since the history was last cleared.

Examples

```
>>  get sort_history mincount\x0D\x0A
<<  OK\x0D\x0A
<<  1\x0D\x0A
```

```
>>  get sort_history maxcount\x0D\x0A
<<  OK\x0D\x0A
<<  6\x0D\x0A
```

AVERAGE_COLOR_RESULT Command Group

Command	Group	Item	Description
Get	AVERAGE_COLOR_RESULT	RedAverage	The average of the red color component, represented as a number from 0 to 255. Fully saturated red is a [255, 0, 0].
Get	AVERAGE_COLOR_RESULT	RedStdDeviation	The variance of the red component of each pixel inside the ROI.
Get	AVERAGE_COLOR_RESULT	GreenAverage	The average of the green color component, represented as a number from 0 to 255. Fully saturated green is a [0, 255, 0].
Get	AVERAGE_COLOR_RESULT	GreenStdDeviation	The variance of the green component of each pixel inside the ROI.
Get	AVERAGE_COLOR_RESULT	BlueAverage	The average of the blue color component, represented as a number from 0 to 255. Fully saturated blue is a [0, 0, 255].
Get	AVERAGE_COLOR_RESULT	BlueStdDeviation	The variance of the blue component of each pixel inside the ROI.
Get	AVERAGE_COLOR_RESULT	HueAverage	The average of the hue component, represented as a number from 0 to 359.
Get	AVERAGE_COLOR_RESULT	HueStdDeviation	The variance of the hue component of each pixel inside the ROI.
Get	AVERAGE_COLOR_RESULT	SaturationAverage	The average of the saturation component, represented as a number from 0 to 100.
Get	AVERAGE_COLOR_RESULT	SaturationStdDeviation	The variance of the saturation component of each pixel inside the ROI.
Get	AVERAGE_COLOR_RESULT	IntensityAverage	The average brightness of a color, represented in a number from 0 (black) to 255 (white).
Get	AVERAGE_COLOR_RESULT	IntensityStdDeviation	The variance of the hue component of each pixel inside the ROI.

Examples

```
>>  get average_color_result <AvgColor1> redaverage\x0D\x0A
<<  OK\x0D\x0A
<<  206\x0D\x0A
```

```
>>  get average_color_result <AvgColor1> bluestddeviation\x0D\x0A
<<  OK\x0D\x0A
<<  63.423\x0D\x0A
```

AVERAGE_COLOR_HISTORY Command Group

Command	Group	Item	Description
Get	AVERAGE_COLOR_HISTORY	MinRedAverage	The minimum average of the red color component since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MaxRedAverage	The maximum average of the red color component since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MinRedStdDeviation	The smallest variance of the red component.
Get	AVERAGE_COLOR_HISTORY	MaxRedStdDeviation	The largest variance of the red component.
Get	AVERAGE_COLOR_HISTORY	MinGreenAverage	The minimum average of the green color component since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MaxGreenAverage	The maximum average of the green color component since the history was last cleared.

Command	Group	Item	Description
Get	AVERAGE_COLOR_HISTORY	MinGreenStdDeviation	The smallest variance of the green component.
Get	AVERAGE_COLOR_HISTORY	MaxGreenStdDeviation	The largest variance of the green component.
Get	AVERAGE_COLOR_HISTORY	MinBlueAverage	The minimum average of the blue color component since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MaxBlueAverage	The maximum average of the blue color component since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MinBlueStdDeviation	The smallest variance of the blue component.
Get	AVERAGE_COLOR_HISTORY	MaxBlueStdDeviation	The largest variance of the blue component.
Get	AVERAGE_COLOR_HISTORY	MinHueAverage	The minimum average of the hue component since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MaxHueAverage	The maximum average of the hue component since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MinHueStdDeviation	The smallest variance of the hue component.
Get	AVERAGE_COLOR_HISTORY	MaxHueStdDeviation	The largest variance of the hue component.
Get	AVERAGE_COLOR_HISTORY	MinSaturationAverage	The minimum average of saturation component since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MaxSaturationAverage	The maximum average of saturation component since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MinSaturationStdDeviation	The smallest variance of the saturation component.
Get	AVERAGE_COLOR_HISTORY	MaxSaturationStdDeviation	The largest variance of the saturation component.
Get	AVERAGE_COLOR_HISTORY	MinIntensityAverage	The minimum average of the brightness of a color since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MaxIntensityAverage	The maximum average of the brightness of a color since the history was last cleared.
Get	AVERAGE_COLOR_HISTORY	MinIntensityStdDeviation	The smallest variance of the intensity component.
Get	AVERAGE_COLOR_HISTORY	MaxIntensityStdDeviation	The largest variance of the intensity component.

Examples

```
>>  get average_color_history <AvgColor1> minredaverage\x0D\x0A
<<  OK\x0D\x0A
<<  187\x0D\x0A
```

```
>>  get average_color_history <AvgColor1> minbluestddeviation\x0D\x0A
<<  OK\x0D\x0A
<<  65\x0D\x0A
```

COLOR_COMPARE_RESULT Command Group

Command	Group	Item	Description
Get	COLOR_COMPARE_RESULT	ColorDifference	The found percent difference in color.

Command	Group	Item	Description
Get	COLOR_COMPARE_RESULT	IntensityDifference	The found difference of the brightness of the color.

Examples

```
>>  get color_compare_result <ColorCmp1> colordifference\x0D\x0A
<<  OK\x0D\x0A
<<  7\x0D\x0A
```

```
>>  get color_compare_result <ColorCmp1> intensitydifference\x0D\x0A
<<  OK\x0D\x0A
<<  26\x0D\x0A
```

COLOR_COMPARE_HISTORY Command Group

Command	Group	Item	Description
Get	COLOR_COMPARE_HISTORY	MinColorDifference	The minimum found percent difference in color since the history was last cleared.
Get	COLOR_COMPARE_HISTORY	MaxColorDifference	The maximum found percent difference in color since the history was last cleared.
Get	COLOR_COMPARE_HISTORY	MinIntensityDifference	The minimum brightness of a color since the history was last cleared.
Get	COLOR_COMPARE_HISTORY	MaxIntensityDifference	The maximum brightness of a color since the history was last cleared.

Examples

```
>>  get color_compare_history <ColorCmp1> mincolordifference
              \x0D\x0A
<<  OK\x0D\x0A
<<  7\x0D\x0A
```

```
>>  get color_compare_history <ColorCmp1> maxintensitydifference\x0D\x0A
<<  OK\x0D\x0A
<<  47\x0D\x0A
```

COLOR_AREA_RESULT Command Group

Command	Group	Item	Description
Get	COLOR_AREA_RESULT	Count	The number of detected areas of a specific color.
Get	COLOR_AREA_RESULT	MinArea	The size of the smallest detected area of a specific color.
Get	COLOR_AREA_RESULT	MaxArea	The size of the largest detected area of a specific color.

Examples

```
>>  get color_area_result <ColorArea2> count\x0D\x0A
<<  OK\x0D\x0A
<<  14\x0D\x0A
```

```
>>  get color_area_result <ColorArea2> minarea\x0D\x0A
<<  OK\x0D\x0A
<<  10\x0D\x0A
```

COLOR_AREA_HISTORY Command Group

Command	Group	Item	Description
Get	COLOR_AREA_HISTORY	MinCount	The minimum number of detected areas of a specific color since the history was last cleared.
Get	COLOR_AREA_HISTORY	MaxCount	The maximum number of detected areas of a specific color since the history was last cleared.
Get	COLOR_AREA_HISTORY	MinArea	The minimum detected area value of a specific color since the history was last cleared.
Get	COLOR_AREA_HISTORY	MaxArea	The maximum detected area value of a specific color since the history was last cleared.

Examples

```
>>  get color_area_history <ColorArea2> mincount\x0D\x0A
<<  OK\x0D\x0A
<<  14\x0D\x0A
```

```
>>  get color_area_history <ColorArea2> minarea\x0D\x0A
<<  OK\x0D\x0A
<<  10\x0D\x0A
```

14.4.5 Multiple Sensors in an Inspection

If there is more than one sensor in the inspection, all SensorType_Result and SensorType_History related commands must include the *Sensor Name* in "< >" brackets.

Examples

```
>> get area_result <Area1> count\x0D\x0A
<< OK\x0D\x0A
<< 7665\x0D\x0A
```

Notice that <Area1> is the sensor name of an Area sensor in the current inspection.

```
>> get blemish_history <Blemish1> minedgelength\x0D\x0A
<< OK\x0D\x0A
<< 22\x0D\x0A
```

Notice that <Blemish1> is the sensor name of a Blemish sensor in the current inspection.

14.4.6 Command Channel Command Status Register

The command status register will confirm receipt of a command by reflecting the exact command ID received, regardless of whether the command was valid or not.

14.4.7 Command Channel Error Codes

Table 20: iVu Command Channel Error Codes

Numeric ID	Text ID	Description
00000	SUCCESS	Command processed successfully
10000	EMPTY_FRAME_RECEIVED	Indicates that the request was empty. The command channel requires a command, any arguments, and an end-of-frame delimiter.
10001	COMMAND_NOT_RECOGNIZED	The command specified is not recognized
10100	GROUP_MISSING	A Group ID must be specified immediately after the command
10101	GROUP_NOT_FOUND	The specified Group ID is invalid / unknown
10102	GROUP_ITEM_MISSING	A Group Item ID must be specified immediately after the Group ID

Numeric ID	Text ID	Description
10103	GROUP_ITEM_NOT_FOUND	The specified Group Item ID is invalid / unknown
10152	NOT_READABLE	Attempt to get a value that is not readable
10153	NOT_WRITEABLE	Attempt to set a value that is not writeable
10250	NOT_A_METHOD	Method ID specified is not a method
10251	WRONG_ARGUMENT_COUNT	Total method arguments specified do not match method
10252	COMMAND_NOT_FINISHED	Attempt to issue command when a previous command has not finished
10300	SET_WITH_ARGUMENT_TYPE_INVALID	Item ID specified must be an item (not a group or method)
10301	DATA_VALUE_MISSING	Command missing item's data value
10340	MINIMUM_VALUE_EXCEEDED	New item value is below the minimum
10341	MAXIMUM_VALUE_EXCEEDED	New items value is above the maximum
10350	ARGUMENTS_DETECTED	Get command received with unneeded arguments
10351	GET_WITH_ARGUMENT_TYPE_INVALID	Item ID specified must be an item (not a group or method)
10500	DATA_SET_EMPTY	Data export operation returned no results
10900	SENSOR_NOT_READY	Command specified requires the iVu to be in the READY state
10920	SENSOR_TYPE_NOT_ACTIVE	Command specified belongs to a different sensor type
15000	VALUE_INVALID	Text value is invalid / unknown
15050	VALUE_INVALID	Text value is invalid - expecting True or False
15100	STRING_TOO_LONG	String value specified exceeds maximum allowable length
20200	NO_AREAS_FOUND	Attempt to obtain value when no areas were found
20600	NO_MATCHES_FOUND	Attempt to obtain value when no matches were found
20800	NO_MATCHES_FOUND	Attempt to obtain value when no sort patterns were found
80000	REMOTE_DISPLAY_NOT_CONNECTED	Remote Display must be connected to obtain this value
80001	REMOTE_DISPLAY_NOT_SUPPORTED	This device does not have Remote Display capability
80100	COMMAND_MODE_EXPECTED	The Trigger Mode must be set to **Command** perform this operation
80101	COMMAND_TIMED_OUT	The command timed out before finishing
80102	TRIGGER_REQUIRED	Access to the specified data requires a triggered inspection
80150	COMMAND_TIMED_OUT	The command timed out before finishing
80200	SYSTEM_ERROR_NOT_ACTIVE	A System Error must be active to execute this command
80300	TEACH_SENSOR_TYPE_INVALID	Teach requires Match sensor
80350	MULTIPLE_INSPECTIONS_DISABLED	Requires multiple inspections to be enabled
80351	MULTIPLE_INSPECTIONS_EMPTY	No inspections are available in multiple inspection mode
80400	PRODUCT_CHANGE_WHEN_NOT_READY	The iVu must be in the READY state to perform a product change
80401	PRODUCT_CHANGE_INVALID_INSPECTION	Attempt to product change to an unknown or invalid inspection
80402	PRODUCT_CHANGE_TIMEOUT	The Product Change operation timed out
80403	PRODUCT_CHANGE_TO_SAME_INSPECTION	Attempt to product change to the same inspection
80404	SENSOR_NAME_NOT_FOUND	Attempt to use a command without a sensor name in a multi-sensor inspection

14.5 iVu Discovery Protocol

The iVu Discovery Protocol is a method to dynamically discover Banner iVu devices on an Ethernet network.

The goal is to both be able to find a device and, if necessary, change the IP address of that device so that it is on the same subnet as the controlling PC. This is done without requiring the PC to change its IP address or using anything more than an Ethernet cable connected to the device.

The iVu Discovery Protocol is implemented using UDP broadcast packets that are mapped to Ethernet Broadcast packets by the TCP/IP stack. Broadcast packets are the only mechanism that ensures delivery of the data if the device and controlling PC are configured for different subnets and on the same bridged Ethernet network. The contents of the packets used for Banner's iVu devices are proprietary.

The iVu Discovery Protocol is supported by **iVu** devices from the 2012R1 or later releases.

14.5.1 UDP Usage

All packets are sent with the source and destination port number set to 19995.

The destination IP address is always set to a broadcast value of 255.255.255.255.

14.5.2 Packet Format

The packets used by the Discovery Protocol follow the same general format. The packets have a short header and a larger body area with ASCII text.

Header Format

The header of the packets is as follows:

Name	Offset	Length (bytes)	Description
Protocol ID	0	4	The number that identifies this as a Discovery Protocol Packet. Always set to 0x6956752b. This appears as "iVu+" when viewed with packet dump software.
Message Type	4	4	Identifies the type of message: DISCOVER = 0x44495343, ASCII translates as "DISC" DISCOVER_REPLY = 0x52504c59, ASCII translates as "RPLY" DISCOVER_SETIP = 0x53455449, ASCII translates as "SETI" See the following for a detailed description of each of these messages: • DISCOVER Message on p. 125 • DISCOVER_REPLY Message on p. 125 • DISCOVER_SETIP Message on p. 126
Correlation Tag	8	4	A number chosen by the sender of a DISCOVER packet. The value sent in a DISCOVER packet is returned in the DISCOVER_REPLY packet. This allows the sender to match its requests with responses it receives.

Body Format

The Body of the packet follows the header and consists of a long string of ASCII text. The ASCII text section contains some strings in the format of "<name>=<value>," Those names and values are detailed in the following table. Note that the comma is required, and is used as a string separator.

Name	Values	Description
SerialNumber	String	Device serial number
Version	String	Firmware version string
Name	String	Name of the device as an ASCII string. This field is filled in only if the device is configured for English. For all other languages, this field is omitted.

Name	Values	Description
MAC	xx:xx:xx:xx:xx:xx – Each 'x' is a hexadecimal character.	Ethernet MAC address of this device
IP	String in decimal dot notation	IP address of the device
NetMask	String in decimal dot notation	Network mask of the device
Gateway	String in decimal dot notation	IP address of the device's default gateway

DISCOVER Message

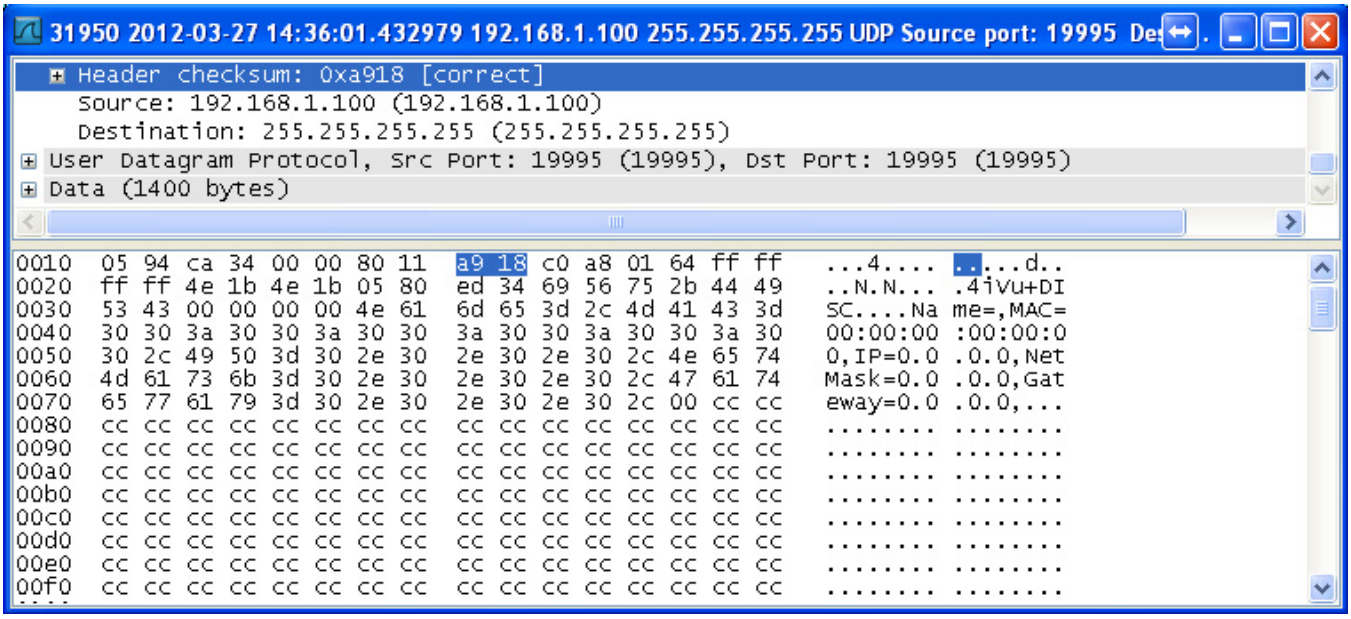
A controlling PC sends the packet with DISCOVER message to find which devices are present on its network. The DISCOVER message should broadcast on all Ethernet interfaces of the controlling PC. After sending the DISCOVER message packet, the PC should wait to receive DISCOVER_REPLY packets from the devices.

The controlling PC does not know how many devices are connected. Therefore, it should wait up to 5 seconds for any reply packets to allow for any variation in time needed for the devices to reply.

Sending more than one DISCOVER packet is recommended because a single UDP packet may be lost by network switches or the iVu. The probability of multiple packets being lost is much smaller. Separate the packets in time by 100 milliseconds or more.

This and the following packet capture examples were created using a free network tracing and troubleshooting software called Wireshark. Banner Engineering Corporation does not provide support for this product nor endorses it.

Figure 174. Wireshark DISCOVER Packet



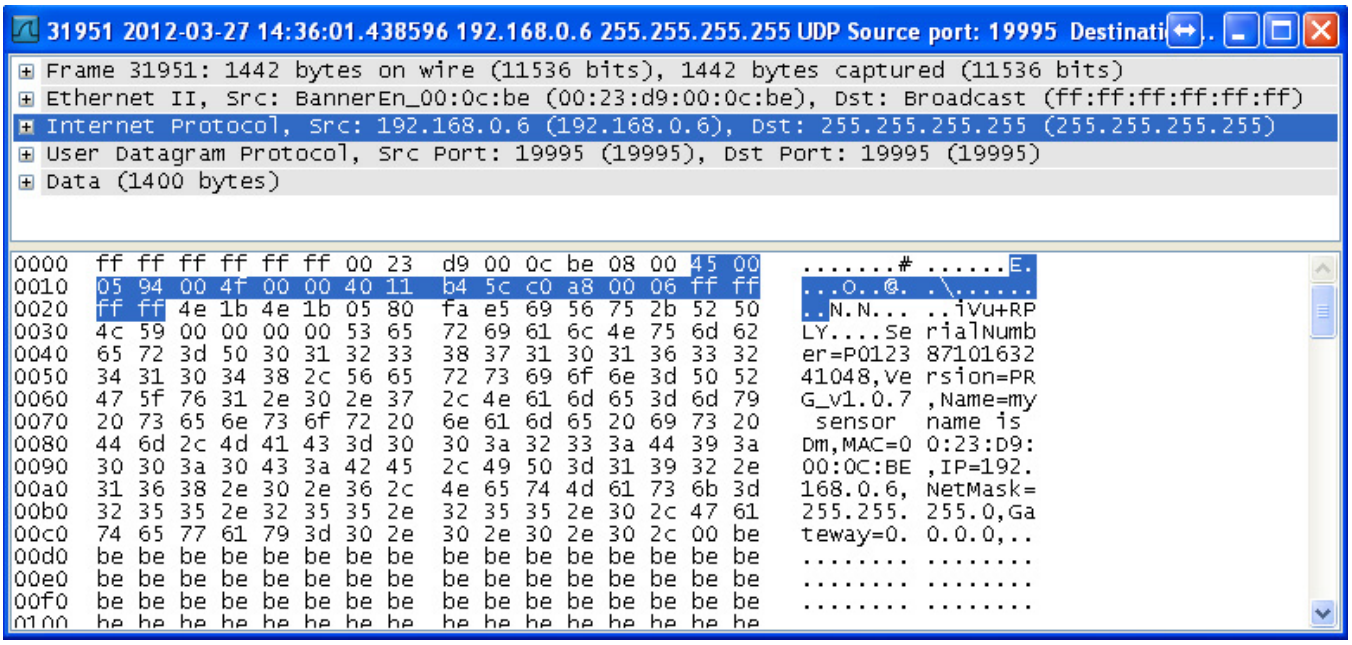
Note: In some situations, it is possible for a PC to receive a copy of the packet it sent. This condition is subject to the operating system and/or network configuration. If received, such a received packet should be detected (by checking the message type) and discarded.

In this example for the DISCOVER packets, empty sections for Name, MAC, IP, NetMask and Gateway are shown. These empty fields in the DISCOVER packet are not necessary and are an artifact of the application used to test the iVu Discovery Protocol.

DISCOVER_REPLY Message

The device sends a DISCOVER_REPLY packet in reply to a DISCOVER message. The body portion of the message contains all of the parameters detailed in Body Format on p. 124.

Figure 175. Wireshark DISCOVER_REPLY Packet



Note: In some situations, a network switch/router receives a broadcast packet and duplicates it. This results in the controlling PC receiving multiple responses that are completely identical. Discard multiple replies that have the same correlation tag.

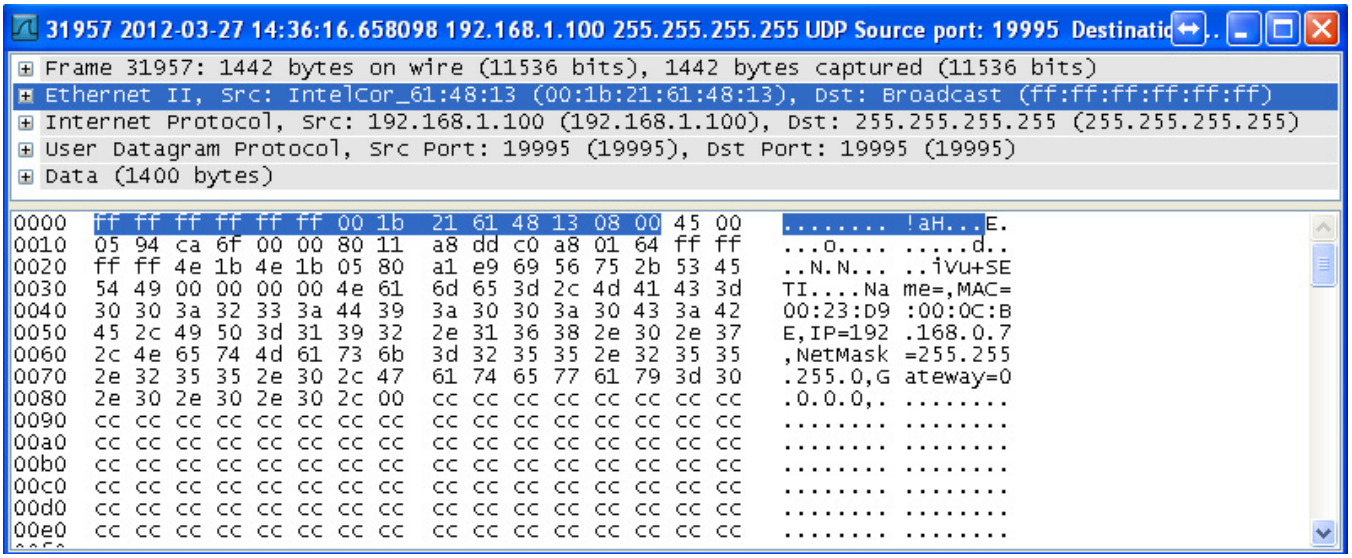
DISCOVER_SETIP Message

The controlling PC sends the DISCOVER_SETIP message to instruct a device to change its IP address, subnet mask, and default gateway. The message sent by the PC must always have the following parameters in the body portion:

- Either MAC or SerialNumber or both. If both are present, the match will be performed on both fields.
- IP
- NetMask
- Gateway

Any other parameters in the body are ignored by the device.

Figure 176. Wireshark DISCOVER_SETIP Packet

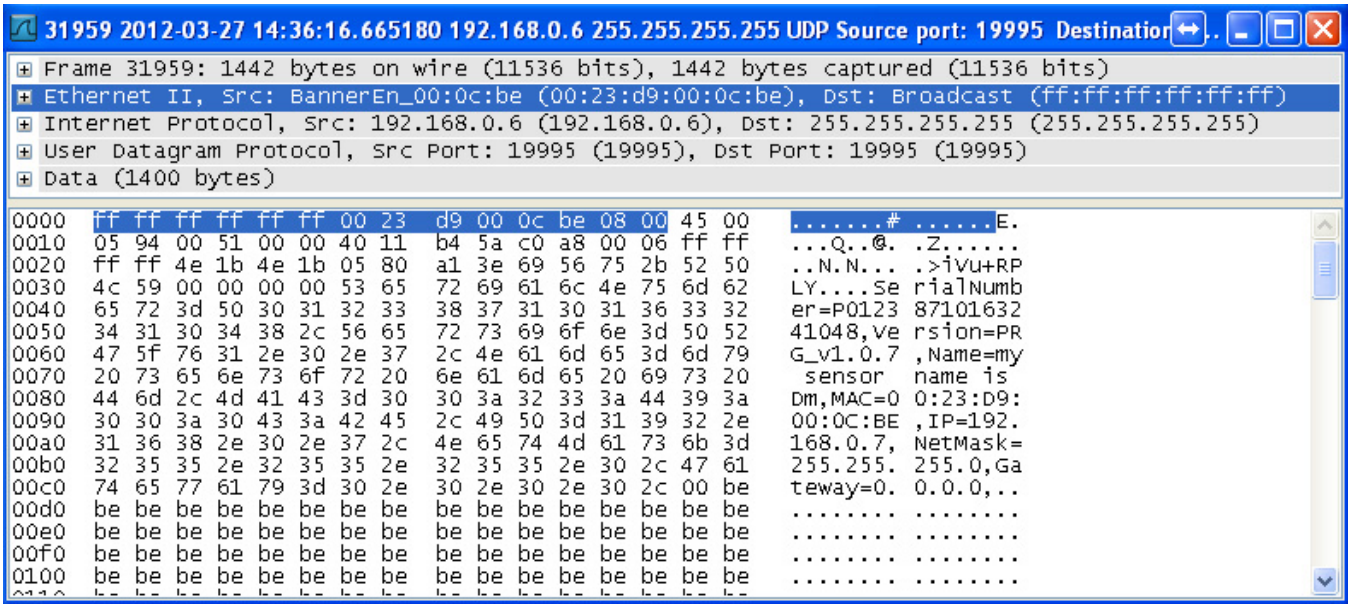


When the device receives a DISCOVER_SETIP message, the following actions are performed:

1. The device compares the specified MAC address, the SerialNumber, or both, if both are present, with its own.

2. If the above field(s) does not match the device's equivalent, the device discards the packet and no replay is generated.
3. If the above field(s) match the device's equivalent:
    a. The device compares the new values with the current values.
    b. If the new values are the same as the current values, the device discards the packet and no further reply is generated.
    c. If the new values are different from the current values, the device set its IP address, subnet mask, and default gateway to match what is in the packet.
        - The device performs only syntactic checks on the supplied data. It will not perform gateway presence or duplicate IP address checks.
        - The change is logged in iVu system log as a success
        - A DISCOVER_REPLY packet is sent by the device back to the request originator
        - The device reboots after approximately 1 second

Figure 177. Wireshark DISOVER_REPLY with New IP Address



14.5.3 Message Flow

The following are examples of typical message flows for various interactions with the device.

Discovery of a Device

1. The PC broadcasts as DISCOVER message.

    Only the header values need to be filled:
    - The Protocol ID field should be set to 0x6956752b, “iVu+"
    - The Message Type field should be set to 0x44495343, “DISC”
    - The Correlation tag should be set by the sender to the non-zero value that will allow the sender to identify the response.

    The packet with the header values is sent using the broadcast address of 255.255.255.255.

    Note: Not all the switches are configured to pass broadcast packets by default. A switch configuration change may be necessary to enable the passing of broadcast packets.

2. Upon receipt of the broadcast message the device verifies that the message is addressed to it by comparing the Protocol ID field to value 0x6956752b.
    - If the value matches, the device examines the Message Type field.
    - If the value does not match any of the commands, the device discards the packet.
    - If the Message Type field matches 0x44495343, “DISC”, the device prepares the response in the form of DISCOVER_REPLY packet:
        - The Protocol ID field is set to 0x6956752b, “iVu+”
        - The Message Type field is set to 0x52504c59, “RPLY”
        - The Correlation Tag is copied from the received message

- The body of the message is populated with the following fields, separated by a comma:
  - SerialNumber (“SerialNumber=P01238710163241048”)
  - Version (“Version=TB_v1.1.4”)
  - Name (“Name=Sensor1”)
  - MAC (“MAC=00:11:22:33:44:55”)
  - IP (“IP=192.168.0.1”)
  - NetMask (“NetMask=255.255.255.0”)
  - Gateway (“Gateway=0.0.0.0”)

  The body of the message looks like the following:

  ```
  SerialNumber=P01238710163241048,Version=TB_v1.1.4,Name=Sensor1,MAC=00:11:22
  :33:44:55,IP=192.168.0.1,NetMask=255.255.255.0,Gateway=0.0.0.0
  ```

- The packet is broadcast on the network to port 19995. The device uses a pseudo-random back-off time to minimize collisions with other devices.

Change the IP Address of a Device Using the MAC

1. The PC broadcasts a DISCOVER_SETIP message.

   The header values are filled as follows:
   - Protocol ID field must be set to 0x6956752b, “iVu+”
   - Message Type field should be set to 0x53455449, “SETI”
   - Correlation tag must be set by the sender to a non-zero value that will allow the originator to identify the response

   The body of the message must be filled as follows:
   - MAC (“MAC=00:11:22:33:44:55”)
   - IP (“IP=192.168.0.1”)
   - NetMask (“NetMask=255.255.255.0”)
   - Gateway (“Gateway=0.0.0.0”)

   The body of the message looks like the following:

   ```
   MAC=00:11:22:33:44:55,IP=192.168.0.1,NetMask=255.255.255.0,Gateway=0.0.0.0
   ```

   The packet must be sent out using the broadcast address of 255.255.255.255

   Note: Not all the switches are configured to pass broadcast packets by default. A switch configuration change may be necessary to enable the passing of broadcast packets.

2. Upon receipt of the broadcast message, the device verifies that the message is addressed to it by comparing the Protocol ID field to value 0x6956752b, “iVu+”.
   - If the value matches, the device examines the Message Type field.
   - If the Message Type field matches 0x53455449, “SETI”, the received MAC address is compared with the MAC address of the device.
   - If the MAC address does not match, the packet is discarded and no further replies or logs are generated.
   - If the received MAC address matches that of the device, the device performs the following actions:
     - IP, NetMask, and Gateway addresses are extracted from the body of the message.
     - Values are verified to be syntactically correct.
       - For example, Gateway address of 255.255.255.255 is not allowed.
       - IP address of 0.0.0.0 or 255.255.255.255 is not allowed.
       - The check for duplicate IP address is not performed.
     - If the values do not pass the syntax check:
       - The packet is discarded.
       - The attempt is logged in the System Log.
       - A DISCOVER_REPLY (RPLY) reply with current values is generated and sent (see Discovery of a Device on p. 127 for details).
     - If the values pass the syntax check:
       - The new values are stored in the device.
       - The change is logged in the System Log.
       - A DISCOVER_REPLY (“RPLY) reply with new values is generated and sent (see Discovery of a Device on p. 127 for details).
       - The device restarts.

Change the IP Address of a Device Using the Serial Number

1. The PC broadcasts a DISCOVER_SETIP message.

   The header values are filled as follows:
   - Protocol ID field must be set to 0x6956752b, “iVu+”

- Message Type field should be set to 0x53455449, “SETI”
- Correlation tag must be set by the sender to a non-zero value that will allow the originator to identify the response

The body of the message must be filled as follows:

- SerialNumber (“SerialNumber=P0123871016324104 8”)
- IP (“IP=192.168.0.1”)
- NetMask (“NetMask=255.255.255.0”)
- Gateway (“Gateway=0.0.0.0”)

The body of the message looks like the following:

```
SerialNumber=P01238710163241048,IP=192.168.0.1,NetMask=255.255.255.0,Gateway=0.0.0.0
```

The packet must be sent using the broadcast address of 255.255.255.255.

Note: Not all the switches are configured to pass broadcast packets by default. A switch configuration change may be necessary to enable the passing of broadcast packets.

2. Upon receipt of the broadcast message the device verifies that the message is addressed to it by comparing Protocol ID field to value 0x6956752b, “iVu+”.
    - If the value matches, the device examines the Message Type field.
    - If the Message Type field matches 0x53455449, “SETI”, the received SerialNumber is compared with the SerialNumber of the device.
    - If the received serial number does not match, the packet is discarded and no further replies or logs are generated.
    - If the received serial number matches that of the device, the device performs the following actions:
        - IP, NetMask, and Gateway addresses are extracted from the body of the message.
        - Values are verified to be syntactically correct.
            - For example, Gateway address of 255.255.255.255 is not allowed
            - IP address of 0.0.0.0 or 255.255.255.255 is not allowed
            - The check for duplicate IP address will not be performed
        - If the values do not pass the syntax check:
            - The packet is discarded.
            - The failed attempt is logged in the System Log.
            - A DISCOVER_REPLY (RPLY) reply with current values is generated and sent (see Discovery of a Device on p. 127 for details).
        - If the values pass the syntax check:
            - The new values are stored in the device.
            - The change is logged in the System Log.
            - A DISCOVER_REPLY (“RPLY) reply with new values is generated and sent (see Discovery of a Device on p. 127 for details).
            - The device restarts.

15 Industrial Ethernet Overview

15.1 Device Setup

15.1.1 Set IP Address

When shipped, the device is assigned a default IP address of 192.168.0.1, a default Subnet Mask of 255.255.255.0, and a default Gateway of 0.0.0.0. To change these defaults, go to **Main Menu** > **System** > **Communications** > **Ethernet I/O**.

15.1.2 Set the Industrial Ethernet Protocol (Ethernet/IP™/Modbus/PCCC/PROFINET®)

The Industrial Ethernet communication channel is disabled by default. To enable this channel, go to **Main Menu** > **System** > **Communications** > **Industrial Ethernet** > **Connection**. Select the desired channel: Ethernet/IP, MODBUS, PCCC, or PROFINET. Only one type of connection can be established at a time.

View information about an established connection from **Main Menu** > **System** > **Communications** > **Industrial Ethernet** > **Status**. Click the desired connection to view details.

This device provides extensive logging for the communication that occurs over the Industrial Ethernet connection. View logs from either **Main Menu** > **System** > **Communications** > **Industrial Ethernet** > **View Logs** or **Main Menu** > **Logs** > **Communication Logs** > **Industrial Ethernet**.

15.1.3 Set Trigger Mode

Trigger the iVu using the hardware trigger input line or an internally supplied software trigger, or by toggling a bit over Industrial Ethernet. To only accept triggers generated through the Industrial Ethernet communication channel, go to **Main Menu** > **Imager** > **Trigger**, and select **Industrial Ethernet Only** from the drop-down list.

15.2 Supported Functions

Control the iVu over EtherNet/IP, PCCC, Modbus/TCP, or PROFINET using the input and output data the iVu makes available as a slave device for those protocols.

The following are some of the device operations that can be performed using input and output values:

- Product Change
- Teach Enable
- Trigger the iVu
- Read output indicators (pass, fail, ready, error)
- Read counters (pass, fail, system error, missed trigger, frame count, iteration count)
- Read sensor results

15.2.1 iVu Input Values

The operation of the iVu can be controlled through input bits and commands.

Register/Input Coil Bits

The following commands can only be executed using bits:

Input Coil Bit	Command	Description
0	Product Change	Execute a product change (inspection number specified in the "Product Change Number" 32-bit integer register)
1	Teach Latch	Latch a teach flag. The Teach is executed on the next trigger
2	Trigger	Causes the iVu to run the current inspection
15	Command	Set this bit to 1 to execute the command entered in the Command ID Register

15.2.2 iVu Output Values

Using output values, the following information can be obtained:

- ACK bits (acknowledgement bits) for input commands, including error codes
- System indicators (Ready, Pass/Fail, Read/No Read, Output signals, Command Error, etc.)
- Inspection History (Iteration Count, Pass Count, Fail Count, etc.)
- Current Inspection Results (data of the sensor type contained in the inspection)
- Command Responses

Refer to the sections on protocols for more information.

ACK Bits

For each of the Command bits there is a corresponding ACK bit. The iVu sets the ACK bit when the corresponding action is complete. Command bits cause actions to occur on the low-to-high transition of that bit. **You must clear the command bit after the corresponding ACK bit has been observed to be high**.

As an example, to use the Trigger ACK bit, the programming steps for triggering an inspection are:

1. Wait for ready.
2. Set Trigger command bit to 1.
3. Wait for Trigger ACK to go to 1.
4. Set Trigger command bit to 0.

Command Responses

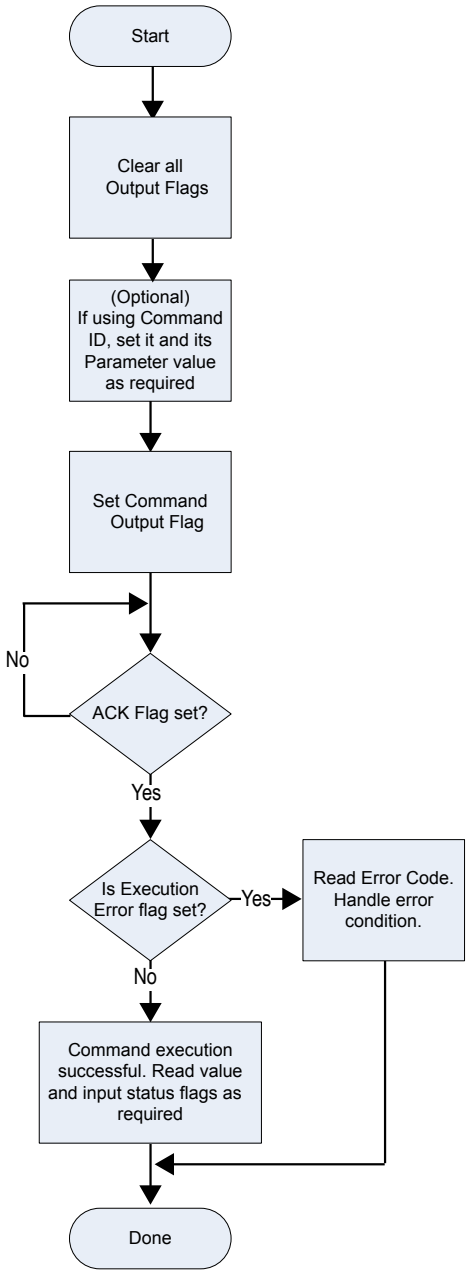
iVu Command Channel commands executed using command IDs may have a response value. Depending on the Data Type, the response value is contained in one or multiple registers. Refer to iVu Command Channel Commands (iVu Command Channel over Industrial Ethernet) on p. 211 and Communications Guide on p. 97for more information about the iVu Command Channel.

15.3 iVu Operation

Any Industrial Ethernet protocol can be used to trigger inspections, remote teach, and perform command functions.

15.3.1 General Command Execution

Point of View of the PLC



The following rules apply for the use of input bit commands:

- Only one iVu input bit can be set at a time
- Corresponding ACK bits are set high only on completion of the command (if the iVu input bit is still high)
- Corresponding ACK bits are cleared when the iVu input bit is cleared
- When multiple iVu input bits are set simultaneously, the Execution Error input bit is set and an Error Code value is reported in the Error Code register
- The Execution Error iVu output bit is cleared when all ACK bits are cleared, or a new valid command is received

15.4 EtherNet/IP™

In this context, references to EtherNet/IP™ [12] refer specifically to EtherNet/IP transport class 1. Sometimes referred to as cyclic EtherNet/IP IO data transfer or implicit messaging, this connection is meant to approximate a real-time data transfer to and from the PLC and the target device.

Allen-Bradley's CompactLogix and ControlLogix family of PLCs uses this communication protocol. The programming software used by these PLCs is RSLogix5000 or Studio 5000 Logix Designer.

[12] EtherNet/IP™ is a trademark of ODVA, Inc.

The iVu can be controlled via EtherNet/IP using assembly objects. From the point of view of a PLC, there are three input assemblies and two output assemblies.

The Originator of the EtherNet/IP connection is the PLC. The Target of the EtherNet/IP connection is the iVu. The direction of communication can be described as T > O or O > T (sometimes also shown as T2O or O2T).

15.4.1 Inputs to the iVu (Outputs from the PLC)

PLC Assembly Instance 112 (0×70) - 6 Registers (iVu Inputs/PLC Outputs)

Data transfer direction: Originator (PLC) to Target (iVu). Assembly Instance 112 (0×70) is a small group of registers used for basic control of the iVu.

WORD #	WORD NAME	DATA TYPE
0	Input Bits Register (see Input and Output Flags Bits on p. 139)	16-bit integer
1-2	Product Change Number	32-bit integer
3-5	*reserved*	16-bit integer

PLC Assembly Instance 113 (0×71) - 240 Registers (iVu Inputs/PLC Outputs)

Data transfer direction: Originator (PLC) to Target (iVu). Assembly Instance 113 (0×71) has more registers than Assembly Instance 112. This allows for more comprehensive control of the iVu, including Command Channel functionality.

WORD #	WORD NAME	DATA TYPE
0	Inputs Bit Register (see Input and Output Flags Bits on p. 139	16-bit integer
1-2	Product Change Number	32-bit integer
3-49	*reserved*	32-bit integer
50	Command ID	16-bit integer
51	Command Parameter Int16	16-bit integer
52-53	Command Parameter Int32	32-bit integer
54-55	Command Parameter Float	Float
56-57	String Length	32-bit integer
58-107	String Parameter	100-Byte Array
108	*reserved*	16-bit integer
109-210	*for Barcode models only*	
211-239	*reserved*	16-bit integer

15.4.2 Outputs from the iVu (Inputs to the PLC)

PLC Assembly Instance 100 (0×64) - 30 Registers (iVu Outputs/PLC Inputs)

Data transfer direction: Target (iVu) to Originator (PLC). Assembly Instance 100 is a small block of registers providing basic inspection results from the iVu.

Note: Assembly Instance 100 does not provide sensor-specific information.

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see Input and Output Flags Bits on p. 139)	16-bit integer
1	Output Bits Register (see Input and Output Flags Bits on p. 139)	16-bit integer
2-3	Error Code	32-bit integer

WORD #	WORD NAME	DATA TYPE
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor P/F Coil	16-bit integer
17-29	*reserved*	16-bit integer

PLC Assembly Instance 101 (0×65) - 240 Registers (iVu Outputs/PLC Inputs)

Assembly Instance 101 provides space for sensor-specific information. See Multiple Sensors Mapping Options on p. 134.

15.4.3 Multiple Sensors Mapping Options

When using an iVu with multiple sensors in an inspection, there are two mapping options: Default and Custom.

Default Map

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Map** > **Default**

The default map automatically maps sensor data for each inspection and is recommended when the execution order of sensor types is the same across inspections. When an inspection includes multiple sensors, the first five sensor results are shown starting at offset 55. Each sensor result occupies 20 words.

Table 21: I/O Assembly Instance 101 (0×65): DEFAULT MAP

WORD #	WORD NAME	Data Type
0	Input Bits ACK Register (see Input and Output Flags Bits on p. 139)	16-bit integer
1	Output Bits Register (see Input and Output Flags Bits on p. 139)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	*reserved*	16-bit integer
30-52	Inspection Name	2-Word Length + 20-Unicode characters
53-54	Frame Number	32-bit integer
55	**Sensor Type ID (Sensor 1)**	**16-bit integer**
56-74	**Sensor 1 Specific Data**	**16-bit integer**
75	**Sensor Type ID (Sensor 2)**	**16-bit integer**
76-94	**Sensor 2 Specific Data**	**16-bit integer**
95	**Sensor Type ID (Sensor 3)**	**16-bit integer**
96-114	**Sensor 3 Specific Data**	**16-bit integer**

WORD #	WORD NAME	Data Type
115	**Sensor Type ID (Sensor 4)**	**16-bit integer**
116-134	**Sensor 4 Specific Data**	**16-bit integer**
135	**Sensor Type ID (Sensor 5)**	**16-bit integer**
136-154	**Sensor 5 Specific Data**	**16-bit integer**
155-170	*reserved*	16-bit integer
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100-Byte Array
229-239	*reserved*	16-bit integer

Note: If the inspection contains more than five sensors, any sensors after the fifth sensor are not included on the map.

Table 22: Area Sensor ID = 2

Sensor Specific Data	Data Size
Area Count	32-bit integer
Area Range Minimum	32-bit integer
Area Range Maximum	32-bit integer

Table 23: Blemish Sensor ID = 3

Sensor Specific Data	Sensor Location
Blemish Count	32-bit integer
Blemish Minimum Edge Length	32-bit integer
Blemish Maximum Edge Length	32-bit integer

Table 24: Match Sensor ID = 4

Sensor Specific Data	Sensor Location
Match Count	32-bit integer
Match Minimum Percent	16-bit integer
Match Maximum Percent	16-bit integer

Table 25: Sort Sensor ID = 5

Sensor Specific Data	Sensor Location
Sort Pattern Map	16-bit integer
Sort Pattern Count	16-bit integer
Sort Pattern 1 Count	16-bit integer
Sort Pattern 2 Count	16-bit integer
Sort Pattern 3 Count	16-bit integer

Sensor Specific Data	Sensor Location
Sort Pattern 4 Count	16-bit integer
Sort Pattern 5 Count	16-bit integer
Sort Pattern 6 Count	16-bit integer
Sort Pattern 7 Count	16-bit integer
Sort Pattern 8 Count	16-bit integer
Sort Pattern 9 Count	16-bit integer
Sort Pattern 10 Count	16-bit integer
Sort Minimum Percent Match	16-bit integer
Sort Maximum Percent Match	16-bit integer

Table 26: Average Color Sensor ID = 6

Sensor-Specific Data	Data Size
Average Red	16-bit Integer
Average Green	16-bit Integer
Average Blue	16-bit Integer
Average Hue	16-bit Integer
Average Saturation	16-bit Integer
Average Intensity	16-bit Integer
Standard Deviation Red	32-bit float
Standard Deviation Green	32-bit float
Standard Deviation Blue	32-bit float
Standard Deviation Hue	32-bit float
Standard Deviation Saturation	32-bit float
Standard Deviation Intensity	32-bit float

Note: Average Color Sensor data that does not apply to the selected color space has a result of 0. For example, if the HSI color space is selected, the Red, Green, and Blue data will have a result of 0.

Table 27: Color Compare Sensor ID = 7

Sensor-Specific Data	Data Size
Color Difference	16-bit Integer
Intensity Difference	16-bit Integer

Table 28: Color Area Sensor ID = 8

Sensor-Specific Data	Data Size
Area Count	32-bit Integer
Area Range Minimum	32-bit Integer
Area Range Maximum	32-bit Integer

Custom Map

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Map** > **Custom**

The custom map allows for the customization of sensor data on the map. The user selects data items of interest for each sensor type. This is recommended when the execution order of sensor types varies across inspections or when using more than five sensors.

A system-level custom map is supported for additional flexibility. When **Custom** map is selected, a customizable space is used in the offset range (55 to 166) on I/O Assembly 101 (0×65) registers.

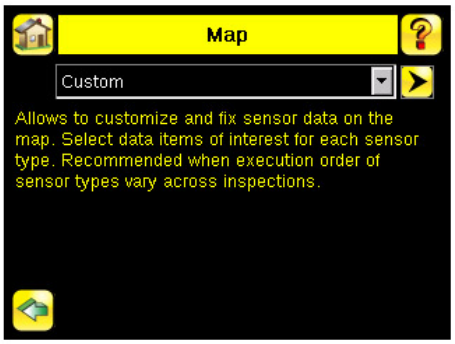
Table 29: I/O Assembly Instance 101 (0×65): CUSTOM MAP

WORD #	WORD NAME	Data Type
0	Input Bits ACK Register (see Input and Output Flags Bits on p. 139)	16-bit integer
1	Output Bits Register (see Input and Output Flags Bits on p. 139)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	*reserved*	16-bit integer
30-52	Inspection Name	2-Word Length + 20-unicode characters
53-54	Frame Number	32-bit integer
55-166	**Customizable Space (112 reg)**	**16-bit integer**
167-170	*reserved*	16-bit integer
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100-Byte Array
229-239	*reserved*	16-bit integer

Configure a Custom Industrial Ethernet (IE) Map

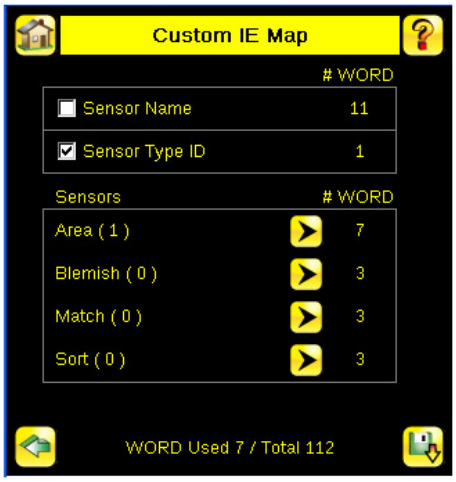
1. Enable the Custom Map by selecting **Custom** on the drop-down list.

*Figure 178. **Map** Screen—**Custom** Map Selected*



2. Click the yellow arrow to access the **Custom IE Map** screen.
3. On the **Custom IE Map** screen, choose the sensor result data that will appear on the customizable space.

*Figure 179. **Custom IE Map** Summary Screen*



The bottom of the screen shows the word use on the customizable space. In the image above, seven words have been used for one Area sensor "Area (**1**)".

4. Click the yellow arrow next to the Area sensor row to go to the **Area Sensor Data**.

*Figure 180. **Custom IE Map** Screen—**Area Sensor Data***



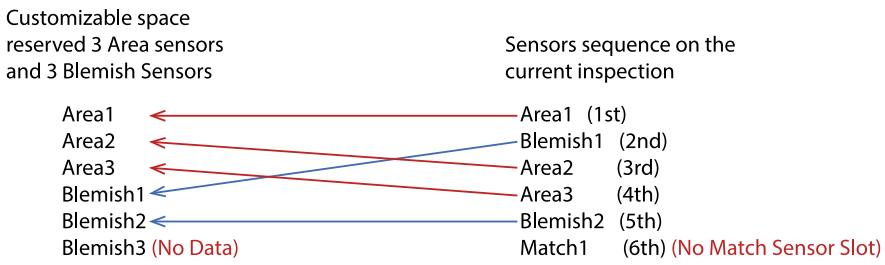
On the **Area Sensor Data** screen shown above, **Area Count**, **Area Range Min** and **Area Range Max** are available to add to the customizable space. The number to the right of each item shows how many words are required to display the data. The bottom reservation count shows the number of Area sensors that have space reserved for them on the customizable map.

Because only one Area sensor's worth of data is reserved on the image above, the selected data will be collected from the first Area sensor in the current inspection. When multiple Area sensors have been reserved, the data will be arranged in the sequential manner of the sensor type in the current inspection.

5. Click the green arrow (Back) to return to the **Custom IE Map** summary.
6. Continue to add more data from any sensor type as required or reserve more sensors into the customizable space.

Sensor Name and **Sensor Type ID** are global settings that are part of any individual sensor reservation. When they are checked, they are inserted into each sensor reservation.

The following is an example of a multiple sensors inspection and its output location on the customizable space.



In this example, there are only two Blemish sensors in the current inspection. The Blemish3 location will be all zero on the customizable space. The customizable map had not reserved space for a Match sensor, so Match1 from the inspection will not be outputted on the custom map.

15.4.4 Input and Output Flags Bits

The Input Bits are used to command execution of basic functions. The Output Bits are used to push single bit outputs from the iVu device to the PLC. The 32 bits of iVu output can also be accessed using the bits of the first two Output Registers (Input Bits ACK Register(word 0) and Output Bits Register (word1)).

Table 30: Inputs Bits Register (Command Flag Bits)

Bit Position															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Command													Trigger	Teach Latch	Product Change

Table 31: Input Bits ACK Register (ACK Flag Bits)

Bit Position															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Command ACK													Trigger ACK	Teach Latch ACK	Product Change ACK

Table 32: Output Bits Register (iVu Status Flag Bits)

Bit Position															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Execution Error	System Error	Teach Error	Missed Trigger					Output 3	Output 2	Output 1		Ready to Latch	Read/No Read	Pass/Fail	Ready

15.4.5 Configuration Assembly Object

The iVu EtherNet/IP implementation does not support an assembly object Configuration instance. However, one is required for the creation of implicit Class 1 connections on a ControlLogix® [17] family PLC. Therefore, a configuration instance is defined as instance number 128 (0×80). Its size is zero.

15.4.6 Data Formats

The iVu EtherNet/IP implementation supports 32-bit Integers in LSW_MSW data format. The LSW_MSW data format is such that the least significant word is stored first, then the most significant word. This format is used for Allen-Bradley ControlLogix PLCs.

The string format is compatible with the Allen-Bradley ControlLogix built-in string data type. This format is a 32-bit (DINT) length followed by character bytes (SINT). This results in the following string format as viewed from the iVu:

Word	0	1	2		3		4			
	Length LSW	Length MSW	byte 1	byte 0	byte 3	byte 2	byte 5	byte 4	...	...

15.4.7 Minimum Requested Packet Interval (RPI) Value

The iVu can operate with input and output Requested Packet Intervals (RPIs) as low as 50 milliseconds. **The device may not operate reliably if a lower RPI value is selected.**

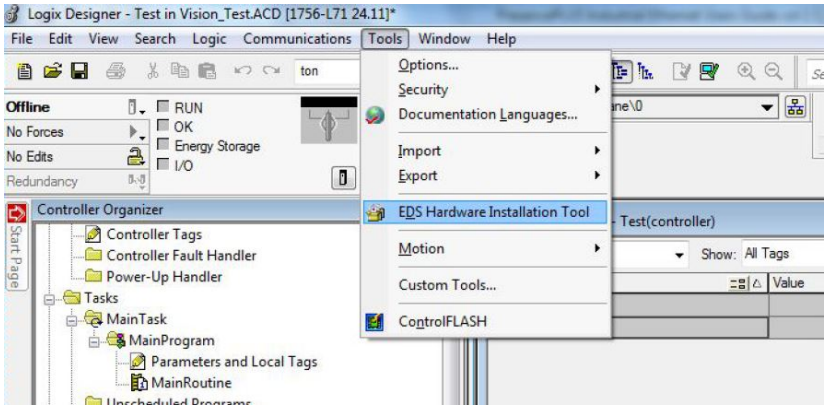
[17] ControlLogix® is a trademark of Rockwell Automation, Inc.

15.4.8 iVu Plus TG and Color Gen2 Image Sensors EDS File Installation in ControlLogix Software

Use the **EDS Hardware Installation Tool** to register the Electronic Data Sheet (EDS) file.

1. On the **Tools** menu, click **EDS Hardware Installation Tool**.
   The **Rockwell Automation's EDS Wizard** dialog displays.

Figure 181. Tools—EDS Hardware Installation Tool



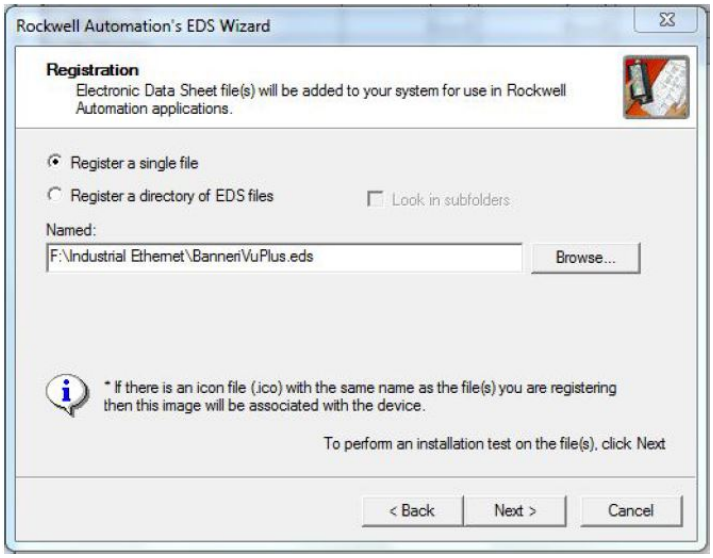
2. Click **Next**.
3. Select the **Register an EDS file(s)** option.

Figure 182. Rockwell Automation's EDS Wizard—Options



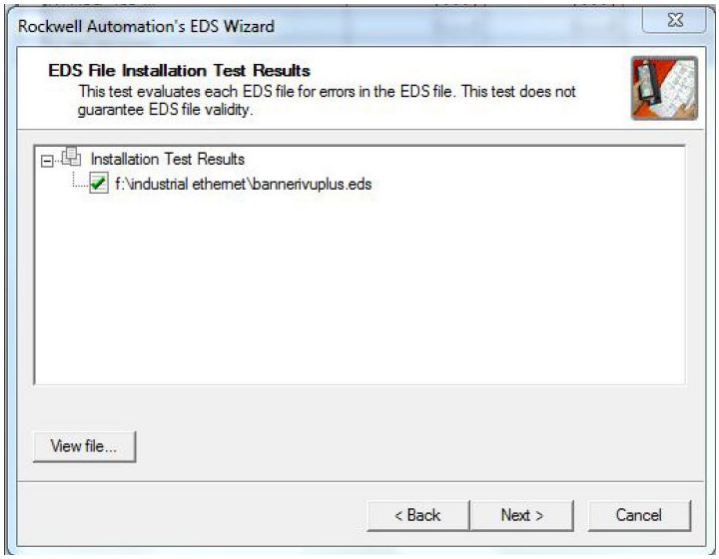
4. Browse to locate the EDS file and click **Next**.

Figure 183. Select File to Register



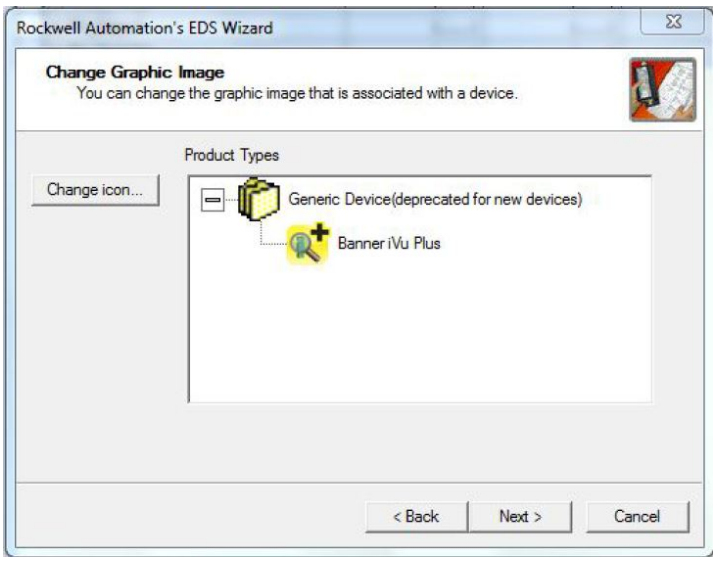
5. Click **Next** to register the tested file.

Figure 184. Register the Tested File



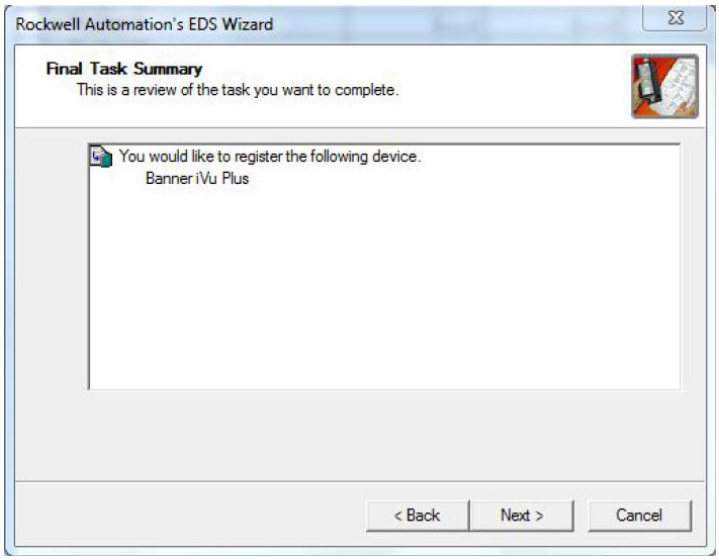
6. Click **Next** when you see the icon associated with the EDS file.

Figure 185. Rockwell Automation's EDS Wizard



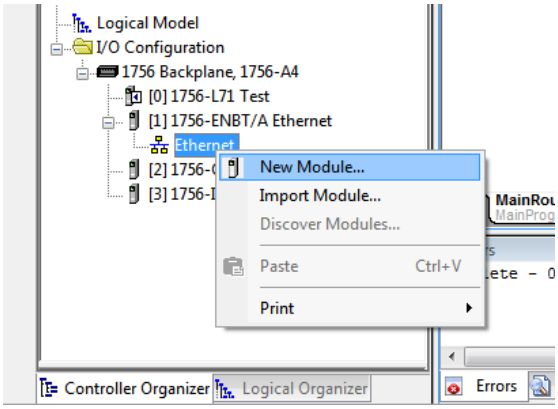
7. Click **Next** to register the EDS file.

Figure 186. Register the EDS File



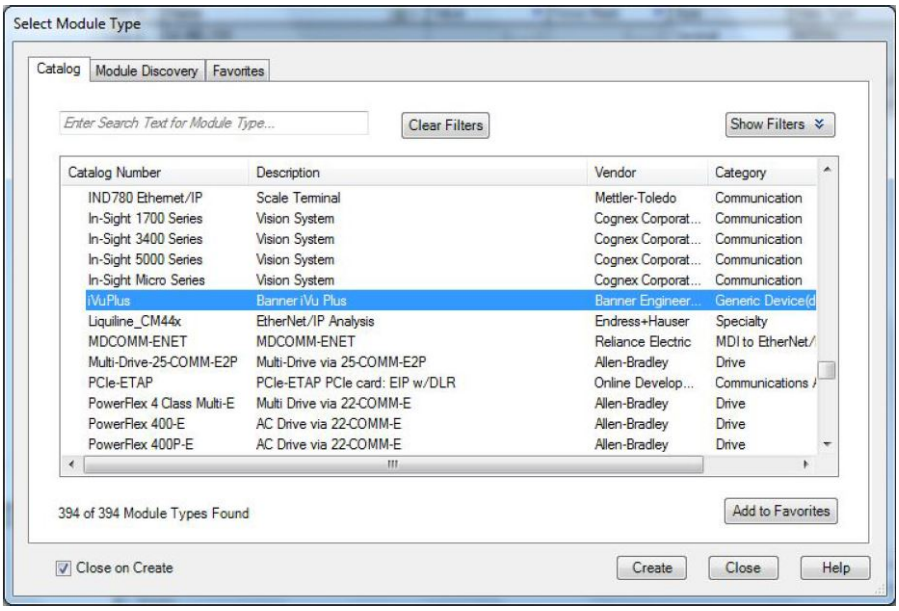
8. Click **Finish** to close the **EDS Wizard** .
9. Right-click on the PLC's Ethernet adapter and select **New Module...**

Figure 187. New Module



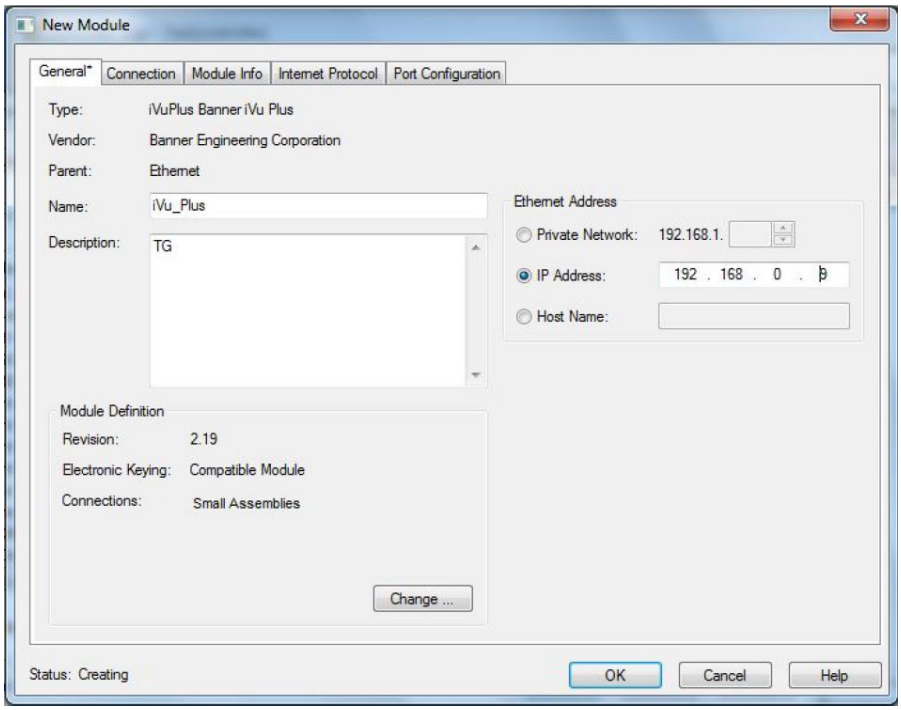
10. Locate the device in the catalog and click **Create**.

Figure 188. Select Module Type



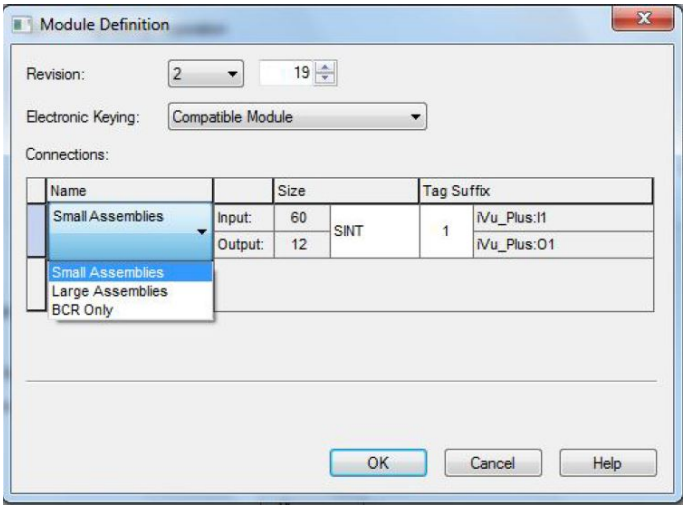
11. Enter a name, description (optional), and IP address for the device.

Figure 189. New Module



12. Click **Change** in the **Module Definition** field.

Figure 190. Module Definition

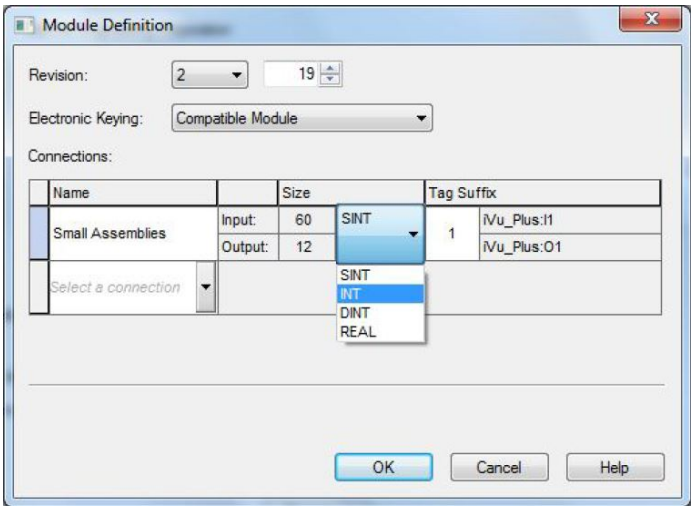


13. Select the desired connection in the **Module Definition** window. Each of the items in the **Name** list represents a fixed grouping of input and output assembly instances:

Small Assemblies	• O>T PLC/iVu Plus Assembly 112 (0x70) • T>O PLC/iVu Plus Assembly 100 (0x64)
Large Assemblies	• O>T PLC/iVu Plus Assembly 113 (0x71) • T>O PLC/iVu Plus Assembly 101 (0x65)

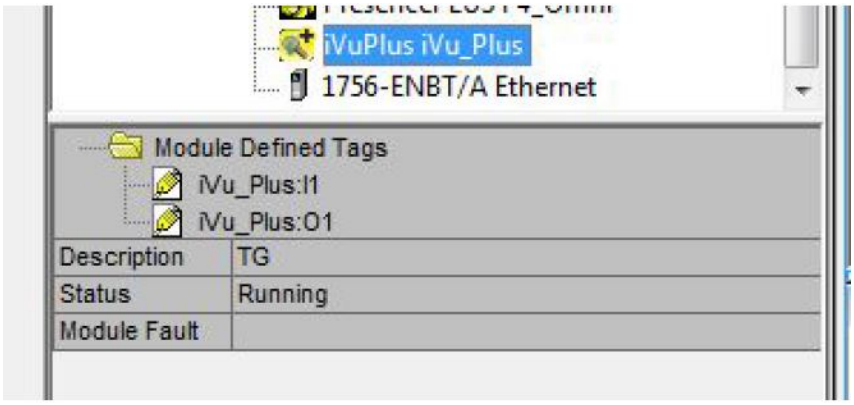
14. Select **INT** as the data type.

Figure 191. Module Definition—Data Type



15. Click **OK** twice and download the program to the PLC.

Figure 192. Download to the PLC



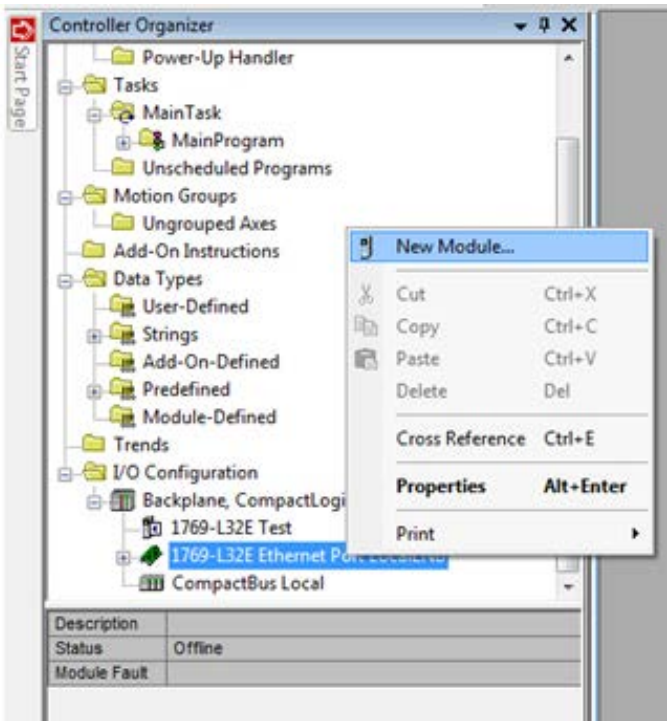
The connection looks like the one in Figure 192 on p. 144.

15.4.9 RSLogix5000 Configuration

To create an implicit Class 1 configuration to the iVu using EtherNet/IP when using a ControlLogix family PLC, configure the iVu as a “Generic Ethernet Module” under the ENET_MODULE. The following is a sample setup of a Banner device:

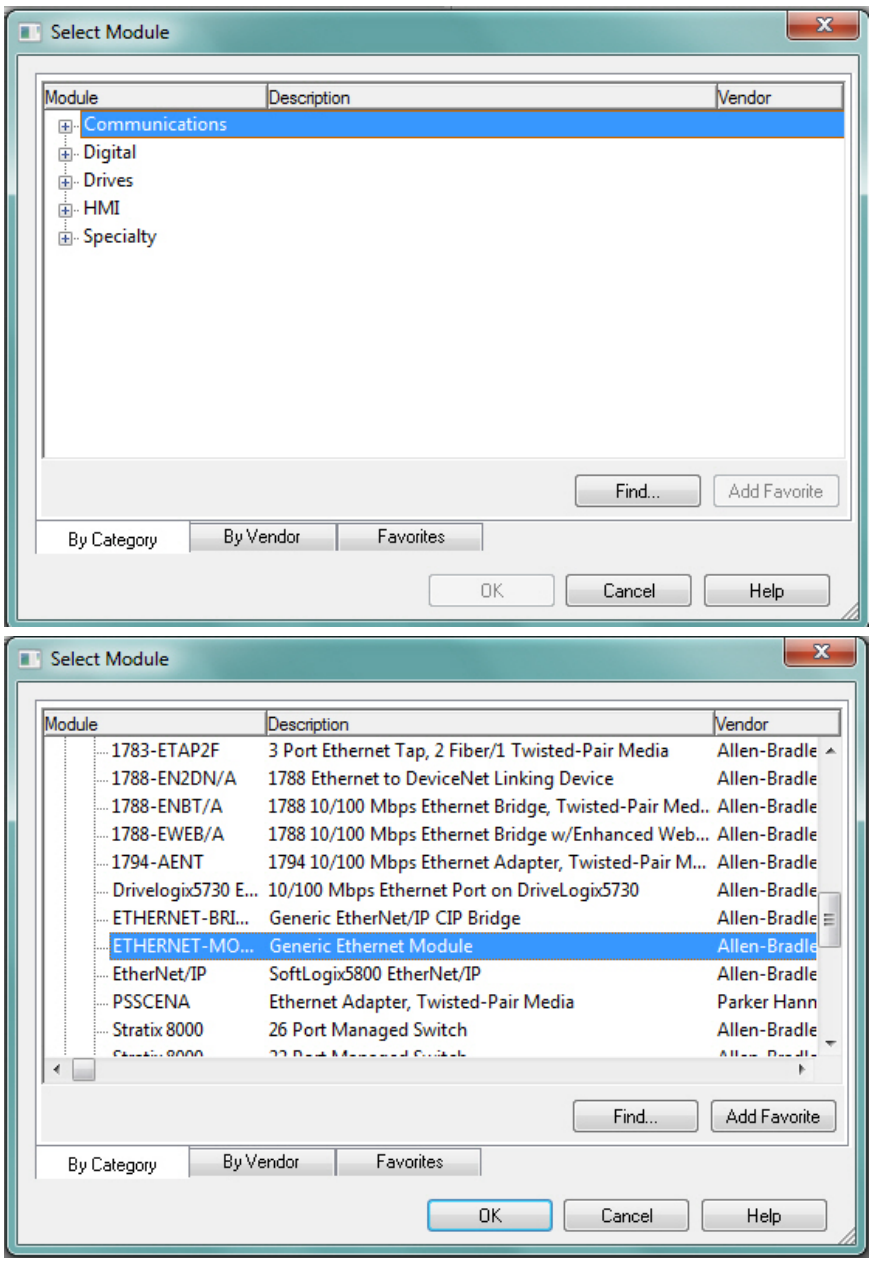
1. Add a generic Ethernet module to the PLC's Ethernet card.
   a. Click **New Module**.

Figure 193. Add Ethernet Module



   b. Click **Communications**, then **Generic Ethernet Module**.

Figure 194. Select Module



2. Configure the Module Properties.

Note: The data type in the Comm Format must be changed to an INT.

See Inputs to the iVu (Outputs from the PLC) on p. 133 and Outputs from the iVu (Inputs to the PLC) on p. 133 for more information on each specific assembly instance.

Figure 195. Example: PLC Input Assembly Instance 0×64 (100), PLC Output Assembly Instance 0×70 (112)

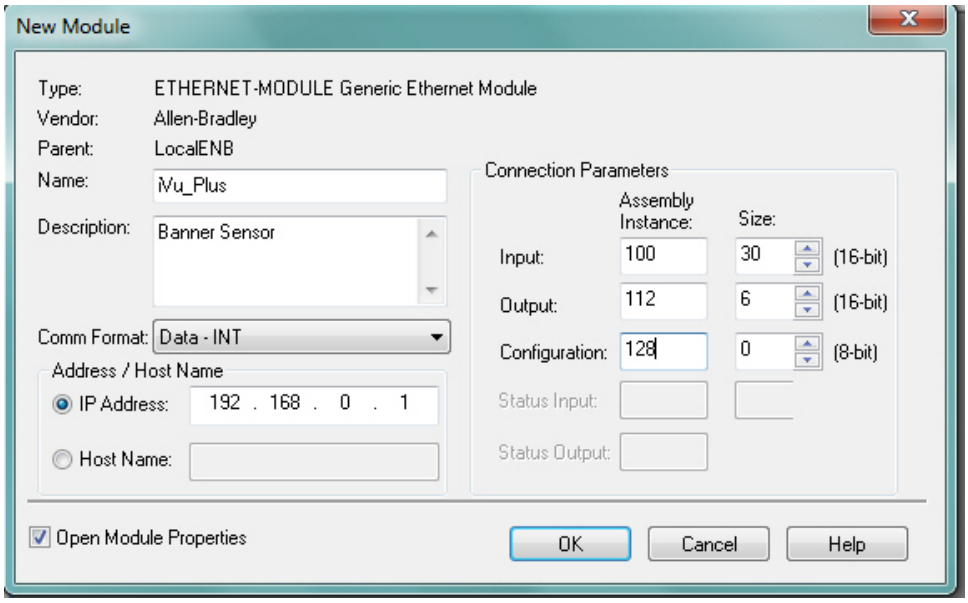


Figure 196. Example: PLC Input Assembly Instance 0×65 (101), PLC Output Assembly Instance 0×71 (113)

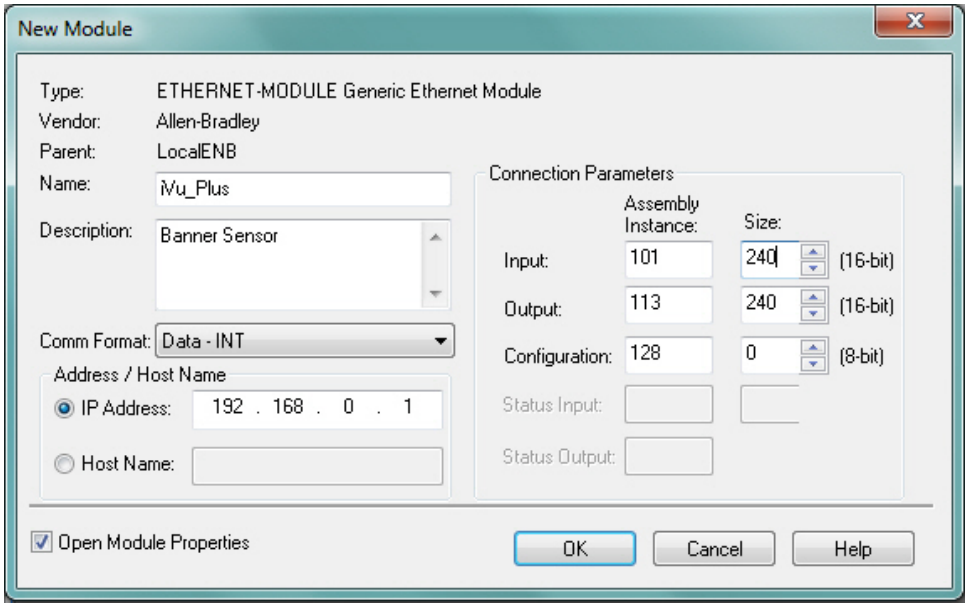
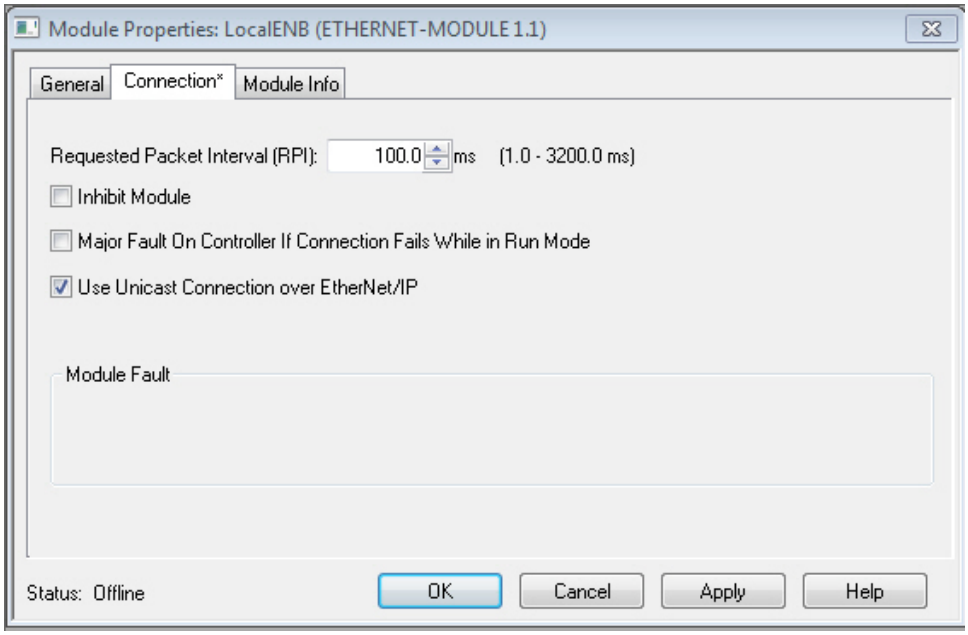


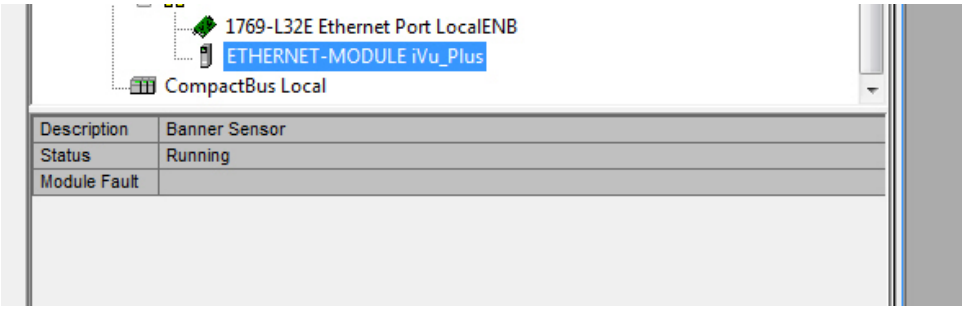
Figure 197. Select or clear the Unicast Connection checkbox as desired



Note: The minimum allowed RPI is 50 ms.

3. If the module configuration was successful, the following information displays:

Figure 198. Successful Configuration



If the module configuration was not successful, the RSLogix 5000 software will indicate errors similar to the following figures:

Figure 199. ERROR: Assembly Instance Number and/or Size Incorrect

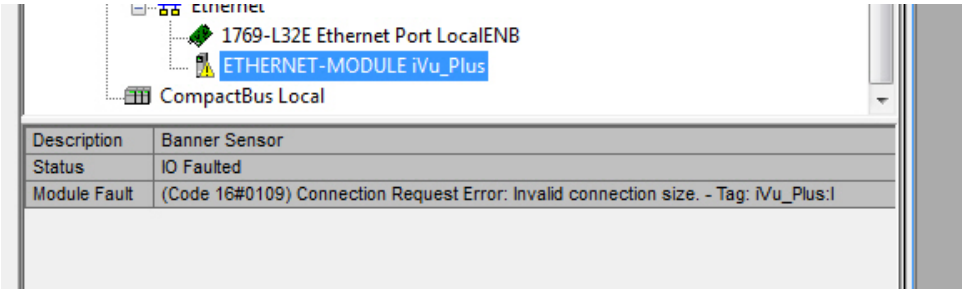
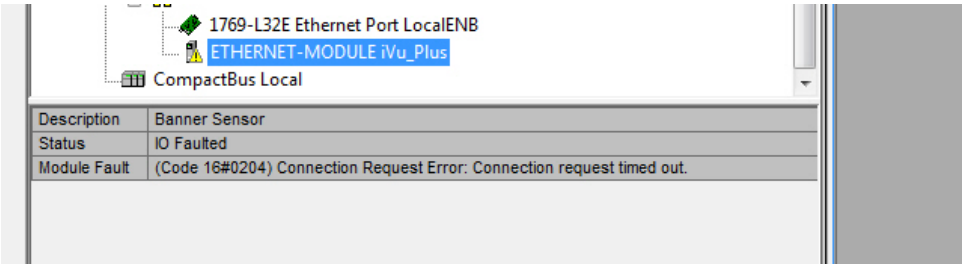
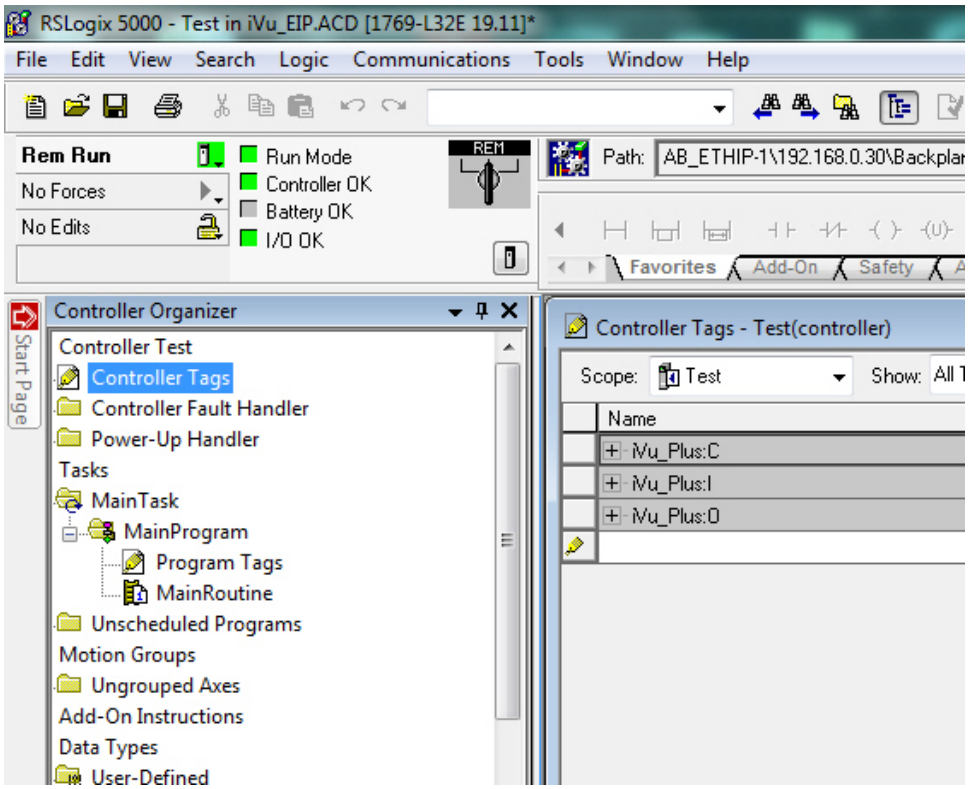


Figure 200. ERROR: iVu Not Powered Up or Ethernet Cable Not Attached



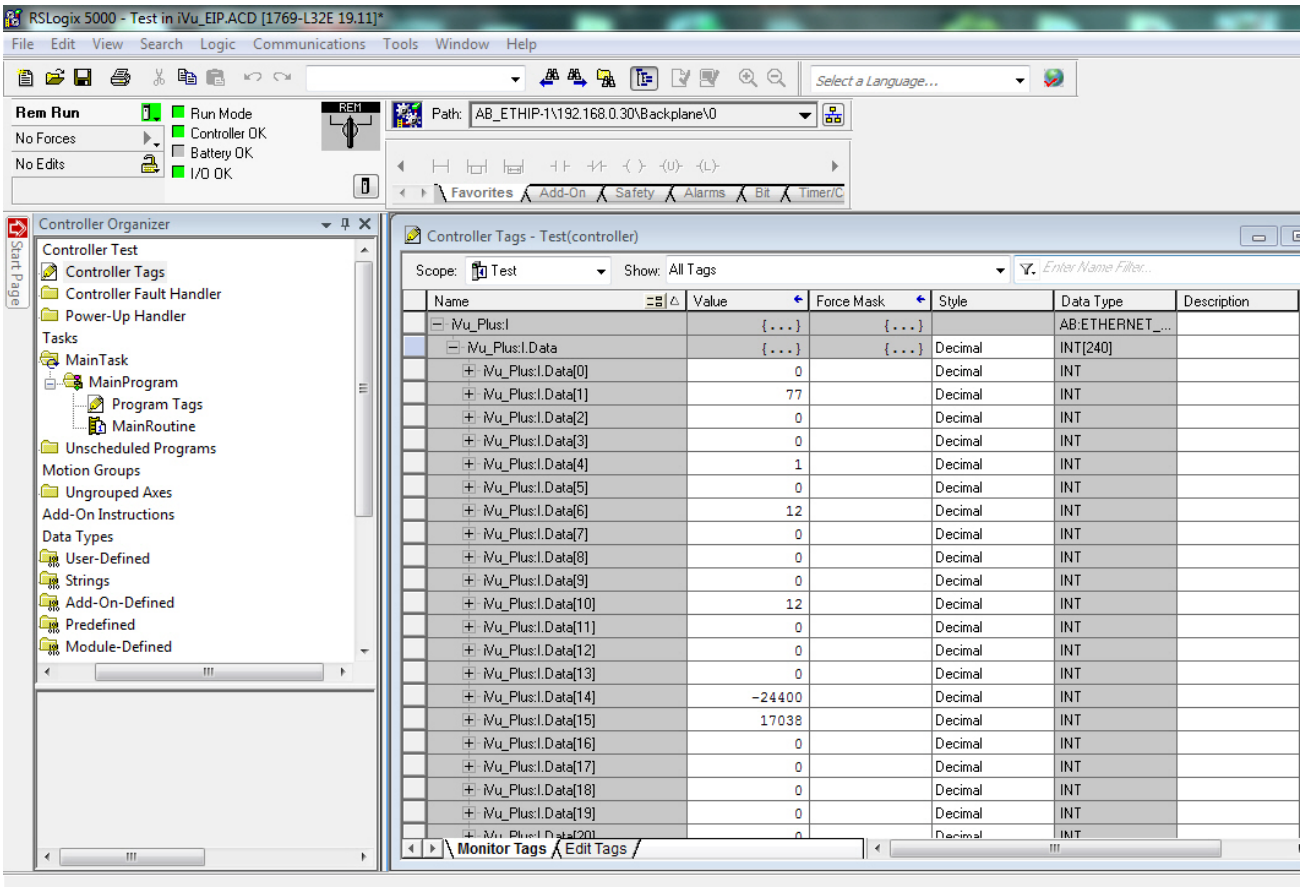
4. Locate the memory map setup from the Banner module to the PLC memory map.

Figure 201. Memory Map



C = Configuration (not used)
I = Inputs to PLC (outputs from the device)
O = Outputs from PLC (inputs to the device)

Figure 202. Memory Map Expanded



The iVu memory map expanded. I = Inputs to PLC (outputs from the device).

Sample map demonstrating string values:

Figure 203. Memory Map: Default

iVu_Plus:I.Data[55]	1		Decimal	INT
iVu_Plus:I.Data[56]	1		Decimal	INT
iVu_Plus:I.Data[57]	1		Decimal	INT
iVu_Plus:I.Data[58]	20		Decimal	INT
iVu_Plus:I.Data[59]	20		Decimal	INT
iVu_Plus:I.Data[60]	0		Decimal	INT
iVu_Plus:I.Data[61]	22121		Decimal	INT
iVu_Plus:I.Data[62]	20597		Decimal	INT
iVu_Plus:I.Data[63]	30060		Decimal	INT
iVu_Plus:I.Data[64]	8307		Decimal	INT
iVu_Plus:I.Data[65]	27977		Decimal	INT
iVu_Plus:I.Data[66]	26465		Decimal	INT
iVu_Plus:I.Data[67]	8293		Decimal	INT
iVu_Plus:I.Data[68]	25939		Decimal	INT
iVu_Plus:I.Data[69]	29550		Decimal	INT
iVu_Plus:I.Data[70]	29295		Decimal	INT

Note: ControlLogix string format. "iVu Plus Image Sensor"

Figure 204. Memory Map: "Style" changed to ASCII

⊞ iVu_Plus:I.Data[55]	1		Decimal	INT
⊞ iVu_Plus:I.Data[56]	1		Decimal	INT
⊞ iVu_Plus:I.Data[57]	1		Decimal	INT
⊞ iVu_Plus:I.Data[58]	20		Decimal	INT
⊞ iVu_Plus:I.Data[59]	20		Decimal	INT
⊞ iVu_Plus:I.Data[60]	0		Decimal	INT
⊞ iVu_Plus:I.Data[61]	'Vi'		ASCII	INT
⊞ iVu_Plus:I.Data[62]	'Pu'		ASCII	INT
⊞ iVu_Plus:I.Data[63]	'ul'		ASCII	INT
⊞ iVu_Plus:I.Data[64]	' s'		ASCII	INT
⊞ iVu_Plus:I.Data[65]	'mI'		ASCII	INT
⊞ iVu_Plus:I.Data[66]	'ga'		ASCII	INT
⊞ iVu_Plus:I.Data[67]	' e'		ASCII	INT
⊞ iVu_Plus:I.Data[68]	'eS'		ASCII	INT
⊞ iVu_Plus:I.Data[69]	'sn'		ASCII	INT
⊞ iVu_Plus:I.Data[70]	'ro'		ASCII	INT

All data is initially transferred as "INT" data type. An ASCII string looks like gibberish in this format. Changing the "style" to ASCII instead of "Decimal" reveals the correct string data.

15.5 Modbus/TCP

The Modbus/TCP protocol provides device information using register and coil banks defined by the slave device. This section defines the register and coil banks. By specification, Modbus/TCP uses TCP port 502.

The following registers are used to send values back and forth from the iVu to the PLC. iVu read-only output data can be read as Input Registers (30000) using Modbus function code 04 (Read Input Registers). Because some devices like the Modicon family of PLCs cannot access data using the 30000 range of registers, the same values can also be read from Holding Registers (40000) using Modbus function code 03 (Read Holding Registers).

The Input Bits can be set as Coils using Modbus function code 05 (Force Single Coil). The state of the Input ACK Bits and Status Bits can be read as Inputs (10000) using Modbus function code 02 (Read Input Status).

Modbus Function Codes Supported

01: Read Coil Status
02: Read Input Status
03: Read Holding Registers
04: Read Input Registers
05: Force Single Coil
06: Preset Single Register
07: Read Exception Status
16: Preset Multiple Registers

Table 33: Input Bits (Coils 00001-00016)

05: Force Single Coil		
Register	**Bit Position**	**WORD Name**
00001	0	Product Change
00002	1	Teach Latch
00003	2	Trigger
00004	3	*Barcode models only*
00005	4	*reserved*
00006	5	*reserved*
00007	6	*reserved*
00008	7	*reserved*
00009	8	*reserved*

05: Force Single Coil		
Register	**Bit Position**	**WORD Name**
00010	9	*reserved*
00011	10	*reserved*
00012	11	*reserved*
00013	12	*reserved*
00014	13	*reserved*
00015	14	*reserved*
00016	15	Command

Table 34: Input ACK Bits (Inputs 10001-10016)

02: Read Input Status		
Register	**Bit Position**	**WORD Name**
10001	0	Product Change ACK
10002	1	Teach Latch ACK
10003	2	Trigger ACK
10004	3	*Barcode models only*
10005	4	*reserved*
10006	5	*reserved*
10007	6	*reserved*
10008	7	*reserved*
10009	8	*reserved*
10010	9	*reserved*
10011	10	*reserved*
10012	11	*reserved*
10013	12	*reserved*
10014	13	*reserved*
10015	14	*reserved*
10016	15	Command ACK

Table 35: Status Bits (Inputs 10017-10032)

02: Read Input Status		
Register	**Bit Position**	**WORD Name**
10017	0	Ready
10018	1	Pass/Fail
10019	2	Read/No Read
10020	3	Ready Latch
10021	4	*reserved*
10022	5	Output 1
10023	6	Output 2
10024	7	Output 3

02: Read Input Status		
Register	**Bit Position**	**WORD Name**
10025	8	*reserved*
10026	9	*reserved*
10027	10	*reserved*
10028	11	*reserved*
10029	12	Missed Trigger
10030	13	Teach Error
10031	14	System Error
10032	15	Execution Error

15.5.1 iVu Input Values

Holding Registers (40000) are used by the PLC or HMI to write values to the iVu device. To write, use function codes 6 (Preset Single Register) or 16 (Preset Multiple Registers).

Table 36: iVu Input Values (Modbus/TCP Holding Registers)

06: Preset Single Register or 16: Preset Multiple Registers		
REG #	**WORD NAME**	**DATA TYPE**
1	Input Bits (See Input and Output Bits on p. 158 and Coils 00001-16)	16-bit integer
2-3	Product Change Number	32-bit integer
4-50	*reserved*	16-bit integer
51	Command ID	16-bit integer
52	Command Parameter Int16	16-bit integer
53-54	Command Parameter Int32	32-bit integer
55-56	Command Parameter	Float
57-58	Command Parameter ASCII String Length	32-bit integer
59-108	Command Parameter ASCII String	100-byte Unicode character array
109-240	*reserved*	16-bit integer

15.5.2 iVu Output Values

The iVu sends output data to the PLC or HMI via a bank of Input Registers (30000). Some devices, like the Modicon family of PLCs, cannot access data using the 30000 range of register addresses. For these devices, the iVu output data is also made available as Holding Registers (40000). To access this data, use either function code 04 (Read Input Registers) or function code 03 (Read Holding Registers).

15.5.3 Multiple Sensors Mapping Options

When using an iVu with multiple sensors in an inspection, there are two mapping options: Default and Custom.

Default Map

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Map** > **Default**

The default map automatically maps sensor data for each inspection and is recommended when the execution order of sensor types is the same across inspections. When an inspection has multiple sensors, the first five sensor results are shown, starting at offset 55. Each sensor result occupies 20 words.

Table 37: iVu Output Values (Modbus/TCP Input or Holding Registers): DEFAULT MAP

04: Read Input Registers or 03: Read Holding Registers			
Input REG #	**Holding REG #**	**WORD NAME**	**DATA TYPE**
1	1001	Input ACK Bits (see Input and Output Bits on p. 158 *Flags*, and Inputs 10001-16).	16-bit Integer
2	1002	Status Bits (see Input and Output Bits on p. 158, and Inputs 10017-32).	16-bit Integer
3-4	1003-4	Error Code	32-bit Integer
5-6	1005-6	Inspection Number	32-bit Integer
7-8	1007-8	Iteration Count	32-bit Integer
9-10	1009-10	Pass Count	32-bit Integer
11-12	1011-12	Fail Count	32-bit Integer
13-14	1013-14	Missed Triggers	32-bit Integer
15-16	1015-16	Current Inspection Time	Float
17	1017	Sensor Pass/Fail Bits	16-bit Integer
18-30	1018-30	*reserved*	16-bit Integer
31-53	1031-53	Inspection Name	2-word Length + 20 Unicode characters
54-55	1054-55	Frame Number	32-bit Integer
56	**1056**	**Sensor Type ID (Sensor 1)**	**16-bit Integer**
57-75	**1057-75**	**Sensor 1 Specific Data**	**16-bit Integer**
76	**1076**	**Sensor Type ID (Sensor 2)**	**16-bit Integer**
77-95	**1077-95**	**Sensor 2 Specific Data**	**16-bit Integer**
96	**1096**	**Sensor Type ID (Sensor 3)**	**16-bit Integer**
97-115	**1097-115**	**Sensor 3 Specific Data**	**16-bit Integer**
116	**1116**	**Sensor Type ID (Sensor 4)**	**16-bit Integer**
117-135	**1117-135**	**Sensor 4 Specific Data**	**16-bit Integer**
136	**1136**	**Sensor Type ID (Sensor 5)**	**16-bit Integer**
137-155	**1137-155**	**Sensor 5 Specific Data**	**16-bit Integer**
156-171	1156-71	*reserved*	16-bit Integer
172	1172	Command Status	16-bit Integer
173	1173	Command Response Int16	16-bit Integer
174-75	1174-75	Command Response Int32	32-bit Integer
176-77	1176-77	Command Response	Float
178-79	1178-79	Command Response ASCII String Length	16-bit Integer
180-229	1180-229	Command Response ASCII String Data	100-byte Unicode character array
230-40	1230-40	*reserved*	16-bit Integer

Note: If the inspection contains more than five sensors, any sensors after the fifth sensor are not included on the map.

Table 38: Area Sensor ID = 2

Sensor Specific Data	Data Size
Area Count	32-bit Integer
Area Range Minimum	32-bit Integer
Area Range Maximum	32-bit Integer

Table 39: Blemish Sensor ID = 3

Sensor Specific Data	Sensor Location
Blemish Count	32-bit Integer
Blemish Minimum Edge Length	32-bit Integer
Blemish Minimum Edge Length	32-bit Integer

Table 40: Match Sensor ID = 4

Sensor Specific Data	Sensor Location
Match Count	32-bit Integer
Match Minimum Percent	16-bit Integer
Match Maximum Percent	16-bit Integer

Table 41: Sort Sensor ID = 5

Sensor Specific Data	Sensor Location
Sort Pattern Map	16-bit Integer
Sort Pattern Count	16-bit Integer
Sort Pattern 1 Count	16-bit Integer
Sort Pattern 2 Count	16-bit Integer
Sort Pattern 3 Count	16-bit Integer
Sort Pattern 4 Count	16-bit Integer
Sort Pattern 5 Count	16-bit Integer
Sort Pattern 6 Count	16-bit Integer
Sort Pattern 7 Count	16-bit Integer
Sort Pattern 8 Count	16-bit Integer
Sort Pattern 9 Count	16-bit Integer
Sort Pattern 10 Count	16-bit Integer
Sort Minimum Percent Match	16-bit Integer
Sort Maximum Percent Match	16-bit Integer

Table 42: Average Color Sensor ID = 6

Sensor-Specific Data	Data Size
Average Red	16-bit Integer
Average Green	16-bit Integer
Average Blue	16-bit Integer
Average Hue	16-bit Integer

Sensor-Specific Data	Data Size
Average Saturation	16-bit Integer
Average Intensity	16-bit Integer
Standard Deviation Red	32-bit float
Standard Deviation Green	32-bit float
Standard Deviation Blue	32-bit float
Standard Deviation Hue	32-bit float
Standard Deviation Saturation	32-bit float
Standard Deviation Intensity	32-bit float

Note: Average Color Sensor data that does not apply to the selected color space has a result of 0. For example, if the HSI color space is selected, the Red, Green, and Blue data will have a result of 0.

Table 43: Color Compare Sensor ID = 7

Sensor-Specific Data	Data Size
Color Difference	16-bit Integer
Intensity Difference	16-bit Integer

Table 44: Color Area Sensor ID = 8

Sensor-Specific Data	Data Size
Area Count	32-bit Integer
Area Range Minimum	32-bit Integer
Area Range Maximum	32-bit Integer

iVu Output Values (Modbus/TCP Input or Holding Registers)- Custom Map

The Custom Map option allows for more flexibility regarding iVu Output Values. The Custom Map option allows the user to choose which pieces of Sensor Specific Data are given space in the register map.

Table 45: iVu Output Values (Modbus/TCP Input or Holding Registers): CUSTOM MAP

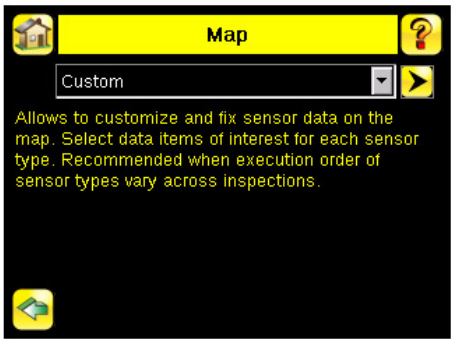
04: Read Input Registers or 03: Read Holding Registers			
Input REG #	**Holding REG #**	**WORD NAME**	**DATA TYPE**
1	1001	Input ACK Bits (see Input and Output Bits on p. 158) see also Inputs 10001-16	16-bit Integer
2	1002	Status Bits (see Input and Output Bits on p. 158) see also Inputs 10017-32	16-bit Integer
3-4	1003-4	Error Code	32-bit Integer
5-6	1005-6	Inspection Number	32-bit Integer
7-8	1007-8	Iteration Count	32-bit Integer
9-10	1009-10	Pass Count	32-bit Integer
11-12	1011-12	Fail Count	32-bit Integer
13-14	1013-14	Missed Triggers	32-bit Integer
15-16	1015-16	Current Inspection Time	Float
17	1017	Sensor Pass/Fail Bits	16-bit Integer

04: Read Input Registers or 03: Read Holding Registers			
Input REG #	**Holding REG #**	**WORD NAME**	**DATA TYPE**
18-30	1018-30	*reserved*	16-bit Integer
31-53	1031-53	Inspection Name	2-word Length + 20 Unicode characters
54-55	1054-55	Frame Number	32-bit Integer
56-167	**1056-167**	**Customizable Space (112 registers)**	***varies by sensor***
168-171	1168-71	*reserved*	16-bit Integer
172	1172	Command Status	16-bit Integer
173	1173	Command Response Int16	16-bit Integer
174-75	1174-75	Command Response Int32	32-bit Integer
176-77	1176-77	Command Response	Float
178-79	1178-79	Command Response ASCII String Length	16-bit Integer
180-229	1180-229	Command Response ASCII String Data	100-byte Unicode character array
230-40	1230-40	*reserved*	16-bit Integer

Configure a Custom Industrial Ethernet (IE) Map

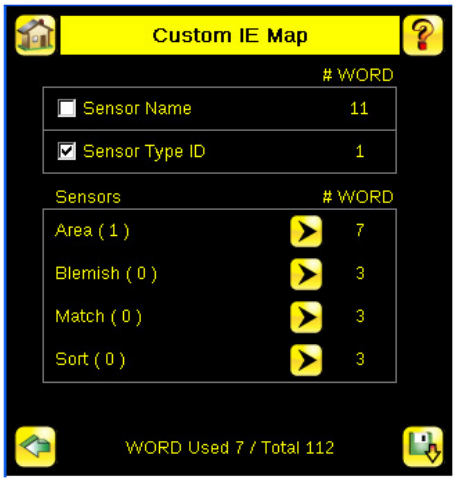
1. Enable the Custom Map by selecting **Custom** on the drop-down list.

*Figure 205. **Map** Screen—**Custom** Map Selected*



2. Click the yellow arrow to access the **Custom IE Map** screen.
3. On the **Custom IE Map** screen, choose the sensor result data that will appear on the customizable space.

*Figure 206. **Custom IE Map** Summary Screen*



The bottom of the screen shows the word use on the customizable space. In the image above, seven words have been used for one Area sensor "Area (**1**)".

4. Click the yellow arrow next to the Area sensor row to go to the **Area Sensor Data**.

*Figure 207. **Custom IE Map** Screen—**Area Sensor Data***



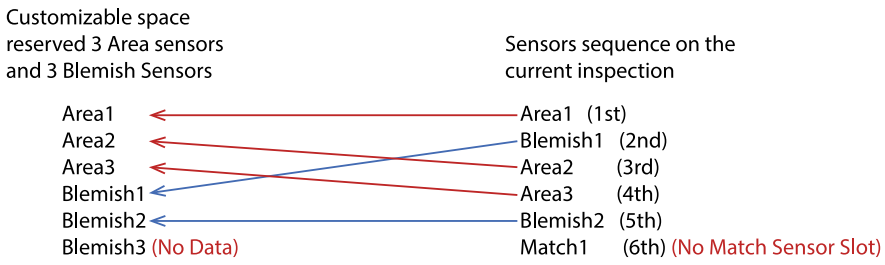
On the **Area Sensor Data** screen shown above, **Area Count**, **Area Range Min** and **Area Range Max** are available to add to the customizable space. The number to the right of each item shows how many words are required to display the data. The bottom reservation count shows the number of Area sensors that have space reserved for them on the customizable map.

Because only one Area sensor's worth of data is reserved on the image above, the selected data will be collected from the first Area sensor in the current inspection. When multiple Area sensors have been reserved, the data will be arranged in the sequential manner of the sensor type in the current inspection.

5. Click the green arrow (Back) to return to the **Custom IE Map** summary.
6. Continue to add more data from any sensor type as required or reserve more sensors into the customizable space.

Sensor Name and **Sensor Type ID** are global settings that are part of any individual sensor reservation. When they are checked, they are inserted into each sensor reservation.

The following is an example of a multiple sensors inspection and its output location on the customizable space.



In this example, there are only two Blemish sensors in the current inspection. The Blemish3 location will be all zero on the customizable space. The customizable map had not reserved space for a Match sensor, so Match1 from the inspection will not be outputted on the custom map.

15.5.4 Input and Output Bits

Writeable **Input Bits** are inputs to the iVu (outputs from the PLC or HMI). They are used for basic control of the iVu. They are accessible using function code 6 (Preset Single Register). The same control is also possible using Coils 00001-16, function code 05 (Force Single Coil).

Table 46: Input Bits: PLC Holding Register 1, also Coils 00001-16

Coil 16	Coil 15	Coil 14	Coil 13	Coil 12	Coil 11	Coil 10	Coil 9	Coil 8	Coil 7	Coil 6	Coil 5	Coil 4	Coil 3	Coil 2	Coil 1
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Command	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*Barcode models only*	Trigger	Teach Latch	Product Change

Read-only **Input ACK Bits** are outputs from the iVu (inputs to the PLC or HMI). They are used to acknowledge each of the input bits sent from the PLC. For example, if the PLC changes the Trigger bit (from Input Bits, above) from a 0 to a 1, the iVu changes the Trigger ACK bit from a 0 to a 1 in response. This information is available as Input Registers or Holding

Registers. Use either function code 04 (Read Input Registers) or function code 03 (Read Holding Registers). The same data can also be read from Inputs (10000) using Modbus function code 02 (Read Input Status).

Table 47: Input ACK Bits: PLC Input Register 1 or Holding Register 1001, also Inputs 10001-16

Input 16	Input 15	Input 14	Input 13	Input 12	Input 11	Input 10	Input 9	Input 8	Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Command ACK	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*Barcode models only*	Trigger ACK	Teach Latch ACK	Product Change ACK

Read-only **Status Bits** are outputs from the iVu (inputs to the PLC or HMI). They are used to report the basic status of the iVu and the last inspection run. This information is available as Input Registers or Holding Registers. Use either function code 04 (Read Input Registers) or function code 03 (Read Holding Registers). The same data can also be read from Inputs (10000) using Modbus function code 02 (Read Input Status).

Table 48: Status Bits: PLC Input Register 2 or Holding Register 1002, also Inputs 10017-32

Input 32	Input 31	Input 30	Input 29	Input 28	Input 27	Input 26	Input 25	Input 24	Input 23	Input 22	Input 21	Input 20	Input 19	Input 18	Input 17
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Execution Error	System Error	Teach Error	Missed Trigger	*reserved*	*reserved*	*reserved*	*reserved*	Output 3	Output 2	Output 1	*reserved*	Ready Latch	Read/No Read	Pass/Fail	Ready

15.6 PLC5, SLC500, and MicroLogix (PCCC)

Allen-Bradley's PLC5, SLC 500, and MicroLogix family of devices uses PCCC communications protocol.

PCCC is also known as EtherNet/IP transport class 3 and uses explicit Read and Write message commands, or EIP messaging, placed into the ladder logic program, to interface with the iVu.

These PLCs do not support cyclic EtherNet/IP IO data transfer (referred to as EtherNet/IP in this manual). The programming software used by these PLCs is RSLogix 5 (PLC5) or RSLogix 500 (SLC500 and MicroLogix series).

The iVu supports these PLCs using input and output register arrays.

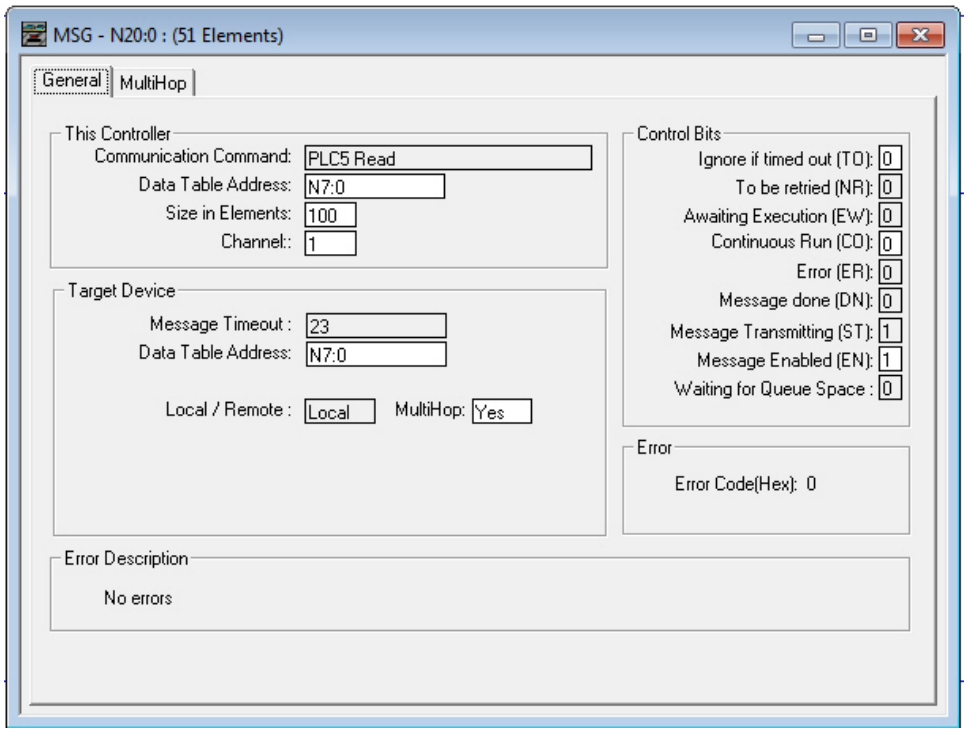
The Output bits, ACK bits and Input bits bit definitions are the same as defined in Input and Output Bits on p. 158. The terms "Input" and "Output" are from the point of view of the PLC.

15.6.1 Configuration

The following images represent a typical configuration.

PLC Read Message Command

Figure 208. General tab: Example message command reading from N7 table on the iVu and sending the data to the N7 table on the PLC



This Controller

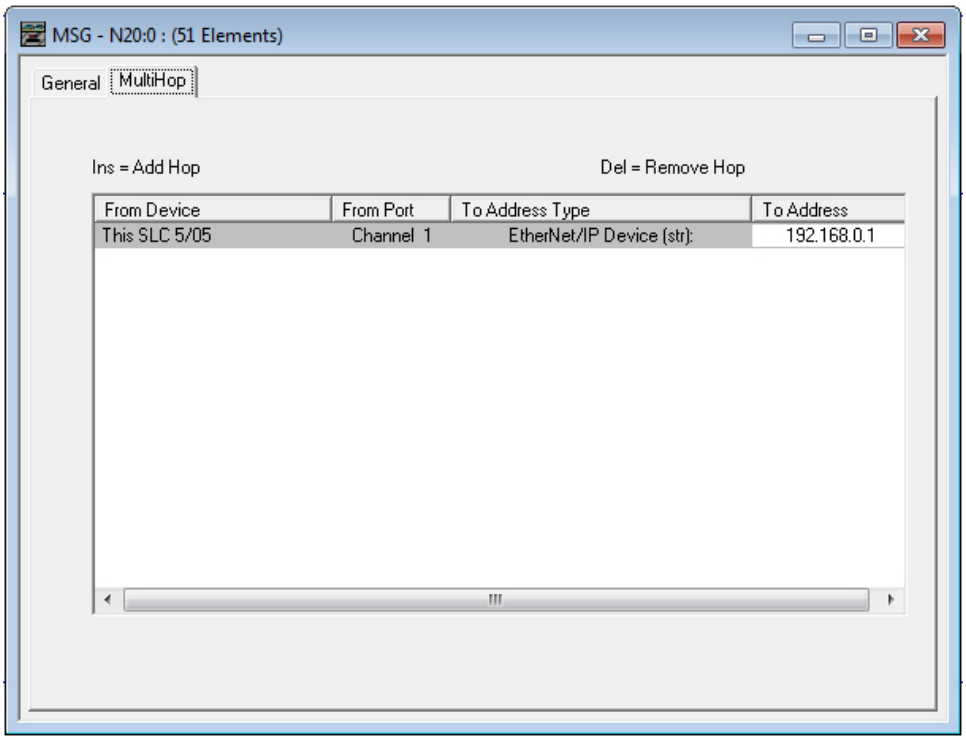
Communications Command = PLC5 Read

Data Table Address = Integer table "Nx"

Target Device

Data Table Address = N7:x

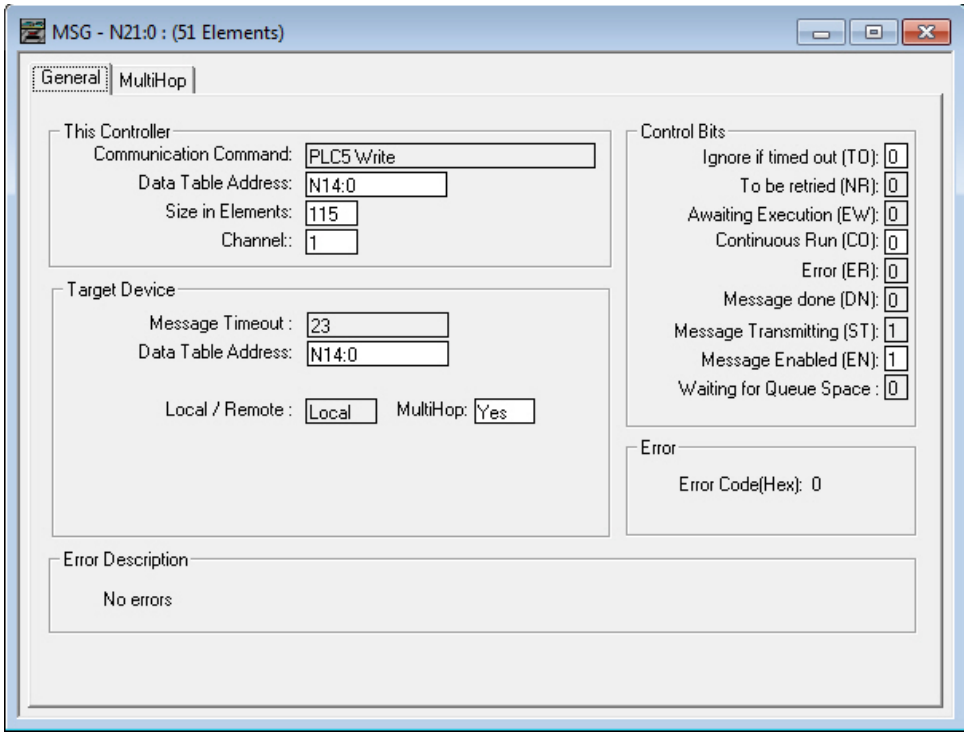
Figure 209. MultiHop tab: IP Address of the iVu is entered here



To Address = IP address of the iVu

PLC Write Message Command

Figure 210. General tab: Example message command writing to N14 table on the iVu from the N14 table of the PLC



This Controller

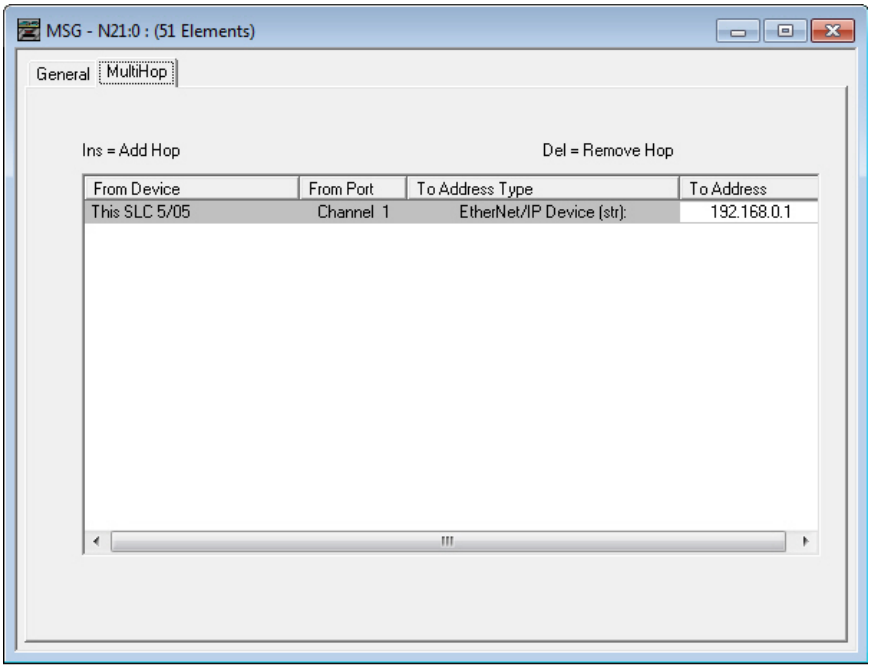
Communications Command = PLC5 Write

Data Table Address = Integer table "Nx"

Target Device

Data Table Address = N14:x

Figure 211. MultiHop tab: IP address of the iVu is entered here



To Address = IP address of the iVu

15.6.2 Inputs to iVu (Outputs from PLC)

The registers below are used by the PLC to push values to the iVu device. MSG (message) commands are used to write (N14) to the iVu.

Table 49: PCCC PLC Output Registers (iVu Inputs, N14 Table)

WORD #	WORD NAME	DATA TYPE
0	Input Bits Register (see Input and Output Flags on p. 168)	16-bit integer
1-2	Product Change Number	32-bit integer
3-49	*reserved*	32-bit integer
50	Command ID	16-bit integer
51	Command Parameter Int16	16-bit integer
52-53	Command Parameter Int 32	32-bit integer
54-55	Command Parameter	Float
56-57	Command Parameter String Length	32-bit integer
58-107	Command Parameter String	100-Byte Array
108	*reserved*	16-bit integer
109-120	*for Barcode models only*	
211-239	*reserved*	16-bit integer

15.6.3 Outputs from iVu (Inputs to PLC)

The registers below are used to send output values from the iVu device to the PLC. MSG (message) commands are used to read (N7) from the iVu.

15.6.4 Multiple Sensors Mapping Options

When using an iVu with multiple sensors in an inspection, there are two mapping options: Default and Custom.

Default Map

Main Menu > System > Communications > Industrial Ethernet > Map > Default

Automatically maps sensor data for each inspection. Recommended when the execution order of the sensor types is the same across inspections. When an inspection has multiple sensors, the first 5 sensor results are shown starting at offset 55. Each sensor result occupies 20 words.

Table 50: PCCC PLC Input Registers (iVu Outputs, N7 Table): DEFAULT MAP

WORD #	WORD NAME	Data Type
0	Input Bits ACK Register (see Input and Output Flags on p. 168)	16-bit integer
1	Output Bits Register (see Input and Output Flags on p. 168)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	*reserved*	16-bit integer
30-52	Inspection Name	2-Word Length + 20-Unicode characters
53-54	Frame Number	32-bit integer
55	**Sensor Type ID (Sensor 1)**	**16-bit integer**
56-74	**Sensor 1 Specific Data**	**16-bit integer**
75	**Sensor Type ID (Sensor 2)**	**16-bit integer**
76-89	**Sensor 2 Specific Data**	**16-bit integer**
95	**Sensor Type ID (Sensor 3)**	**16-bit integer**
95-114	**Sensor 3 Specific Data**	**16-bit integer**
115	**Sensor Type ID (Sensor 4)**	**16-bit integer**
116-134	**Sensor 4 Specific Data**	**16-bit integer**
135	**Sensor Type ID (Sensor 5)**	**16-bit integer**
136-154	**Sensor 5 Specific Data**	**16-bit integer**
155-170	*reserved*	16-bit integer
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100-Byte Array
229-239	*reserved*	16-bit integer

Note: If the inspection contains more than 5 sensors, the sensor after the 5th one will not be included on the map.

Table 51: Area Sensor ID = 2

Sensor Specific Data	Data Size
Area Count	32-bit integer
Area Range Minimum	32-bit integer
Area Range Maximum	32-bit integer

Table 52: Blemish Sensor ID = 3

Sensor Specific Data	Sensor Location
Blemish Count	32-bit integer
Blemish Minimum Edge Length	32-bit integer
Blemish Maximum Edge Length	32-bit integer

Table 53: Match Sensor ID = 4

Sensor Specific Data	Sensor Location
Match Count	32-bit integer
Match Minimum Percent	16-bit integer
Match Maximum Percent	16-bit integer

Table 54: Sort Sensor ID = 5

Sensor Specific Data	Sensor Location
Sort Pattern Map	16-bit integer
Sort Pattern Count	16-bit integer
Sort Pattern 1 Count	16-bit integer
Sort Pattern 2 Count	16-bit integer
Sort Pattern 3 Count	16-bit integer
Sort Pattern 4 Count	16-bit integer
Sort Pattern 5 Count	16-bit integer
Sort Pattern 6 Count	16-bit integer
Sort Pattern 7 Count	16-bit integer
Sort Pattern 8 Count	16-bit integer
Sort Pattern 9 Count	16-bit integer
Sort Pattern 10 Count	16-bit integer
Sort Minimum Percent Match	16-bit integer
Sort Maximum Percent Match	16-bit integer

Table 55: Average Color Sensor ID = 6

Sensor-Specific Data	Data Size
Average Red	16-bit Integer
Average Green	16-bit Integer

Sensor-Specific Data	Data Size
Average Blue	16-bit Integer
Average Hue	16-bit Integer
Average Saturation	16-bit Integer
Average Intensity	16-bit Integer
Standard Deviation Red	32-bit float
Standard Deviation Green	32-bit float
Standard Deviation Blue	32-bit float
Standard Deviation Hue	32-bit float
Standard Deviation Saturation	32-bit float
Standard Deviation Intensity	32-bit float

Note: Average Color Sensor data that does not apply to the selected color space has a result of 0. For example, if the HSI color space is selected, the Red, Green, and Blue data will have a result of 0.

Table 56: Color Compare Sensor ID = 7

Sensor-Specific Data	Data Size
Color Difference	16-bit Integer
Intensity Difference	16-bit Integer

Table 57: Color Area Sensor ID = 8

Sensor-Specific Data	Data Size
Area Count	32-bit Integer
Area Range Minimum	32-bit Integer
Area Range Maximum	32-bit Integer

Custom Map

Main Menu > **System** > **Communications** > **Industrial Ethernet** > **Map** > **Custom**

The custom map allows for customization of fixed sensor data on the map. The user selects data items of interest for each sensor type. This is recommended when the execution order of the sensor types varies across inspections or when using more than five sensors.

A system-level custom map is supported for additional flexibility. When **Custom** map is selected, a customizable space is used in the offset range (55 to 166) on PCCC registers.

Table 58: PCCC PLC Input Registers (iVu Outputs, N7 Table): CUSTOM MAP

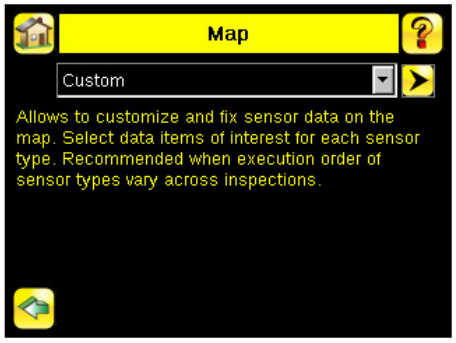
WORD #	WORD NAME	Data Type
0	Input Bits ACK Register (see Input and Output Flags on p. 168)	16-bit integer
1	Output Bits Register (see Input and Output Flags on p. 168)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer

WORD #	WORD NAME	Data Type
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	*reserved*	16-bit integer
30-52	Inspection Name	2-Word Length + 20-unicode characters
53-54	Frame Number	32-bit integer
55-166	**Customizable Space (112 reg)**	16-bit integer
167-170	*reserved*	16-bit integer
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100-Byte Array
229-239	*reserved*	16-bit integer

Configure a Custom Industrial Ethernet (IE) Map

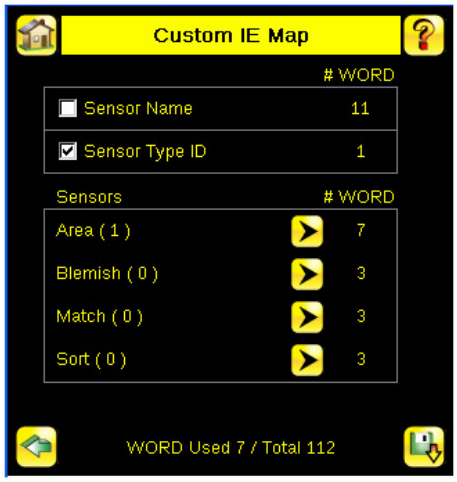
1. Enable the Custom Map by selecting **Custom** on the drop-down list.

*Figure 212. **Map** Screen—**Custom** Map Selected*



2. Click the yellow arrow to access the **Custom IE Map** screen.
3. On the **Custom IE Map** screen, choose the sensor result data that will appear on the customizable space.

*Figure 213. **Custom IE Map** Summary Screen*



The bottom of the screen shows the word use on the customizable space. In the image above, seven words have been used for one Area sensor "Area (**1**)".

4. Click the yellow arrow next to the Area sensor row to go to the **Area Sensor Data**.

*Figure 214. **Custom IE Map** Screen—**Area Sensor Data***



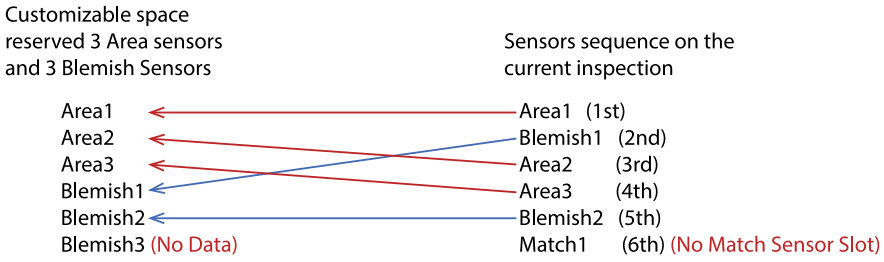
On the **Area Sensor Data** screen shown above, **Area Count**, **Area Range Min** and **Area Range Max** are available to add to the customizable space. The number to the right of each item shows how many words are required to display the data. The bottom reservation count shows the number of Area sensors that have space reserved for them on the customizable map.

Because only one Area sensor's worth of data is reserved on the image above, the selected data will be collected from the first Area sensor in the current inspection. When multiple Area sensors have been reserved, the data will be arranged in the sequential manner of the sensor type in the current inspection.

5. Click the green arrow (Back) to return to the **Custom IE Map** summary.
6. Continue to add more data from any sensor type as required or reserve more sensors into the customizable space.

Sensor Name and **Sensor Type ID** are global settings that are part of any individual sensor reservation. When they are checked, they are inserted into each sensor reservation.

The following is an example of a multiple sensors inspection and its output location on the customizable space.



In this example, there are only two Blemish sensors in the current inspection. The Blemish3 location will be all zero on the customizable space. The customizable map had not reserved space for a Match sensor, so Match1 from the inspection will not be outputted on the custom map.

15.6.5 Input and Output Flags

The Input Bits are used to command execution of basic functions. The Output Bits are used to push single bit outputs from the iVu device to the PLC. The 32 bits of iVu output can also be accessed using the bits of the first two Output Registers (Input Bits ACK Register(word 0) and Output Bits Register (word1)).

Table 59: Inputs Bits Register

Bit Position															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Command													Trigger	Teach Latch	Product Change

Table 60: Bit Position

Bit Position															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Command ACK													Trigger ACK	Teach Latch ACK	Product Change ACK

Table 61: Output Bits Register

Bit Position															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Execution Error	System Error	Teach Error	Missed Trigger					Output 3	Output 2	Output 1		Ready Latch	Read/No Read	Pass/Fail	Ready

15.7 PROFINET®

PROFINET® [25] is a data communication protocol for industrial automation and processes. PROFINET IO defines how controllers (IO controllers) and peripheral devices (IO devices) exchange data in real time.

The iVu Plus TG and Color Gen2 Image Sensors supports PROFINET IO. The data communication protocol is TCP/IP; the data transmission medium is copper wire; the PROFINET conformance class is CC-A. [26]

Note: In this document, outputs from the iVu device are referred to as "inputs" to the controller (PLC). Outputs from the controller (PLC) are referred to as "inputs" to the iVu device.

15.7.1 General Station Description (GSD) File

The General Station Description (GSD) file contains module information, such as:

- Configuration data
- Data information (pass count, inspection status, etc.)
- Diagnostics

Note: A single iVu Plus GSD file describes iVu Plus TG, iVu Plus BCR, and iVu Color models.

15.7.2 PROFINET IO Data Model

The PROFINET IO data model is based on the typical, expandable field device that has a backplane with slots. Modules and submodules have different functionalities.

Modules are plugged into slots; submodules are plugged into subslots. In the PROFINET IO data model, Slot 0 Subslot 1 is reserved for the Device Access Point (DAP) or network interface.

Both modules and submodules are used to control the type and volume of data that is sent to the controller (PLC).

- A submodule is typically designated as input type, output type, or combined input/output type
- An input submodule is used to send data to the controller (PLC)
- An output submodule is used to receive data from the controller (PLC)
- The combined input/output submodule simultaneously receives and sends data in both directions

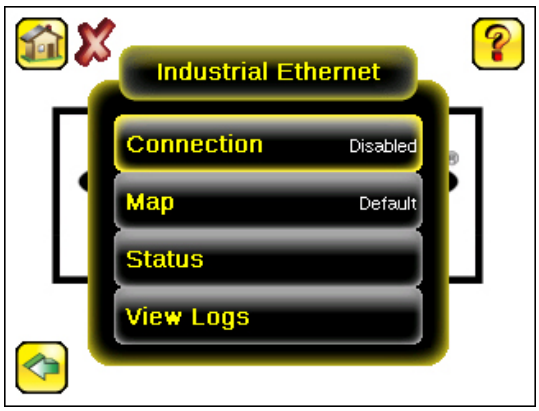
Configuring the iVu for a PROFINET IO Connection

The iVu device and the controller (PLC) must be configured for PROFINET® .

1. Go to **Main Menu** > **System** > **Communications** > **Industrial Ethernet** > **Connection**.

[25] PROFINET® is a registered trademark of PROFIBUS Nutzerorganisation e.V.
[26] CC-A ensures that the device has the minimum properties regarding functionality and interoperability.

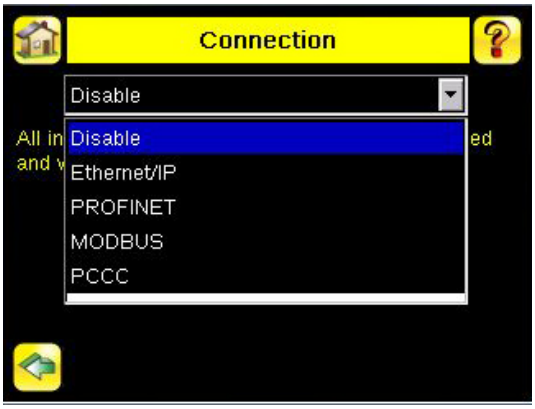
*Figure 215. **Industrial Ethernet** Menu*



Note: The default Industrial Ethernet Connection setting is Disabled.

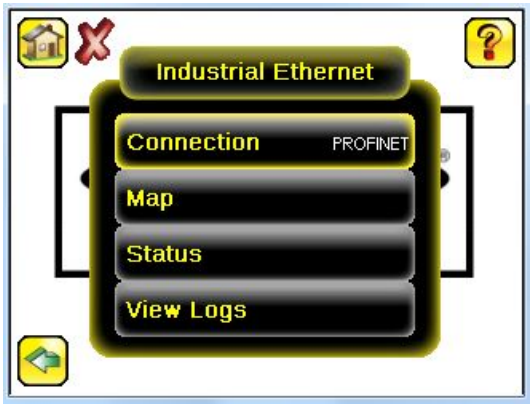
2. Click **PROFINET** in the drop-down menu.

*Figure 216. **Connection** Screen*



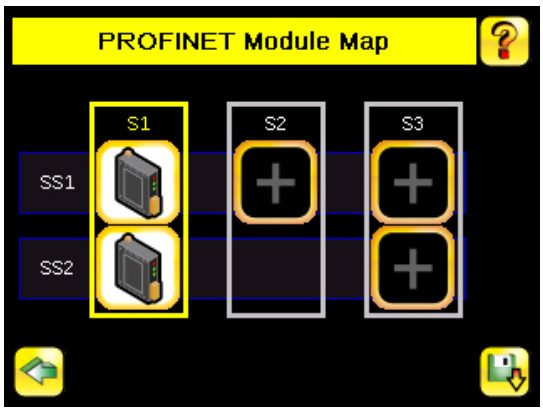
3. Click (only one time) on the **Arrow** button on the bottom left to return to the **Industrial Ethernet** window.

*Figure 217. **Industrial Ethernet** Menu*



4. Click **Map** to configure the PROFINET module map.

*Figure 218. **PROFINET Module Map** Screen*



Note: The PROFINET module map displays S1 SS1 and S1 SS2 by default. S1 represents Slot 1, SS1 represents SubSlot 1; S2 represents Slot 2, SS2 represents SubSlot 2. The other slots are not configured by default.

The default PROFINET configuration consists of a single module plugged into Slot 1. This module, called the Device Control and Status Module, accepts two submodules: the Inspection Result Submodule, plugged into Subslot 1, and the Device Control Submodule, plugged into Subslot 2.

The Inspection Result Submodule provides the inspection results from the iVu, including Pass Count, Fail Count, and Current Inspection Time. See Table 67 on p. 173.

Note: The Inspection Result Submodule does not provide any sensor-specific output data.

The Device Control Submodule allows you to issue commands to the iVu, such as Trigger, TEACH, and Product Change. This submodule also provides command feedback. See Table 68 on p. 174.

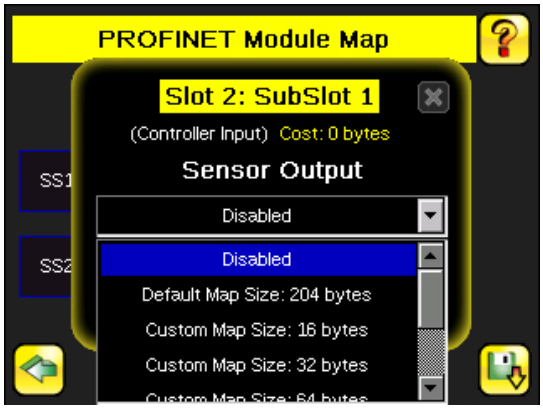
Adding sensor-specific output data requires the use of a sensor output submodule, plugged into Slot 2 Subslot 1. The iVu provides different options for configuring this submodule, based on the complexity of the inspection. The selection of sensor output submodules is based on size, allowing the user to control network bandwidth use.

The Command Channel Module can be plugged into Slot 3. The selection of Command Channel Submodules is based on the required length of the data output string. See Description of Submodules on p. 172.

Follow Step 5 and Step 6 to add a submodule to the configuration (optional).

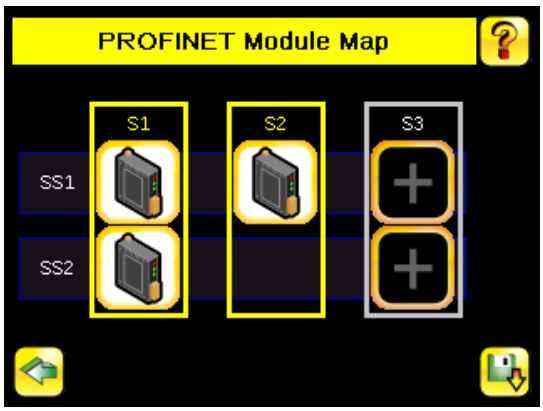
5. Click **S2** to go to the configuration window and add a submodule.

*Figure 219. **PROFINET Module Map** Screen—Add Submodule*



6. Click the **Drop-Down Arrow** next to Disabled to open the list of submodule slots.
7. Select a submodule and hit enter.
   The submodule slot now shows an icon, which means that it has been configured.
8. Set up all submodules for your application.

*Figure 220. **PROFINET Module Map** Screen—With a Submodule Added*



The iVu PROFINET configuration is complete. The PLC can now be configured to complete the PROFINET connection.

Description of Modules

Table 62: Assignment of Slots and Subslots

	Slot 1 - TG/Color Control and Status Module	Slot 2 - TG/Color Sensor Output Module	Slot 3 - Command Channel Module
Subslot 1	TG/Color Inspection Result Submodule	sensor output submodules	Command Channel Command submodules
Subslot 2	TG/Color Device Control Submodule	—	Command Channel Response submodules

Table 63: TG (Ident 0x00000010) / Color (Ident 0x00000012) Control and Status Module

Number of Physical Subslots	Subslot Label	Subslot Number
1	1.1 TG Inspection Result Submodule	1 (0x1)
1	1.2 TG Device Control Submodule	2 (0x2)

Table 64: TG (Ident 0x00000040) / Color (Ident 0x00000042) Sensor Output Module

Number of Physical Subslots	Subslot Label	Subslot Number
1	2.1 sensor output submodules	1 (0x1)

Table 65: Command Channel Module (Ident 0x00000030)

Number of Physical Subslots	Subslot Label	Subslot Number
1	3.1 Command Channel Command submodules	1 (0x1)
1	3.2 Command Channel Response submodules	2 (0x2)

Description of Submodules

Table 66: Supported Submodules and Locations

Submodules	Location	Notes
TG Inspection Result Submodule	Slot 1, Subslot 1	Always present.
TG Device Control Submodule	Slot 1, Subslot 2	Present by default, but can be removed.
Sensor Output – Default Map Submodule	Slot 2, Subslot 1	This is a default sensor output submodule.

Submodules	Location	Notes
Sensor Output – Custom Map Submodules	Slot 2, Subslot 1	There are six versions of this submodule supporting payloads of 16, 32, 64, 128, 256, and 512 bytes.
Command Channel Command Submodule	Slot 3, Subslot 1	There are four versions of this submodule supporting command strings of 0, 32, 64, and 128 bytes.
Command Channel Response Submodule	Slot 3, Subslot 2	There are four versions of this submodule supporting command strings of 0, 32, 64, and 128 bytes.

Inspection Result Submodule

The Inspection Result Submodule contains inspection results and sends input data to the controller (PLC). This submodule is plugged into Slot 1 Subslot 2 and cannot be removed.

Table 67: TG (Ident 0x101) / Color (Ident 0x103) Inspection Result Submodule

PLC Input Data Name	Input Data Type
Inspection Status Word	Unsigned16
Inspection Number	Unsigned32
Sensor Pass/Fail Status	Unsigned32
Iteration Count	Unsigned32
Pass Count	Unsigned32
Fail Count	Unsigned32
Missed Trigger Count	Unsigned32
Current Inspection Time	Float 32

PLC Output Data Name	Output Data Type
Not applicable	Not applicable

Inspection Status Word	
Bit Position for Cyclic Input Data	**Function**
Bit 0	System Ready
Bit 1	Inspection Pass/Fail
Bit 3	Ready Signal Latch
Bit 5	Output 1 ON/OFF
Bit 6	Output 2 ON/OFF
Bit 7	Output 3 ON/OFF
Bit 8	Missed Trigger Occurrence

Device Control Submodule

The Device Control Submodule contains controller (PLC) input and output data, including device controls for the iVu. The user-enabled Device Control Submodule is optional and plugged into Slot 1 Subslot 2 by default. The user can remove it.

Table 68: TG (Ident 0x1) / Color (Ident 0x3) Device Control Submodule

PLC Input Data Name	Input Data Type
Device Control ACK Word	Unsigned16
Return Error Code	Unsigned32

PLC Output Data Name	Output Data Type
Device Control Command Word	Unsigned16
Product Change Number	Unsigned32

Device Control ACK Word	
Bit Position for Cyclic Input Data	**Function**
Bit 0	Product Change Acknowledgement
Bit 1	Teach Latch Acknowledgement
Bit 2	Trigger Acknowledgement
Bit 13	Teach Error
Bit 14	System Error
Bit 15	Command Execution Error

Device Control Command Word	
Bit Position for Cyclic Output Data	**Function**
Bit 0	Product Change Request
Bit 1	Teach Latch Request
Bit 2	Trigger Request

Sensor Output Submodules

The Default Map Submodule contains sensor output data. This user-enabled submodule is optional and plugged into Slot 2 Subslot 1.

Table 69: Default Map Submodule (Ident 0x00027)

PLC Input Data Name	Input Data Type
Frame Number	Unsigned32
Sensor Type	Unsigned16
38-byte Sensor-specific Data Block	38-byte OctetString
Sensor Type	Unsigned16
38-byte Sensor-specific Data Block	38-byte OctetString
Sensor Type	Unsigned16
38-byte Sensor-specific Data Block	38-byte OctetString
Sensor Type	Unsigned16
38-byte Sensor-specific Data Block	38-byte OctetString
Sensor Type	Unsigned16
38-byte Sensor-specific Data Block	38-byte OctetString

PLC Output Data Name	Output Data Type
Not applicable	Not applicable

The 38-byte sensor-specific Data Block for each sensor type is shown below.

Table 70: Area Sensor ID = 2

Sensor-Specific Data	Data Size
Area Count	32-bit Integer
Area Range Minimum	32-bit Integer
Area Range Maximum	32-bit Integer

Table 71: Blemish Sensor ID = 3

Sensor-Specific Data	Data Size
Blemish Count	32-bit Integer
Blemish Minimum Edge Length	32-bit Integer
Blemish Maximum Edge Length	32-bit Integer

Table 72: Match Sensor ID = 4

Sensor-Specific Data	Data Size
Match Count	32-bit Integer
Match Minimum Percent	8-bit Integer
Match Maximum Percent	8-bit Integer

Table 73: Sort Sensor ID = 5

Sensor-Specific Data	Data Size
Sort Pattern Map	16-bit Integer
Sort Pattern Count	16-bit Integer
Sort Pattern 1 Count	16-bit Integer
Sort Pattern 2 Count	16-bit Integer
Sort Pattern 3 Count	16-bit Integer
Sort Pattern 4 Count	16-bit Integer
Sort Pattern 5 Count	16-bit Integer
Sort Pattern 6 Count	16-bit Integer
Sort Pattern 7 Count	16-bit Integer
Sort Pattern 8 Count	16-bit Integer
Sort Pattern 9 Count	16-bit Integer
Sort Pattern 10 Count	16-bit Integer
Sort Minimum Percent Match	8-bit Integer
Sort Maximum Percent Match	8-bit Integer

Table 74: Average Color Sensor ID = 6

Sensor-Specific Data	Data Size
Average Red	16-bit Integer
Average Green	16-bit Integer
Average Blue	16-bit Integer
Average Hue	16-bit Integer
Average Saturation	16-bit Integer
Average Intensity	16-bit Integer
Standard Deviation Red	32-bit float
Standard Deviation Green	32-bit float
Standard Deviation Blue	32-bit float
Standard Deviation Hue	32-bit float

Sensor-Specific Data	Data Size
Standard Deviation Saturation	32-bit float
Standard Deviation Intensity	32-bit float

Note: Average Color Sensor data that does not apply to the selected color space has a result of 0. For example, if the HSI color space is selected, the Red, Green, and Blue data will have a result of 0.

Table 75: Color Compare Sensor ID = 7

Sensor-Specific Data	Data Size
Color Difference	16-bit Integer
Intensity Difference	16-bit Integer

Table 76: Color Area Sensor ID = 8

Sensor-Specific Data	Data Size
Area Count	32-bit Integer
Area Range Minimum	32-bit Integer
Area Range Maximum	32-bit Integer

The Custom Map Submodule contains a user-defined map of sensor output data. There are six versions with 16, 32, 64, 128, 256, and 512 bytes, depending on the size of the output data.

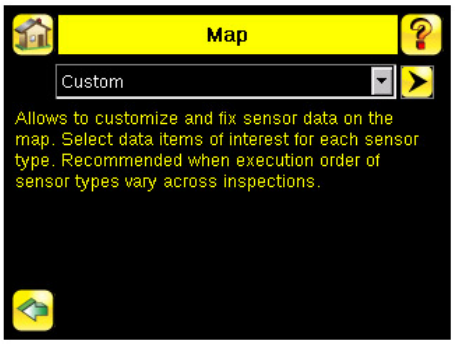
Table 77: Custom Map Submodule

Submodule		PLC Input Data		PLC Output Data	
Name	**Ident No.**	**Name**	**Type**	**Name**	**Type**
16-Byte Custom Map	0x00028	Frame number	Unsigned32	Not applicable	Not applicable
		User-mapped Sensor Result Data Block	16-byte OctetString		
32-Byte Custom Map	0x00029	Frame number	Unsigned32	Not applicable	Not applicable
		User-mapped Sensor Result Data Block	32-byte OctetString		
64-Byte Custom Map	0x00030	Frame number	Unsigned32	Not applicable	Not applicable
		User-mapped Sensor Result Data Block	64-byte OctetString		
128-Byte Custom Map	0x00031	Frame number	Unsigned32	Not applicable	Not applicable
		User-mapped Sensor Result Data Block	128-byte OctetString		
256-Byte Custom Map	0x00032	Frame number	Unsigned32	Not applicable	Not applicable
		User-mapped Sensor Result Data Block	256-byte OctetString		
512-Byte Custom Map	0x00033	Frame number	Unsigned32	Not applicable	Not applicable
		User-mapped Sensor Result Data Block	512-byte OctetString		

Configure a Custom Industrial Ethernet (IE) Map

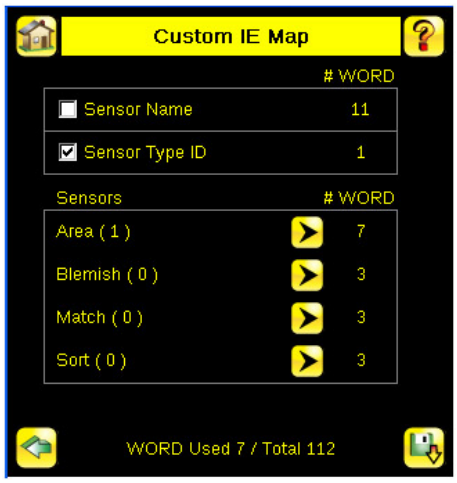
1. Enable the Custom Map by selecting **Custom** on the drop-down list.

*Figure 221. **Map** Screen—**Custom** Map Selected*



2. Click the yellow arrow to access the **Custom IE Map** screen.
3. On the **Custom IE Map** screen, choose the sensor result data that will appear on the customizable space.

*Figure 222. **Custom IE Map** Summary Screen*



The bottom of the screen shows the word use on the customizable space. In the image above, seven words have been used for one Area sensor "Area (**1**)".

4. Click the yellow arrow next to the Area sensor row to go to the **Area Sensor Data**.

*Figure 223. **Custom IE Map** Screen—**Area Sensor Data***



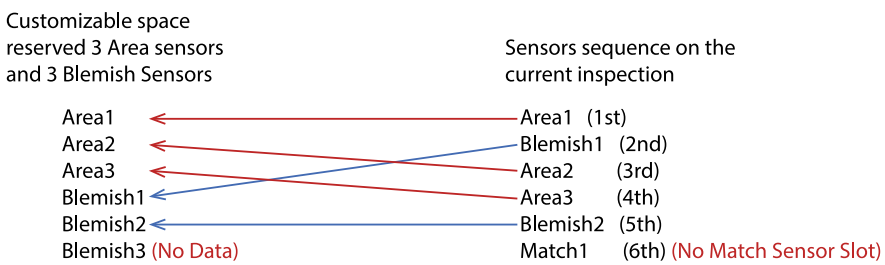
On the **Area Sensor Data** screen shown above, **Area Count**, **Area Range Min** and **Area Range Max** are available to add to the customizable space. The number to the right of each item shows how many words are required to display the data. The bottom reservation count shows the number of Area sensors that have space reserved for them on the customizable map.

Because only one Area sensor's worth of data is reserved on the image above, the selected data will be collected from the first Area sensor in the current inspection. When multiple Area sensors have been reserved, the data will be arranged in the sequential manner of the sensor type in the current inspection.

5. Click the green arrow (Back) to return to the **Custom IE Map** summary.
6. Continue to add more data from any sensor type as required or reserve more sensors into the customizable space.

Sensor Name and **Sensor Type ID** are global settings that are part of any individual sensor reservation. When they are checked, they are inserted into each sensor reservation.

The following is an example of a multiple sensors inspection and its output location on the customizable space.



In this example, there are only two Blemish sensors in the current inspection. The Blemish3 location will be all zero on the customizable space. The customizable map had not reserved space for a Match sensor, so Match1 from the inspection will not be outputted on the custom map.

Command Channel Command Submodules

The Command Channel Command Submodules contain controller (PLC) output data and command channel request data. The user-enabled submodules are optional. On the iVu device the submodule is plugged into Slot 3 Subslot 1.

The Command Channel Command Submodule has four versions, depending on the required length of the input string.

Table 78: Numeric Command Submodule (Ident 0x00012)

PLC Output Data Name	Output Data Type
Flag indicates when to apply the command	Unsigned16
Numeric ID of the command	Unsigned16
16-bit integer command argument	Unsigned16
32-bit integer command argument	Unsigned32
Floating-point command argument	Float32

PLC Input Data Name	Input Data Type
Not applicable	Not applicable

Flag indicates when to apply the command	
Bit Position for Cyclic Output Data	**Function**
Bit 0	Command Channel Command Request

Table 79: Text Command 32-byte Submodule (Ident 0x00013)

PLC Output Data Name	Output Data Type
Flag indicates when to apply the command	Unsigned16
Numeric ID of the command	Unsigned16
16-bit integer command argument	Unsigned16
32-bit integer command argument	Unsigned32
Floating-point command argument	Float32
Length-of-Command/Response string	Unsigned32
32-character command string	32-byte OctetString

PLC Input Data Name	Input Data Type
Not applicable	Not applicable

Flag indicates when to apply the command	
Bit Position for Cyclic Output Data	**Function**
Bit 0	Command Channel Command Request

Table 80: Text Command 64-byte Submodule (Ident 0x00014)

PLC Output Data Name	Output Data Type
Flag indicates when to apply the command	Unsigned16
Numeric ID of the command	Unsigned16
16-bit integer command argument	Unsigned16
32-bit integer command argument	Unsigned32
Floating-point command argument	Float32
Length-of-Command/Response string	Unsigned32
64-character command string	64-byte OctetString

PLC Input Data Name	Input Data Type
Not applicable	Not applicable

Flag indicates when to apply the command	
Bit Position for Cyclic Output Data	**Function**
Bit 0	Command Channel Command Request

Table 81: Text Command 128-byte Submodule (Ident 0x00015)

PLC Output Data Name	Output Data Type
Flag indicates when to apply the command	Unsigned16
Numeric ID of the command	Unsigned16
16-bit integer command argument	Unsigned16
32-bit integer command argument	Unsigned32
Floating-point command argument	Float32
Length-of-Command/Response string	Unsigned32
128-character command string	128-byte OctetString

PLC Input Data Name	Input Data Type
Not applicable	Not applicable

Flag indicates when to apply the command	
Bit Position for Cyclic Output Data	**Function**
Bit 0	Command Channel Command Request

Command Channel Response Submodules

The Command Channel Response Submodules contain only controller (PLC) input data and command channel response data. The user-enabled submodules are optional. On the iVu model the submodule is plugged into Slot 3 Subslot 2.

The Command Channel Response Submodule has four versions, depending on the required length of the data output string.

Table 82: Numeric Response Submodule (Ident 0x00050)

PLC Input Data Name	Input Data Type
Flag indicating when to Command ACK	Unsigned16
Numeric Command Status	Unsigned16
16-bit integer command response	Unsigned16
32-bit integer command response	Unsigned32
Floating-point command argument	Float32

PLC Output Data Name	Output Data Type
Not applicable	Not applicable

Flag Indicating When to Command ACK	
Bit Position for Cyclic Input Data	**Function**
Bit 0	Command Channel Command Acceptance Acknowledgement
Bit 15	Command Execution Error

Table 83: Text Response 32-byte Submodule (Ident 0x00051)

PLC Input Data Name	Input Data Type
Flag indicating when to Command ACK	Unsigned16
Numeric Command Status	Unsigned16
16-bit integer command response	Unsigned16
32-bit integer command response	Unsigned32
Floating-point command argument	Float32
Length-of-Command/Response string	Unsigned32
32-character command response string	32-byte OctetString

PLC Output Data Name	Output Data Type
Not applicable	Not applicable

Flag Indicating When to Command ACK	
Bit Position for Cyclic Input Data	**Function**
Bit 0	Command Channel Command Acceptance Acknowledgement
Bit 15	Command Execution Error

Table 84: Text Response 64-byte Submodule (Ident 0x00052)

PLC Input Data Name	Input Data Type
Flag indicating when to Command ACK	Unsigned16
Numeric Command Status	Unsigned16
16-bit integer command response	Unsigned16
32-bit integer command response	Unsigned32
Floating-point command argument	Float32
Length-of-Command/Response string	Unsigned32
64-character command response string	64-byte OctetString

PLC Output Data Name	Output Data Type
Not applicable	Not applicable

Flag Indicating When to Command ACK	
Bit Position for Cyclic Input Data	**Function**
Bit 0	Command Channel Command Acceptance Acknowledgement
Bit 15	Command Execution Error

Table 85: Text Response 128-byte Submodule (Ident 0x00053)

PLC Input Data Name	Input Data Type
Flag indicating when to Command ACK	Unsigned16
Numeric Command Status	Unsigned16
16-bit integer command response	Unsigned16
32-bit integer command response	Unsigned32
Floating-point command argument	Float32
Length-of-Command/Response string	Unsigned32
128-character command response string	128-byte OctetString

PLC Output Data Name	Output Data Type
Not applicable	Not applicable

Flag Indicating When to Command ACK	
Bit Position for Cyclic Input Data	**Function**
Bit 0	Command Channel Command Acceptance Acknowledgement
Bit 15	Command Execution Error

15.7.3 Configuration Instructions

Using Siemens TIA Portal (v13) Software

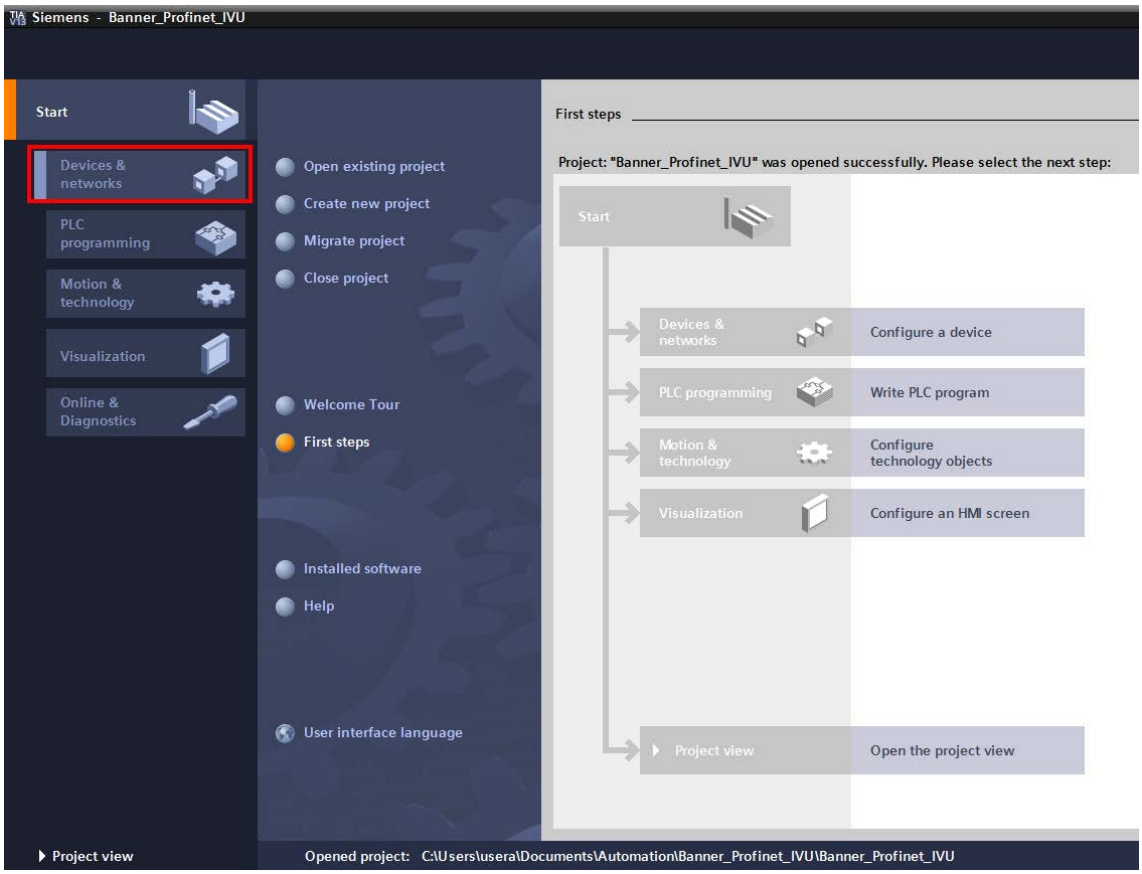
Installing the GSD File

Use these instructions to install the GSD file in the Siemens TIA Portal (v13) software. Use these instructions as a basis for installing the GSD file in another controller (PLC).

1. Download the GSD file from www.bannerengineering.com.
2. Start the Siemens TIA Portal (v13) software.

3. Click **Open existing project**.
4. Select a project and open it.
5. Click **Devices & networks** after the project has been uploaded.

Figure 224. Devices and Networks



6. Click **Configure networks**.

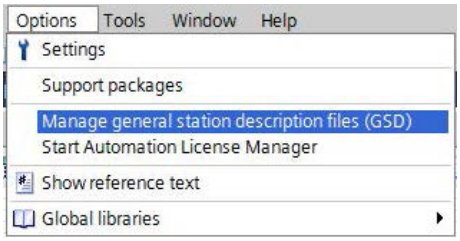
Figure 225. Configure Networks



Network view displays.

7. Click **Options** and select **Manage general station description file (GSD)**.

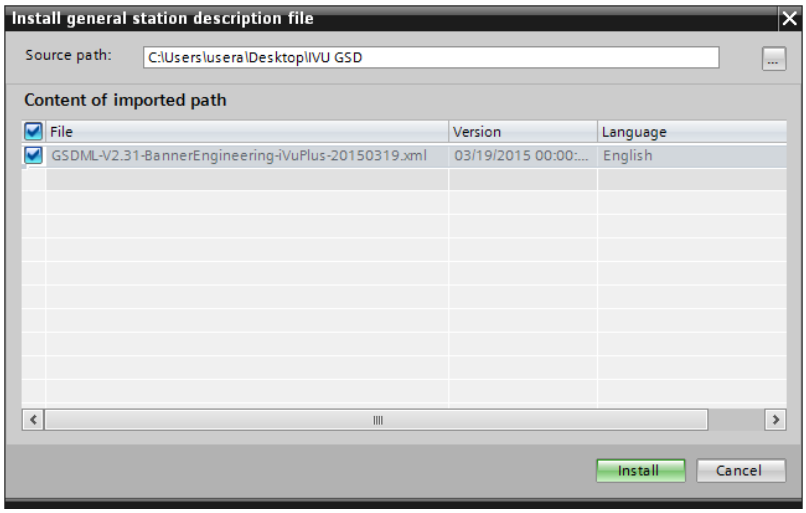
Figure 226. Options—Install the GSD



The **Install general station description file** window opens.

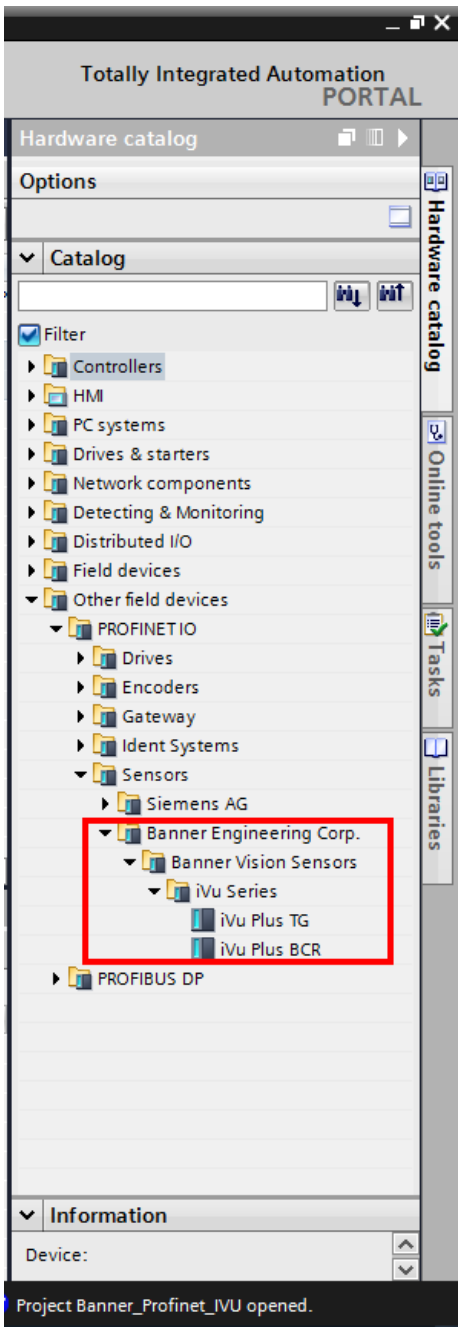
8. Click the browse button **(...)** to the right of the **Source path** field.

Figure 227. Manage GSD Files



9. Navigate to the location the iVu GSD file was downloaded to.
10. Select the iVu GSD file.
11. Click **Install**.

Figure 228. Hardware Catalog



The system installs the iVu GSD file and places it in the **Hardware catalog**. In the above example, the iVu GSD file is located under **Other field devices** > **PROFINET IO** > **Sensors** > **Banner Engineering Corp.** > **Banner Vision Sensors** > **iVu Series** .

Note: If the iVu GSD file does not install properly, save the log and contact Banner Engineering Corp.

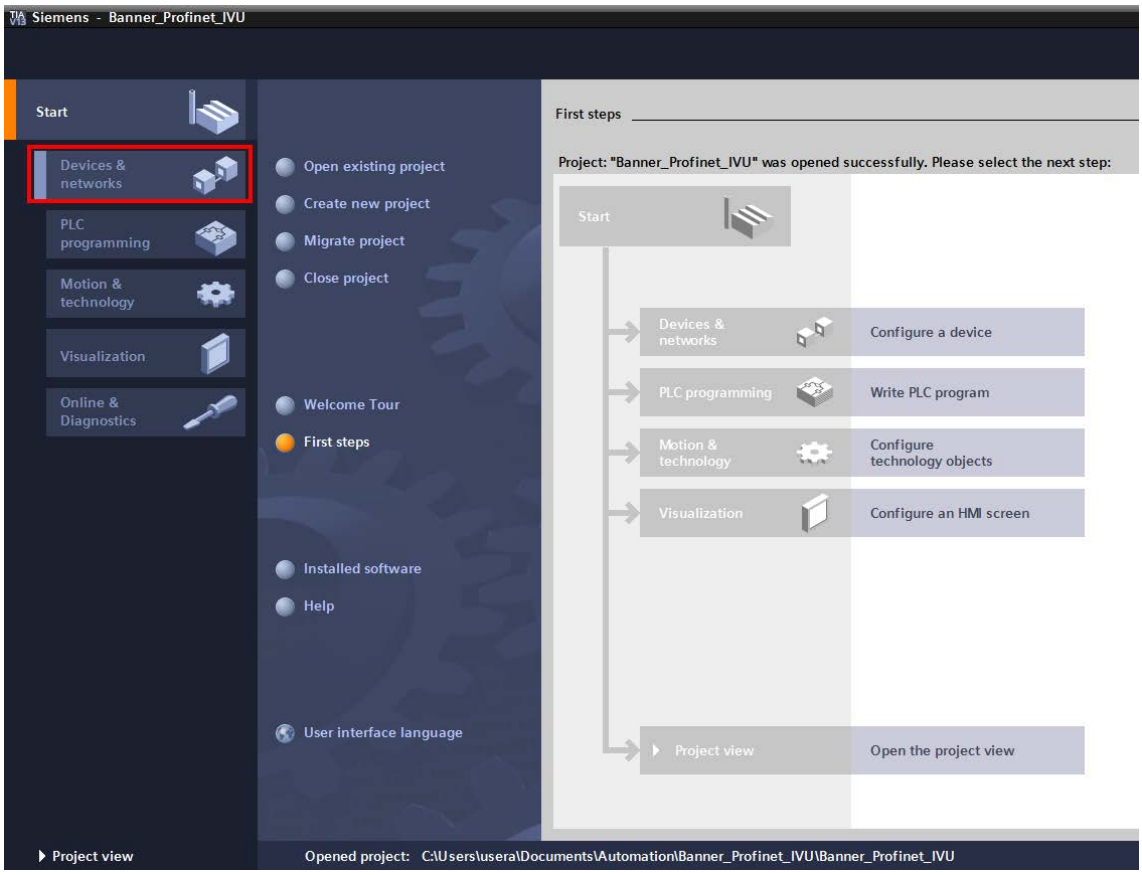
Adding a Device to a Project

Use these instructions to add a iVu device to a Siemens TIA Portal (v13) project, and to configure the device. Use these instructions as a basis for adding a iVu device to another controller (PLC).

1. Start the Siemens TIA Portal (v13) software.
2. Click **Open existing project**.
3. Select a project and open it.

4. Click **Devices & networks** after the project has been uploaded.

Figure 229. Devices and Networks



5. Click **Configure networks**.

Figure 230. Configure Networks

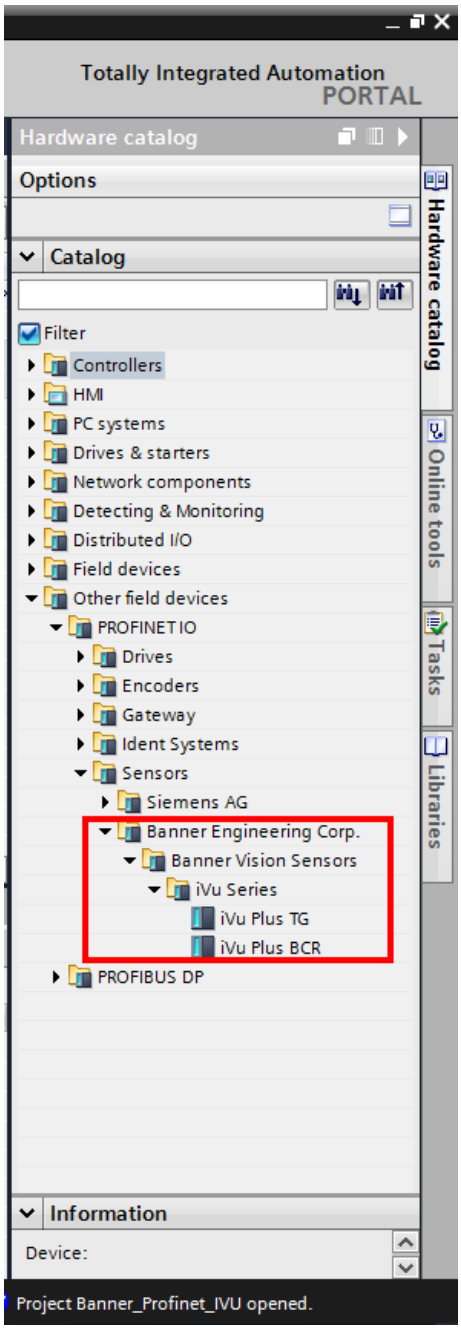


Network view displays.

Note: For Step 6 through Step 10, **Network view** must be open.

6. Locate the iVu in the **Hardware catalog**.

Figure 231. Hardware Catalog



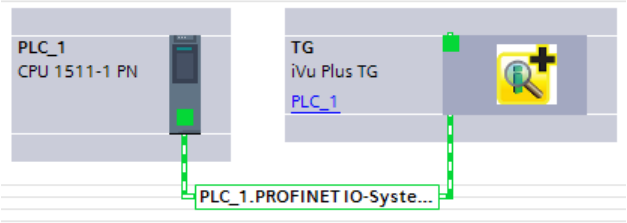
In the above example, the iVu device is located under **Other field devices** > **PROFINET IO** > **Sensors** > **Banner Engineering Corp** > **Banner Vision Sensors** > **iVu Series**.

7. Select the device and add it to the configuration.

Selection Option	Description
Drag	Drag the iVu from the **Hardware catalog** directly into the configuration.
Double-click	Double-click on the iVu and add it to the configuration.

8. Click the green square on the iVu icon. Drag the pointer to the green square on the PLC_1 icon to connect the device to the controller (PLC).

Figure 232. Drag to Connect



The connection is made.

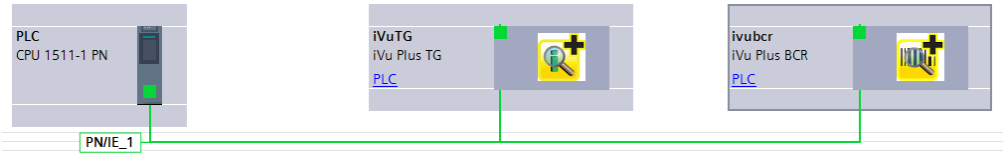
9. Double-click the iVu icon to open the **Device** window.
10. Select the desired modules or submodules from the **Hardware catalog** and drag them onto the **Device overview** tab on the **Device view** tab.
    The iVu device is configured.

Changing the Device IP Address

Use these instructions to change the IP address of the iVu device, using the Siemens TIA Portal (v13) software. Use these instructions as a basis if you are using another controller (PLC).

1. Start the Siemens TIA Portal (v13) software.
2. Click **Open existing project.**
3. Select a project an open it.
4. Click **Devices & networks** after the project has been uploaded to go to **Network view**.

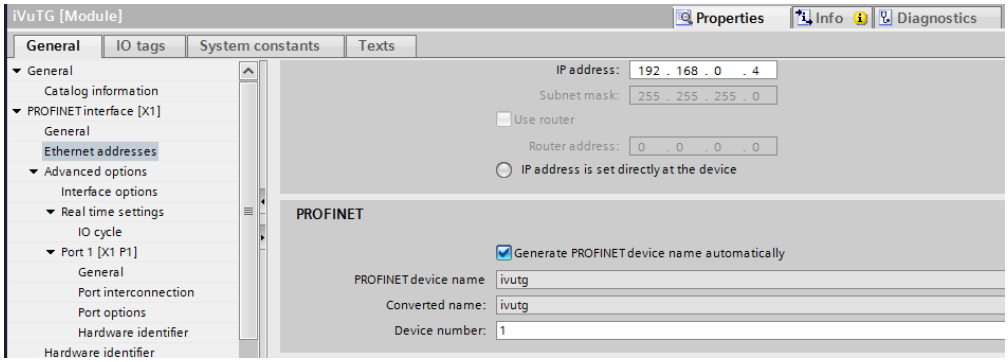
Figure 233. Network View



Network View displays.

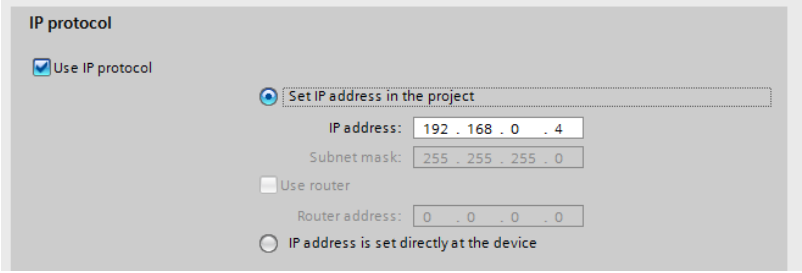
5. Double-click on the iVu icon to open the **Device view**.
6. Click on the iVu icon in the graphic area of the **Device view** to open the **Module properties** window.
   The module can now be configured.
7. Click **Properties**.
8. Click **General**.
9. Select **PROFINET interface** > **Ethernet addresses**.

Figure 234. Ethernet Addresses



10. Select **Set IP address in the project**.

Figure 235. Set IP Address



The project sets the IP address of the device.

11. Enter the IP address.
12. Right-click on the device icon and select **Online & diagnostics**.

Figure 236. Select Online & Diagnostics

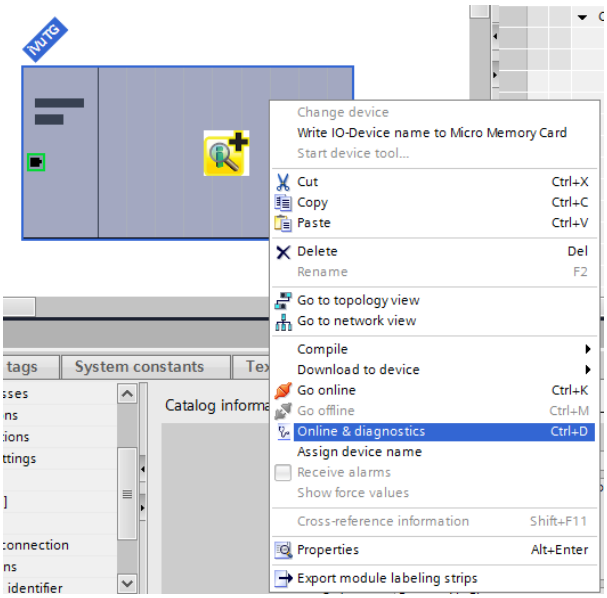
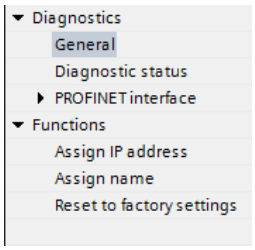


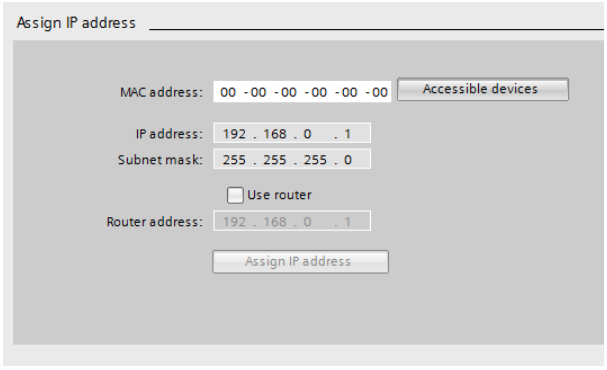
Figure 237. Online & Diagnostics



The **Online & diagnostics** window displays.

13. Select **Assign IP address** under **Functions**.
14. Click **Accessible devices**.

Figure 238. Assign IP Address—Accessible Devices



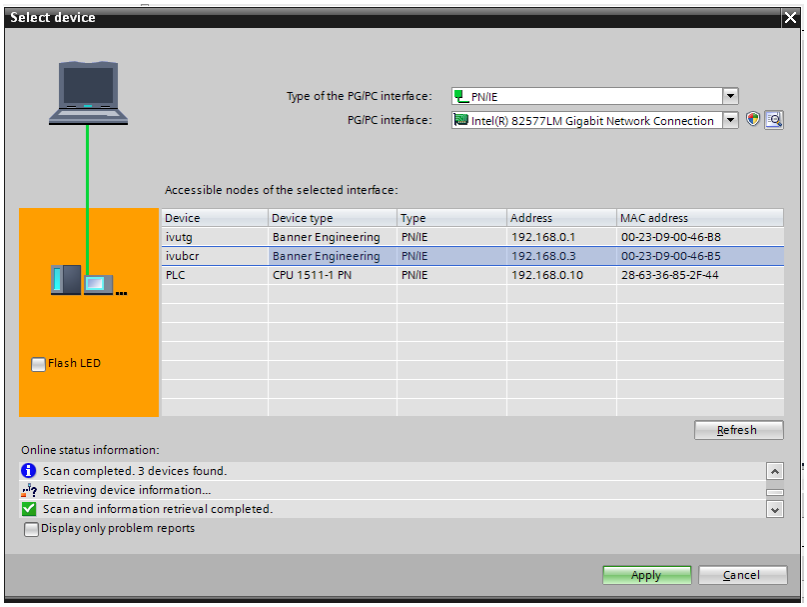
The **Select device** window searches the network for available devices.

15. Determine the device to be adjusted via the MAC address and select it.

Note: Use the display to find the MAC address. **Main Menu** > **System** > **Communications** > **Ethernet IO** > **Status**

16. Click **Apply**.

Figure 239. Select the Device and Apply Changes



The IP address for the device is updated.

17. Click **Assign IP address** to complete the step.

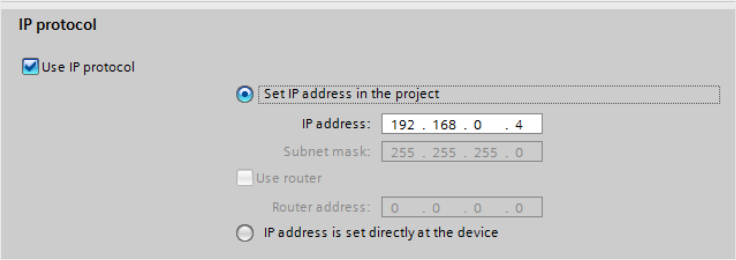
    This step is completed for every device.

Note: PROFINET devices commonly lack an IP address on startup (IP address = all zeros). However, iVu devices require an IP address to connect to Vision Manager to set the device configuration.

By default, each camera shipped from the factory is assigned the IP address 192.168.0.1. The default address can be changed using Vision Manager.

Immediately after the PROFINET protocol has been enabled in the camera, but before the PLC discovers and connects to the camera, the camera will retain its IP address. After the PLC discovers and connects to the camera, the behavior of the IP address depends on how the PLC was configured to assign the camera IP address. Two configuration options are available.

Figure 240. Siemens TIA Portal (v13): IP Protocol Options



- The IP address is set in the project: If the PLC is told to assign the camera IP address (for example, using the **Set IP address in the project** option in Siemens TIA Portal), the camera receives the specified address, but only after the program has been loaded into the PLC and is running.

  If the camera is restarted after it was discovered and configured by the PLC, the camera has an IP address of 0.0.0.0 until the PLC discovers it and assigns it the specified address again.

  When the camera has no IP address assigned, it is still possible to assign an IP address to the camera using Vision Manager. However, if this address is different than what is specified in the PLC, the camera reverts to the address specified in the PLC when the PLC becomes active again.
- The IP address is set at the device: If the PLC is told that the camera IP address is configured at the device (for example, using the **IP address is set directly at the device** option in Siemens TIA Portal), the camera always retains the IP address that was assigned to through Vision Manager.

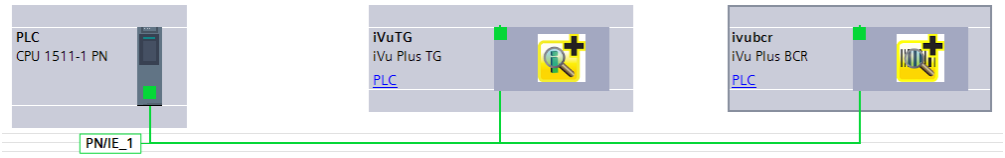
These configuration options conform to the PROFINET standard.

Changing the Device Name

Use these instructions to change the name of the iVu device, using the Siemens TIA Portal (v13) software. Use these instructions as a basis if you are using another controller (PLC).

1. Open a project and click on **Devices & networks** to go to the **Network view**.

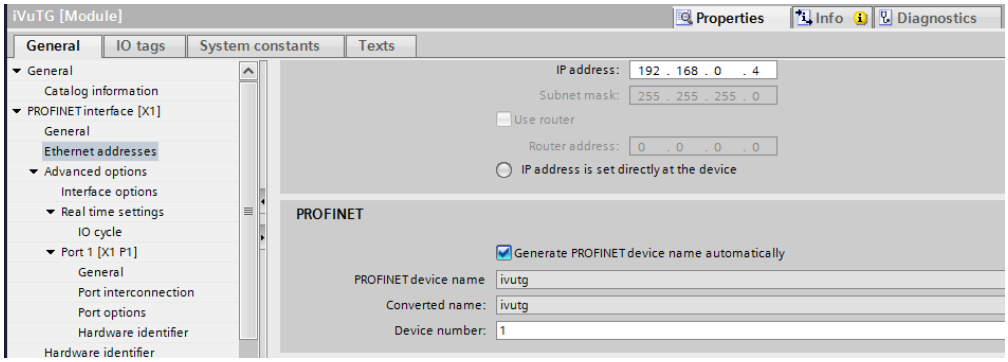
Figure 241. Network View



Network view displays.

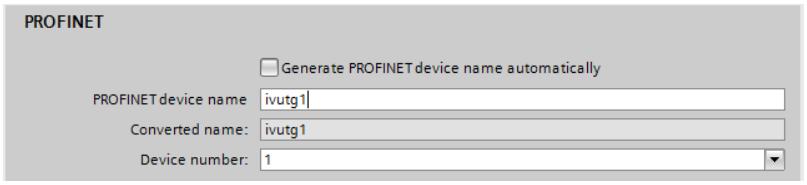
2. Double-click on the iVu icon to open **Device view**.
3. Click on the iVu icon in the graphic area of **Device view** to open the **Module properties** window.
4. Click **General**.
5. Select **PROFINET interface [X1]** > **Ethernet addresses**.

Figure 242. Ethernet Addresses



6. Deselect **Generate PROFINET device name automatically**.

Figure 243. PROFINET Device Name



7. Enter a unique name in the **PROFINET device name** field.
8. Enter a unique device number in the **Device number** field.

Note: Each device number is used only once.

9. Right-click on the device icon and select **Online & diagnostics**.

Figure 244. Select Online & Diagnostics

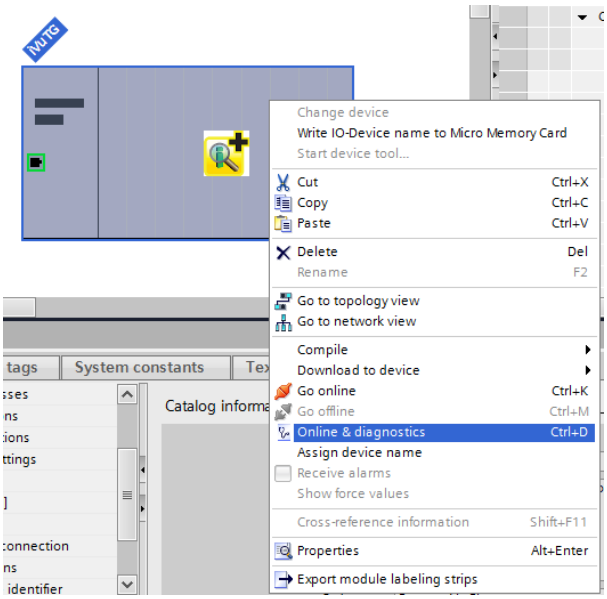
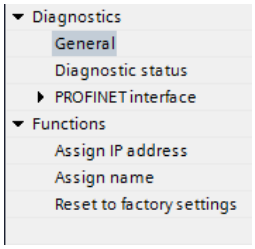


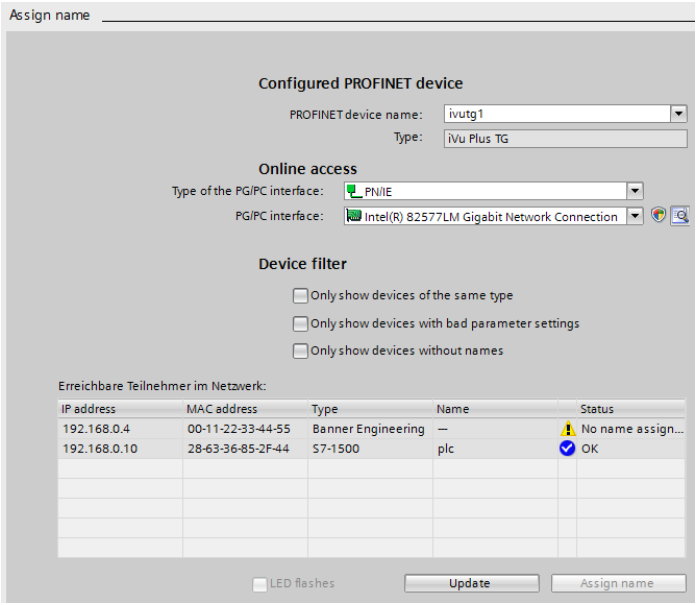
Figure 245. Online & Diagnostics



The **Online & diagnostics** window displays.

10. Select **Assign name** under **Functions**.

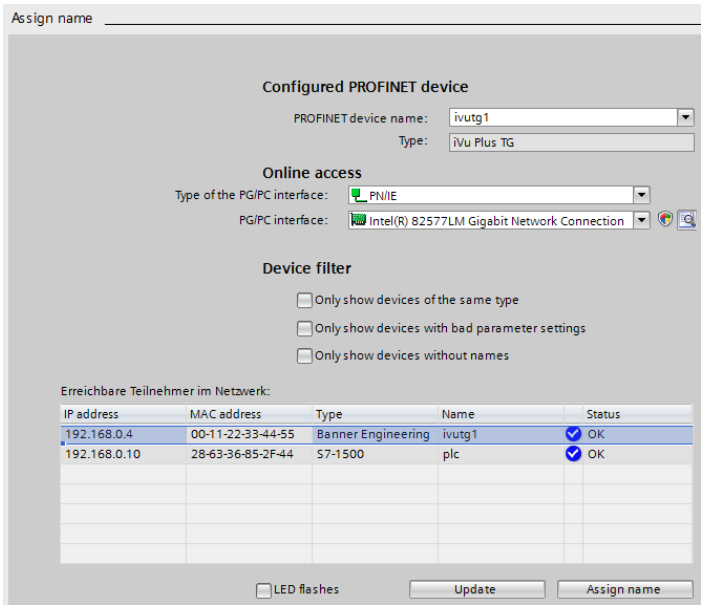
Figure 246. Assign Name



The **Assign name** window displays. The devices in the network are discovered. The **Name** column is blank.

11. Select the device that will have a name assigned to it.
12. Click **Assign name** to start the process.
    The name is assigned.

Figure 247. Assign Name



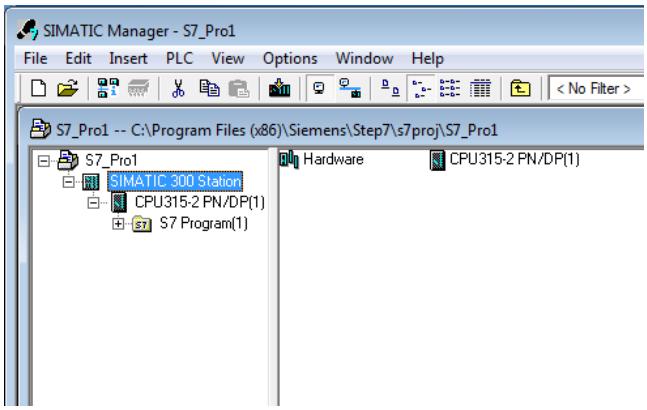
Using Siemens SIMATIC STEP 7 (v5.5) Software

Installing the Banner iVu GSD File

Use these instructions to install the Banner iVu GSD file in the Siemens SIMATIC STEP 7 (v5.5) software.

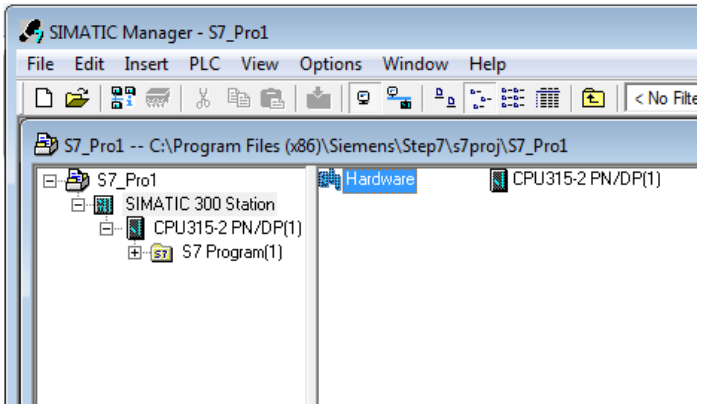
1. Start Siemens SIMATIC Manager.
2. Select an existing project and open it.
3. Select the Station (PLC) from the **Object Hierarchy** list.

*Figure 248. **Object Hierarchy** List*



4. Double-click the **Hardware** icon in the **Station level** window.

*Figure 249. Double-Click the **Hardware** Icon*



The **Hardware configuration** window opens.

5. In the **Hardware configuration** window, click **Options** > **Install GSD File...**.

*Figure 250. **Options** Menu—Select **Install GSD File...***

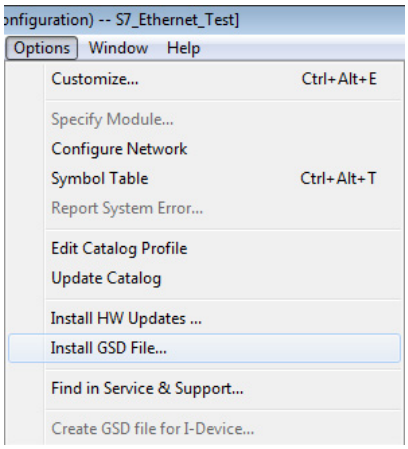
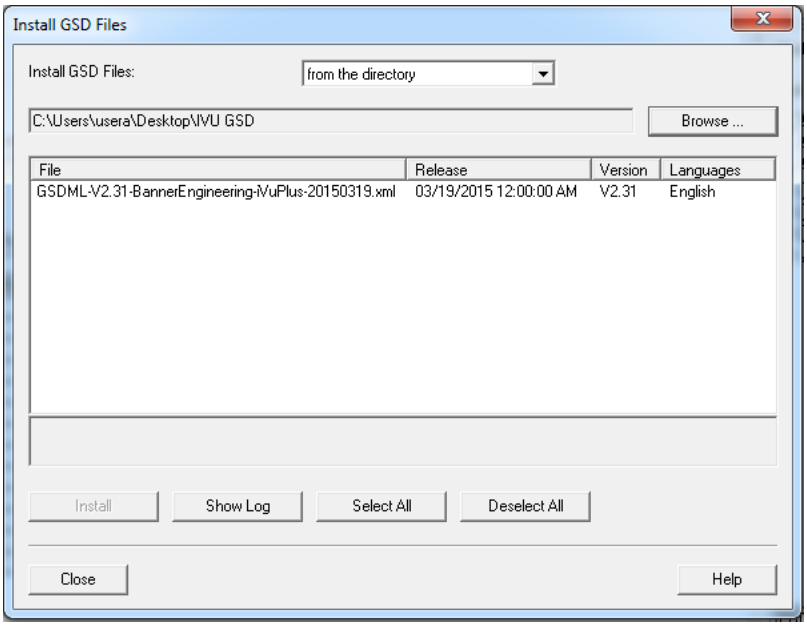


*Figure 251. **Install GSD Files** Screen*

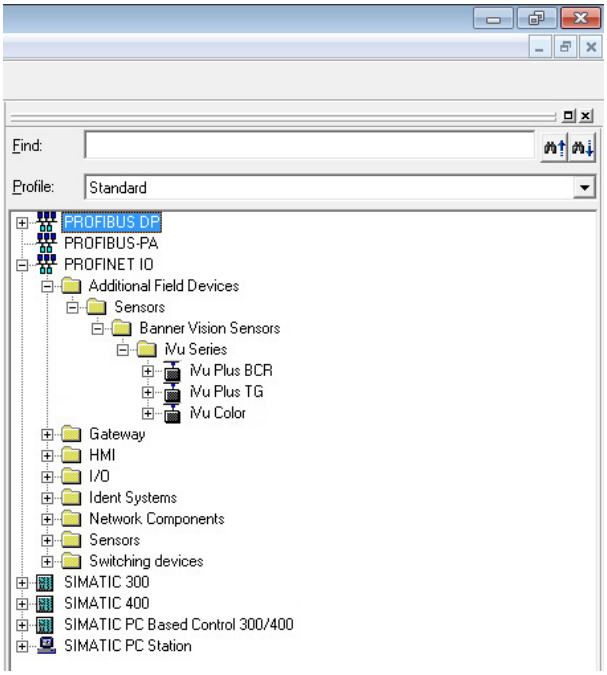


The **Install GSD Files** window displays.

6. Browse to the location of the saved Banner iVu GSD file.
7. Select the version of the file you want to add and click **Install** to add the GSD file to the **Hardware catalog**.
8. Go to the **View** menu in the **Hardware configuration** window.
9. Check the **Catalog** option.

   The **Hardware catalog** appears on the right side of the **Hardware configuration** window.

Figure 252. Hardware Catalog



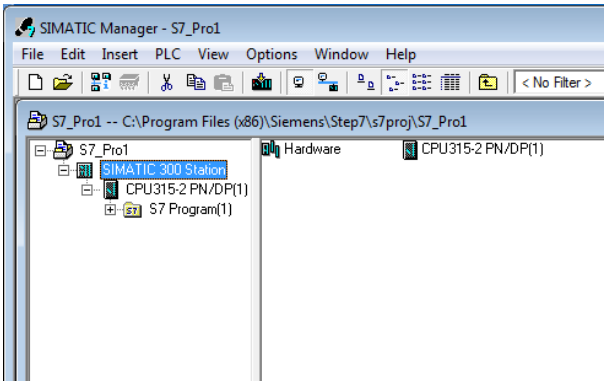
The location in the **Hardware catalog** is **PROFINET IO** > **Additional Field Devices** > **Sensors** > **Banner Vision Sensors** > **iVu Series**

Creating a PROFINET® Connection

Use these instructions to create a PROFINET Connection in **Hardware configuration** with the Siemens SIMATIC STEP 7 (v5.5) software.

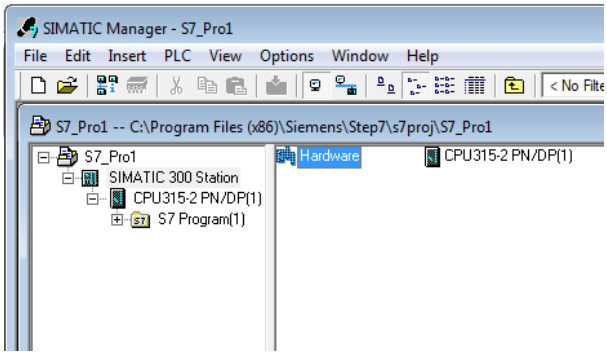
1. Start Siemens SIMATIC Manager.
2. Select an existing project and open it.
3. Select the Station (PLC) from the **Object Hierarchy** list.

*Figure 253. **Object Hierarchy** List*



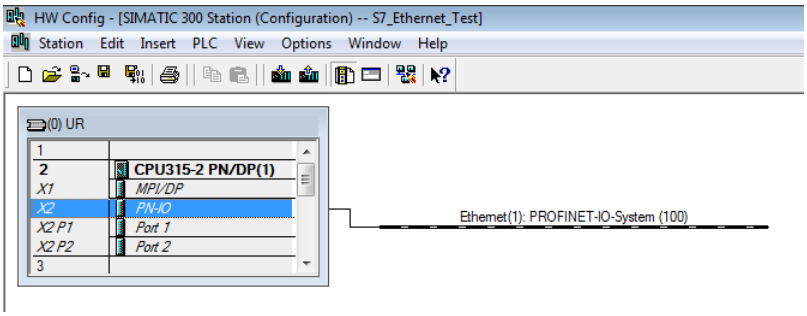
4. Double-click the **Hardware** icon in the **Station level** window to open the **Hardware configuration** window.

*Figure 254. Double-click the **Hardware** Icon*



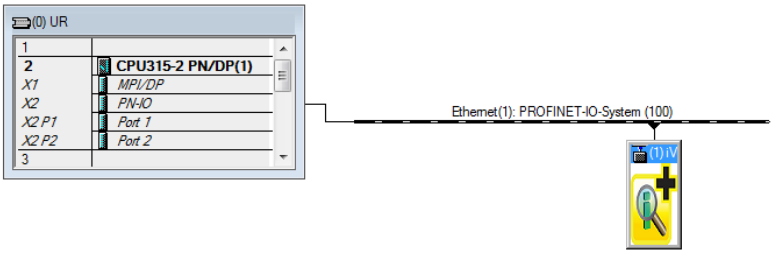
5. Right-click on the PN-IO line in the CPU module of the **Station** window and select *Insert PROFINET IO System*.
6. In the **Parameters** tab of the **Ethernet interface properties** window type in the IP Address and Subnet Mask of the PLC.
7. Select the Ethernet subnetwork from the box at the bottom of the **Ethernet interface properties** window. If no suitable network is shown, click the **New** button to add one, then click **OK**.

Figure 255. Add New Network



8. Click iVu in the **Hardware catalog** and drag and drop onto the PROFINET IO system connection.

Figure 256. Add iVu to the PROFINET IO System Connection



The device is connected to the system.

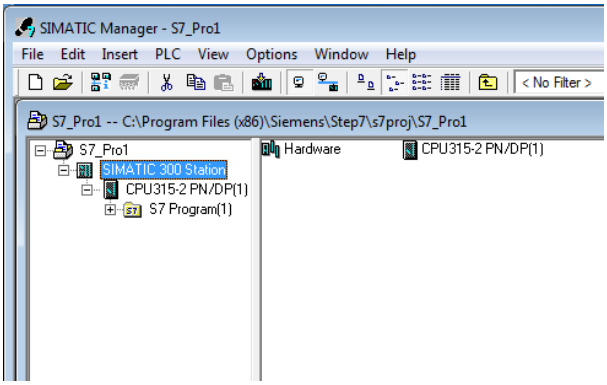
9. Add modules and submodules.

Changing the Device IP Address

Use these instructions for the Siemens SIMATIC STEP 7 (v5.5) software.

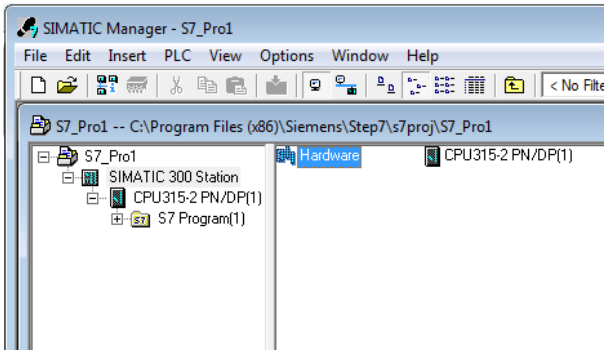
1. Start Siemens SIMATIC Manager.
2. Select an existing project and open it.
3. Select the Station (PLC) from the **Object Hierarchy** list.

*Figure 257. **Object Hierarchy** List*



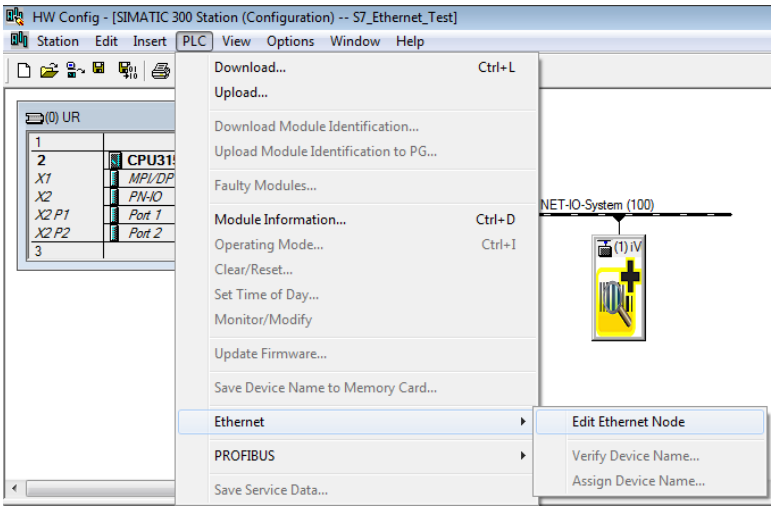
4. Double-click the **Hardware** icon in the **Station level** window to open the **Hardware configuration** window.

*Figure 258. Double-click the **Hardware** Icon*



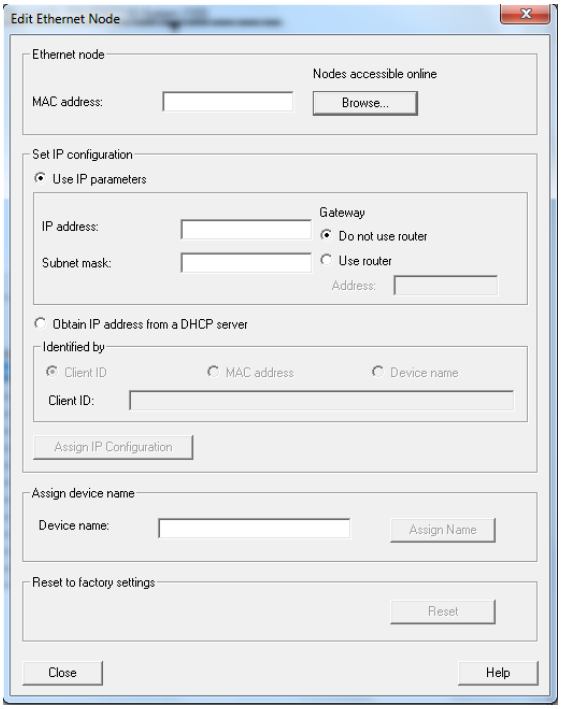
5. Select **PLC** > **Ethernet** > **Edit Ethernet Node**.

*Figure 259. Select **Edit Ethernet Note***



6. Click **Browse...** under **Nodes accessible online** in the **Edit Ethernet Node** window.

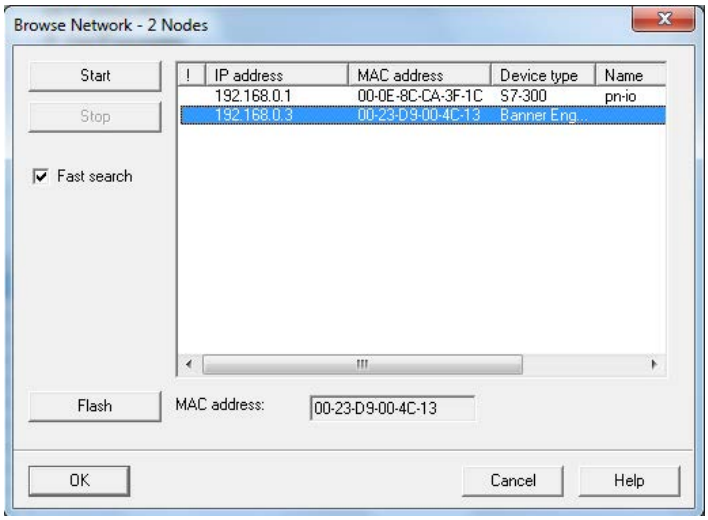
*Figure 260. **Edit Ethernet Node** Screen*



This starts a search for all PROFINET devices on the network and shows the found devices.

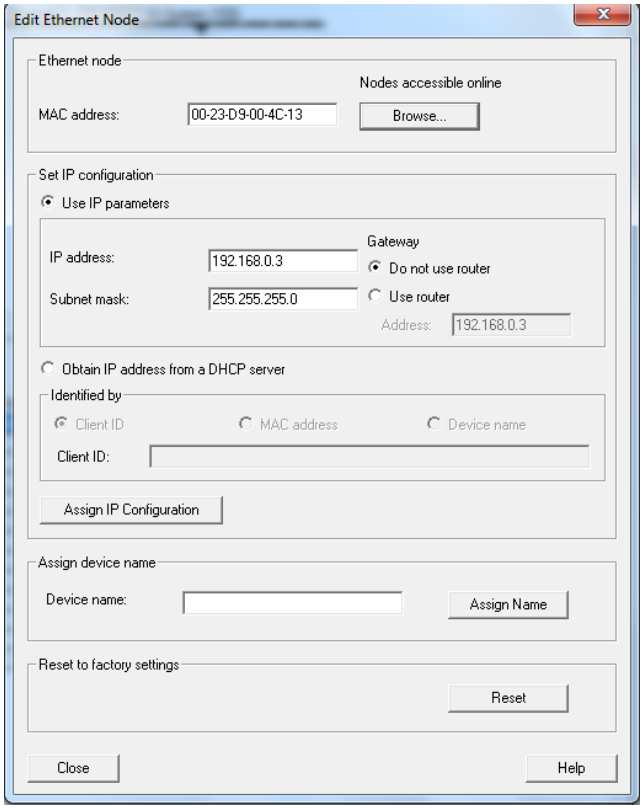
7. Select the device to be modified.

*Figure 261. **Browse Network** Screen*



8. Click **OK**.

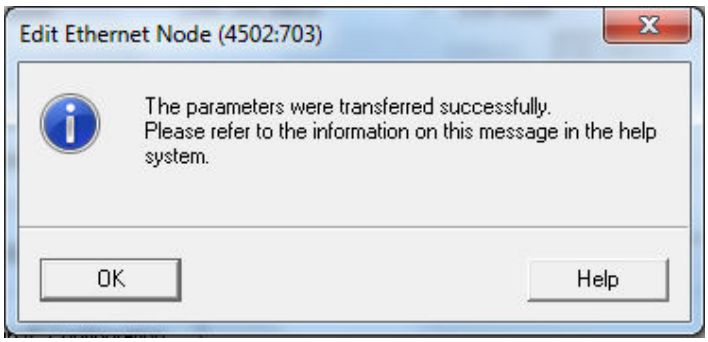
*Figure 262. **Edit Ethernet Note** Screen*



The **Edit Ethernet Node** window is updated.

9. Set the IP address to the desired value.
10. Click **Assign IP Configuration** at the bottom left of the **Set IP configuration** section. The parameters are transferred.
11. Click **OK** to acknowledge the message of a successful transfer.

*Figure 263. **Edit Ethernet Node** Message*



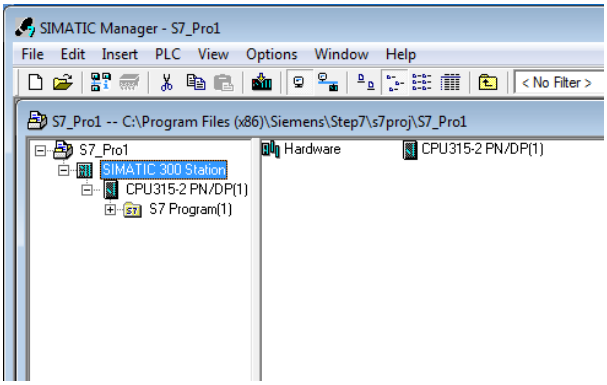
The IP address adjustment is complete.

Changing the Device Name

Use these instructions for the Siemens SIMATIC STEP 7 (v5.5) software.

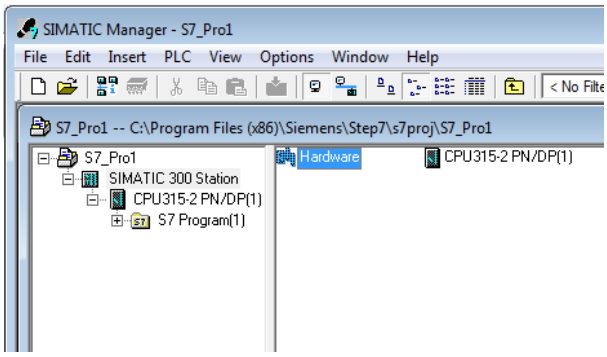
1. Start Siemens SIMATIC Manager.
2. Select an existing project and open it.
3. Select a Station (PLC) from the **Object Hierarchy** list.

*Figure 264. **Object Hierarchy** List*



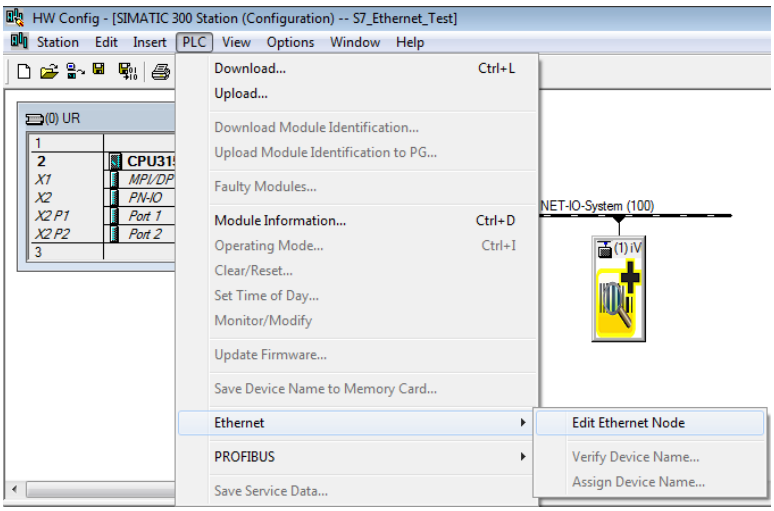
4. Double-click the **Hardware** icon in the **Station level** window to open the **Hardware configuration** window.

*Figure 265. Double-click the **Hardware** Icon*



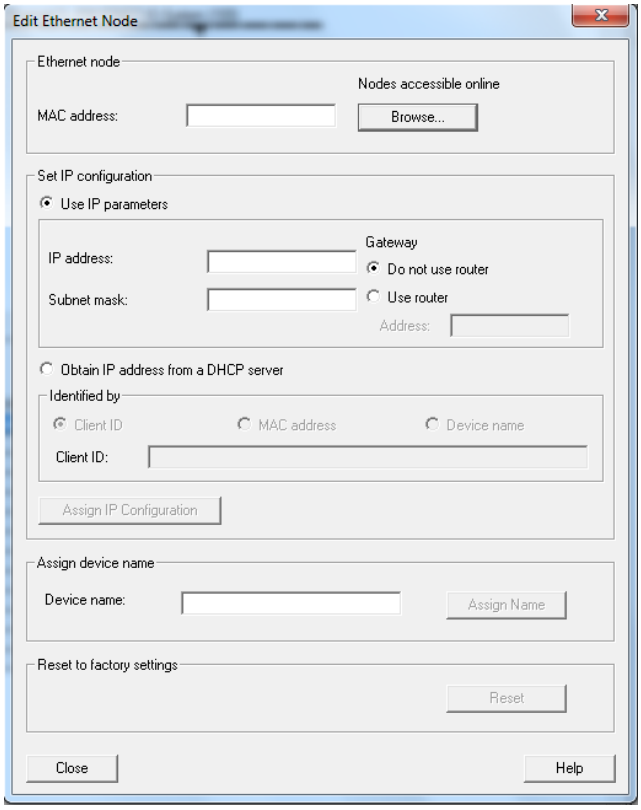
5. Select **PLC** > **Ethernet** > **Edit Ethernet Node**.

*Figure 266. Select **Edit Ethernet Node***



6. Click **Browse...** under **Nodes accessible online** in the **Edit Ethernet Node** window.

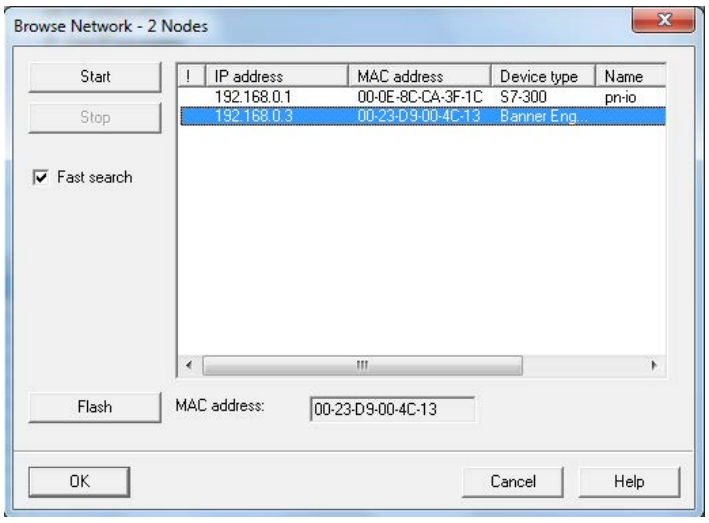
*Figure 267. **Edit Ethernet Node** Screen*



This starts a search for all PROFINET® devices on the network and shows the found devices.

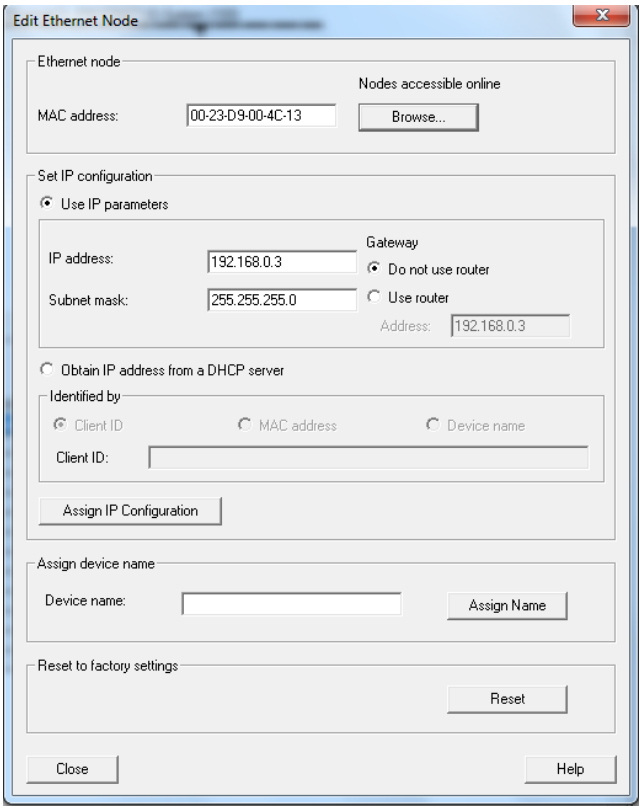
7. Select the device to be modified.

*Figure 268. **Browse Network** Screen*



8. Click **OK**.

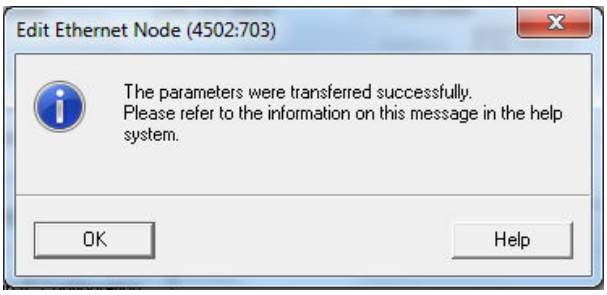
*Figure 269. **Edit Ethernet Node** Screen*



The **Edit Ethernet Node** window is updated.

9. Enter a name with lower case letters in the **Device name** field.
10. Click **Assign Name**.

*Figure 270. **Edit Ethernet Node** Message*



The Device name is updated. If a failed update message is returned, the new name did not meet the naming requirements. Reference the Siemens PLC naming convention.

15.8 Sample Timing Diagrams

X, Y, Z: Represent snapshot in time

Figure 271. Product Change Timing Diagram

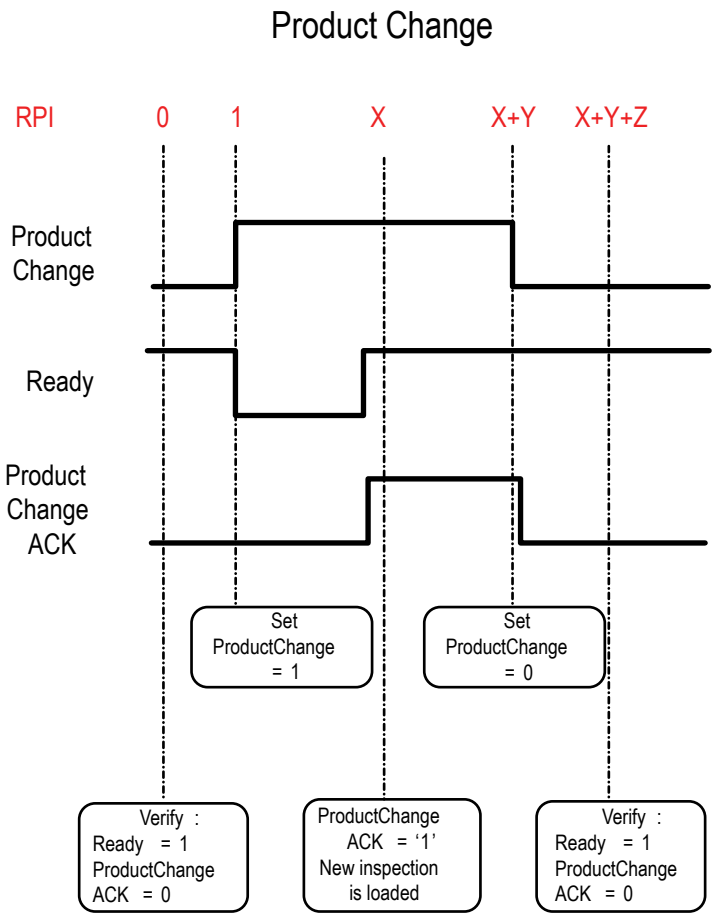


Figure 272. Teach Latch Timing Diagram

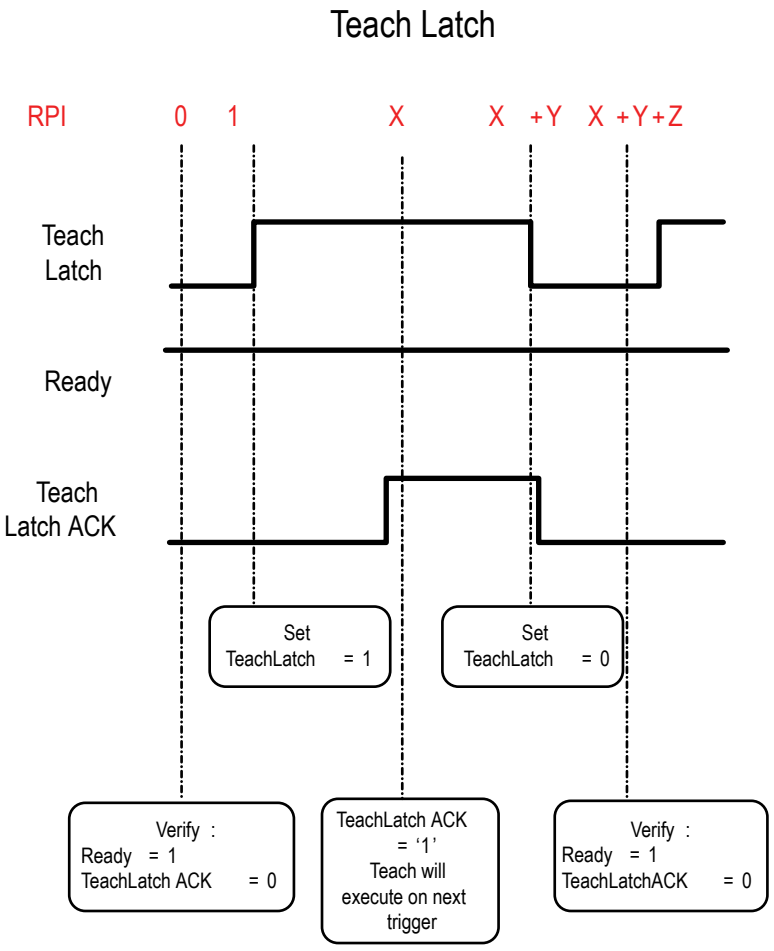
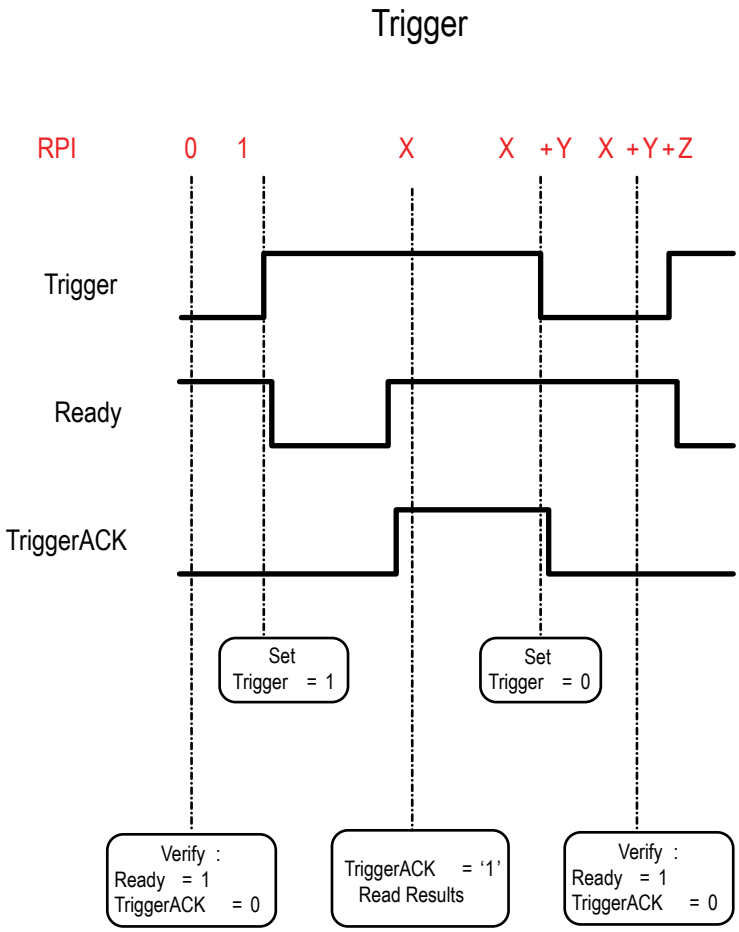


Figure 273. Trigger Timing Diagram



15.9 Command Channel Command Status Register

The command status register will confirm receipt of a command by reflecting the exact command ID received, regardless of whether the command was valid or not.

15.10 Diagnostic Guide

iVu devices provide several methods to help diagnose communication issues when using Ethernet communications.

15.10.1 Ethernet Diagnostics

To verify Ethernet connectivity, follow these steps:

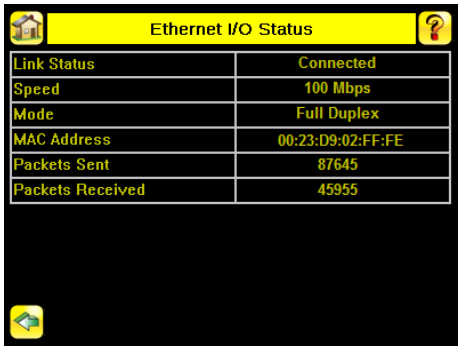
1. Verify that all of the cables are connected and properly seated.
2. Examine the Ethernet I/O LED located on the top of the iVu, between the Pass/Fail and System Status LEDs. The light should be either on or blinking.
3. Go to **System** > **Logs** > **System Log**.
4. Verify that the log entry indicates that the Ethernet link is up:

*Figure 274. **System Log** Screen—Ethernet Link*



5. Go to **System** > **Communications** > **Ethernet I/O**, and click **Status**.
6. Verify that the Link Status is Connected, and that the link parameters, such as speed and duplex settings are as expected. For example:

*Figure 275. **Ethernet I/O Status** Screen*



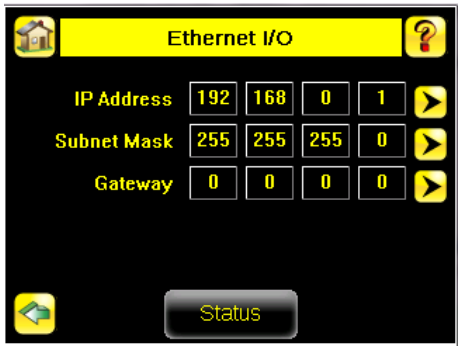
7. If the Link Status indicates that there is no link, inspect the wiring and verify that the Ethernet switch is powered up.
8. If the link parameters are not as expected (wrong baud rate or duplex setting) try the following:
    a. Log in to your managed switch and verify that the port to which the iVu device is connected is correctly configured, or, consult with your IT department to perform this verification.
    b. Verify that your cable is the correct type, and is properly connected to the switch and to the camera.

15.10.2 Networking and TCP/IP Diagnostics

To verify networking and TCP/IP connectivity, follow these steps:

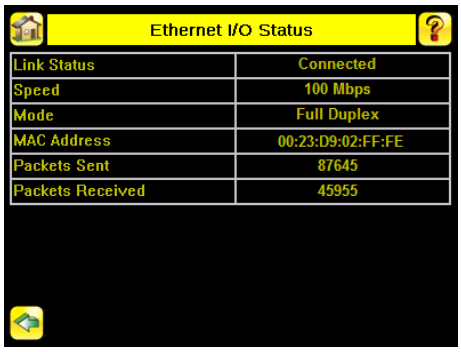
1. Verify that the Ethernet link has been established.
2. Go to **System** > **Communications** > **Ethernet I/O** , and check the iVu IP address, subnet mask, and the Gateway address.

*Figure 276. **Ethernet I/O** Screen*



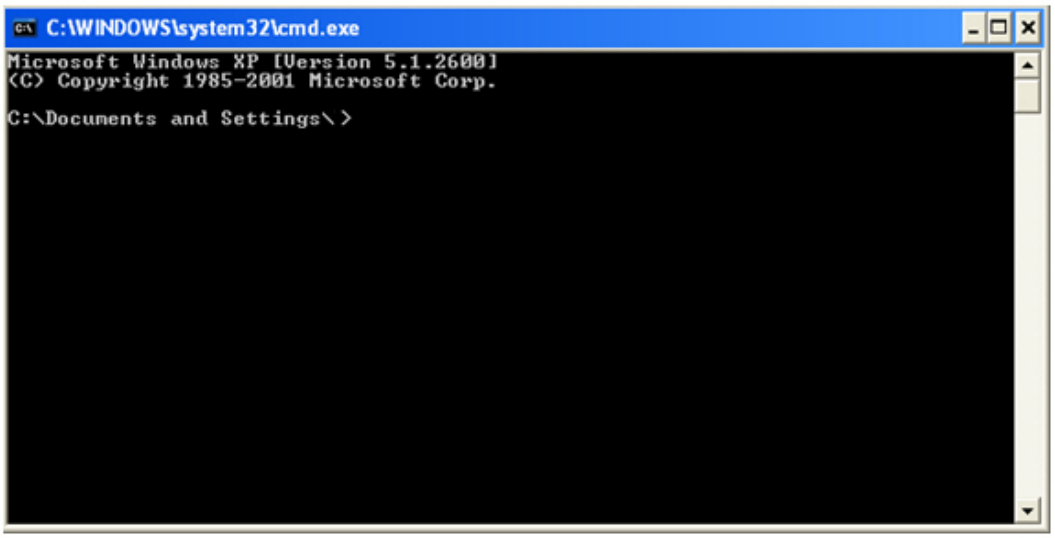
3. Verify with your IT department that these settings are correct. If necessary, make the required modifications and restart the iVu.
4. Click **Status** on the **Ethernet I/O** screen to open the **Ethernet I/O Status** screen.

*Figure 277. **Ethernet I/O Status** Screen*



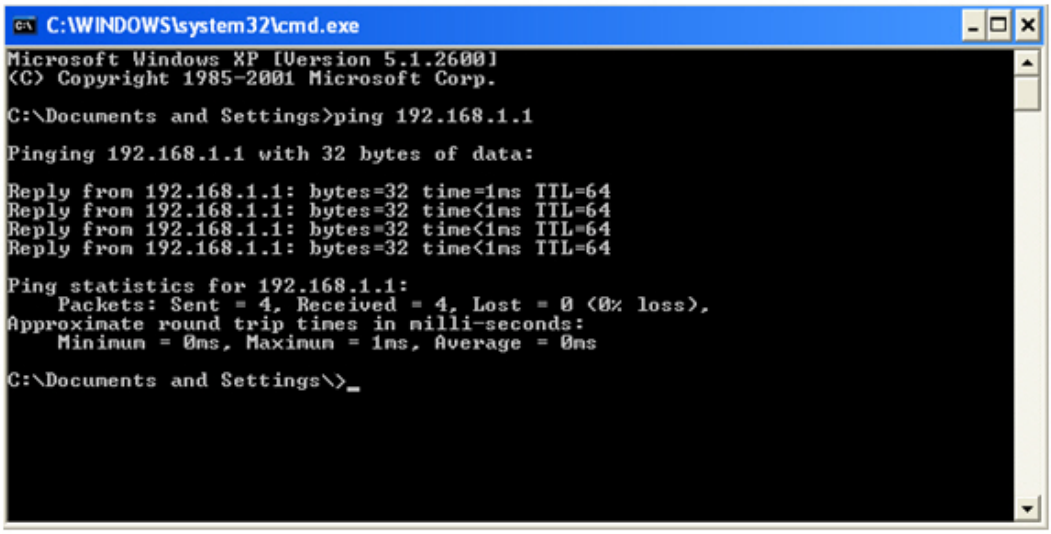
5. On the PC attached to your LAN, open the **Command** window. To do this, click **Start** > **Run**, enter `cmd`, and click **OK**. A command window displays.

Figure 278. Command Window



6. Enter a ping command specifying the iVu IP address as an argument. You should see a series of responses from the iVu.

Figure 279. Command Window with Responses from the iVu



You should also see the Packets Received and Packets Sent count on the **Ethernet I/O Status** screen in the camera increment by at least 4.

7. If the output of the ping command shows request timeouts, try the following:

- Verify that the camera is located on the correct subnet, has the correct IP address, and is connected to the correct switch or router
- If you are running several overlapping subnets, you may want to consult your IT department to ensure that the routing for the network is configured correctly
- If you are trying to access the camera through a gateway or a VPN router, verify that these devices are configured such that they allow traffic from the iVu device to reach the destination device

15.10.3 Industrial Protocols Troubleshooting

Modbus/TCP Protocol

Modbus/TCP protocol relies on the fundamental TCP/IP connectivity to establish connections and transport data. After you have verified Networking and TCP/IP connectivity, you should have little or no problems establishing a Modbus/TCP connection.

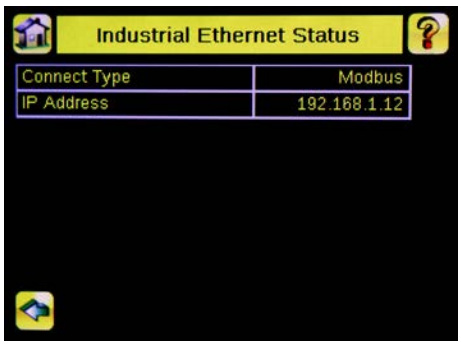
iVu supports one Modbus/TCP connection from a single client, and will reject additional connection requests.

Prior to attempting to establish the Modbus/TCP connection, configure your device and teach it about the iVu device. Tell the device the IP address of the iVu device that you have previously configured. Configuration steps vary for each device. Consult the appropriate device manual for these steps.

The iVu Modbus/TCP port is fixed at port number **502**.

After you have established a Modbus/TCP connection, verify that the iVu has accepted. Go to **System** > **Communications** > **Industrial Ethernet** > **Status** , and view the connection status.

*Figure 280. **Industrial Ethernet Status** Screen*



If you experience issues accessing data, see Modbus/TCP on p. 151 for the Modbus/TCP register maps supported by the iVu, and consult the Industrial Protocols Log. The log, when configured to **Detailed Logging** mode, provides a record of the individual register access sequences and records any errors.

*Figure 281. **Industrial Ethernet** Screen*



EtherNet/IP™ and PCCC Protocols

EtherNet/IP and PCCC protocols rely on Common Industrial Protocol (CIP™) [27] protocol to establish communications and exchange data. CIP protocol, in turn, utilizes TCP/IP.

EtherNet/IP implements Input/Output (I/O) messaging. I/O messaging allows two devices, the iVu and the PLC, to continuously synchronize data sets between each other. These data sets are called Input and Output Assemblies. The iVu device consumes PLC output assemblies, and produces PLC input assemblies. This exchange occurs continuously, at the rate specified by the RPI (Requested Packet Interval) value.

[27] EtherNet/IP™ and CIP™ are trademarks of ODVA, Inc.

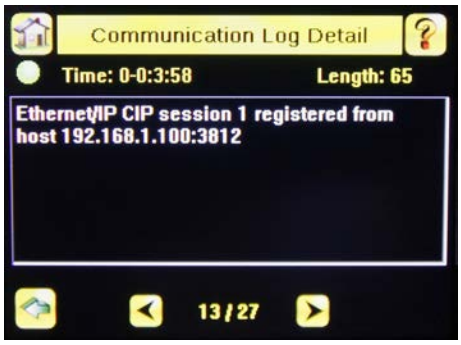
I/O messaging is based on UDP/IP, and utilizes Multicast addressing when sending PLC input assemblies. It is the default mode of operation for I/O messages in PLCs. Many PLCs also support Unicast (direct) addressing for PLC input assemblies, but need to be specially configured.

Because I/O messaging uses UDP/IP and Multicast, it requires special, managed switches, and customized switch configuration. Managed switches, when properly configured, prevent multicast devices from flooding the network with data. Consult with your IT department to make sure that you have the correct switch type, and that these switches have Internet Group Management Protocol (IGMP) snooping enabled to allow them to manage multicast groups.

Some switches with built-in firewalls block UDP traffic by default. If this is the case, and if the path between your devices involves several switches or routers, it is possible that some of them might block the UDP traffic necessary for I/O messages. Consult with your IT department to verify that your network is configured correctly.

Establishing CIP and EtherNet/IP I/O communications is a complicated process. There are several steps during which an error can occur. Industrial Protocols log contains a detail description of the communications process, and should be consulted if any errors are suspected.

*Figure 282. **Communication Log Detail** Screen*



A great level of detail is also provided in the log when the I/O connection is established.

*Figure 283. **Industrial Ethernet** Screen*

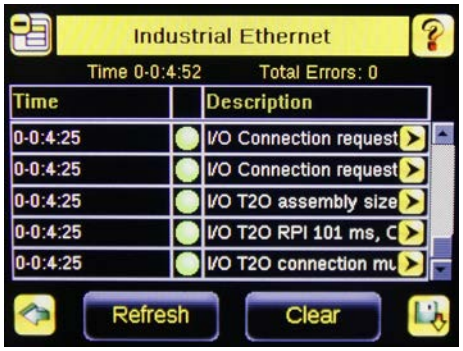
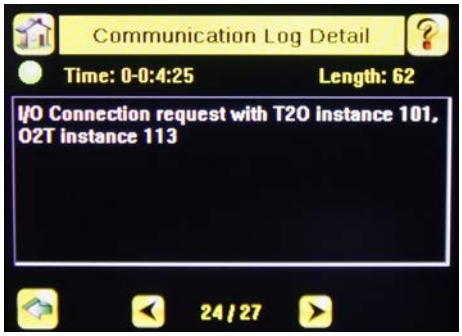
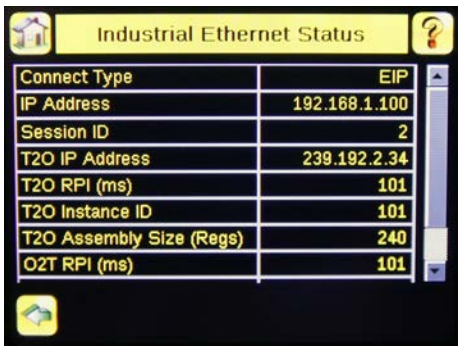


*Figure 284. **Communication Log Detail** Screen*



After the CIP and I/O connections are established, the **Industrial Protocols Status** screen shows the details of the connection.

*Figure 285. **Industrial Ethernet Status** Screen*



Most of the errors in establishing the CIP and I/O connections have to do with specifying the proper Input and Output Assembly Instance IDs and sizes. Refer to the appropriate sections of this manual for this information.

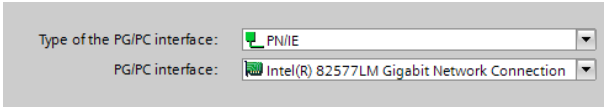
PROFINET

Discovering iVu Devices

The Siemens TIA Portal (v13) software discovery and configuration protocols are used to discover iVu devices on a network.

1. Start the Siemens TIA Portal (v13) software.
2. Click **Open an existing project**.
3. Select a project and open it.
4. Click **Devices & networks** after the project has been uploaded.
5. Click **Configure networks**.
6. Click the **Accessible devices**  icon.
   The **Accessible devices** window opens.
7. Select an interface connection in the **Type of the PG/PC interface** list.
8. Select an interface connection in the **PG/PC interface** list.

Figure 286. PG/PC Interface

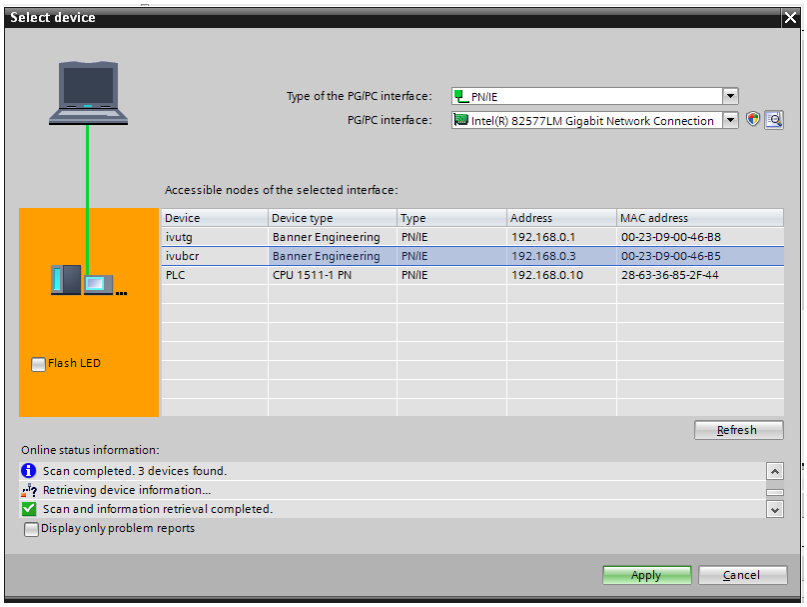


The PC scans the network for PROFINET® devices. If the device you are looking for is not present, check the cabling.

Example of Scanning Results

Under **Online status information**, the scan shows that three devices were found.

Figure 287. Select Device—Online Status Information

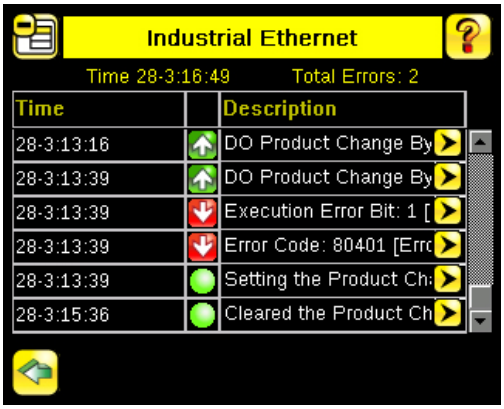


Accessing the iVu Device's Communication Logs

PROFINET® communication activity is recorded in the iVu device's communication logs. Use these instructions to access the iVu device's communication logs via the display.

1. Go to **Main Menu** > **Logs** > **Communication Logs** > **Industrial Ethernet** > **View Logs**.

*Figure 288. **Industrial Ethernet** Screen*

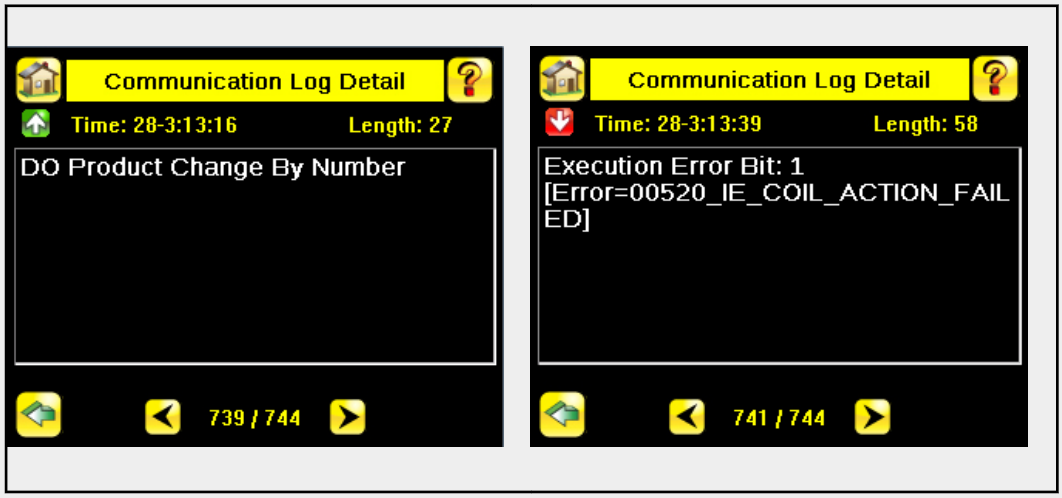


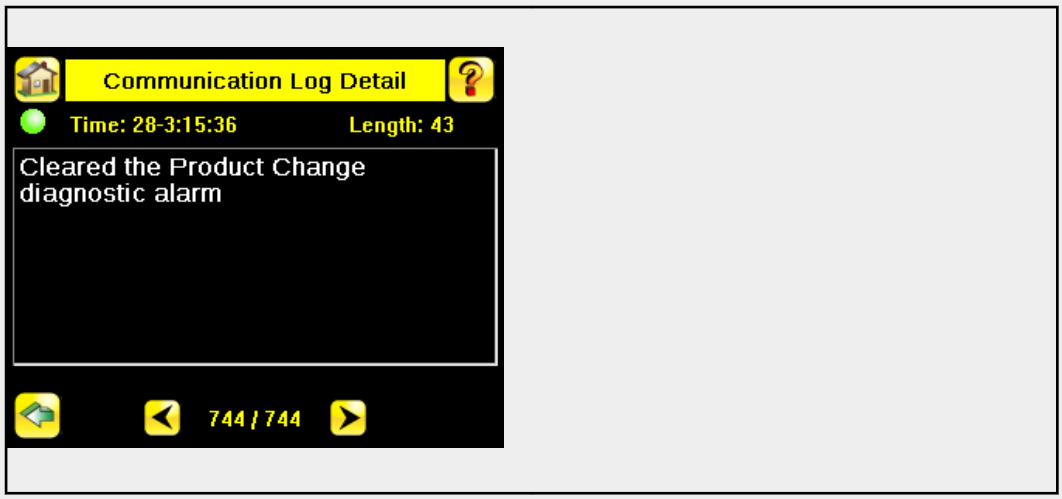
Note: Green communication log icons mean flawless communication. Red communication icons mean communication errors.

2. Click the **Arrow** button on any log entry in the communication log to access the **Communication Log Detail** window.

Note: An expanded description of the communication supports better diagnostics.





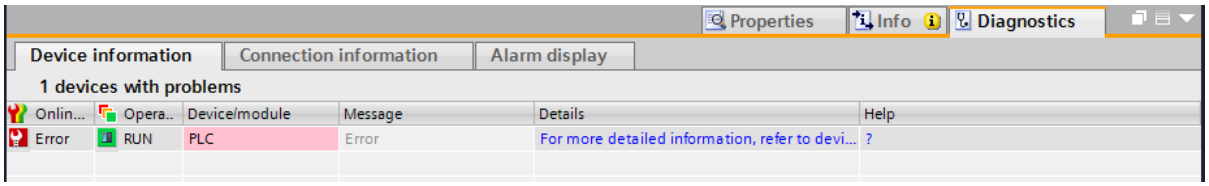


Diagnosing Errors

The Siemens TIA Portal (v13) software includes numerous diagnostic tools. When a computer is connected to the controller (PLC), diagnostic information is available. The controller (PLC) generates a message that displays in the **Diagnostics** window. A flashing red light on the CPU module of the controller (PLC) indicates an error.

1. Click on the text in the **Details** column to request detailed information about the device that caused the error.

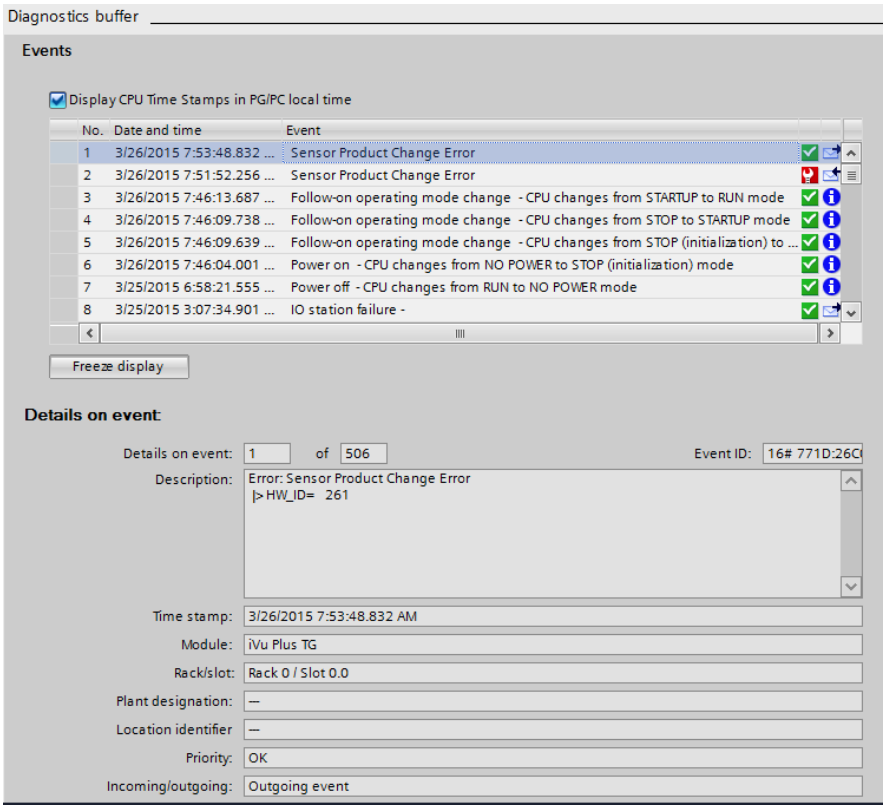
Figure 289. Diagnostics



All system and device messages are displayed in the **Diagnostics buffer** window under **Events** and **Details on event**.

2. Select a message in the table, **Display CPU Time Stamps in PG/PC local time**.

Figure 290. Diagnostics Buffer



The respective information displays in the **Description** field under **Details on event**.

3. Read the message to learn about the error and resolve it. When the error is resolved, the icon that corresponds to the displayed message is green.

15.11 Additional Information

15.11.1 iVu Command Channel Commands (iVu Command Channel over Industrial Ethernet)

This section describes how to use the iVu Command Channel over Industrial Ethernet. See for more information on the iVu Command Channel protocol. The following commands are executed using the Command ID register and the Command Input bit/Input Coil bit.

Command Channel Primer on p. 110

Command	Command ID			Description	Data Type
	Do	Set	Get		
Trigger					
Trigger Mode		1	10001	The iVu triggering mode. This value must match the modes supported by the iVu.	Int16
Product Change					
Product Change By Name	21			This command forces the iVu to switch to the specified inspection. The iVu does not transmit a response until the iVu has completed the action. Inspection results immediately after a product change are invalid until a new trigger is received.	Byte Array
Imager					
Gain		51	10051	The iVu value used to electronically brighten all image pixels.	Int32
Exposure		52	10052	The iVu value used to control the amount of time the imager is allowed to gather light for the image.	Int32
Status					
Clear System Error	81			This command clears the system error LED and resets the internal system error flag to false.	N/A
System					
Reboot Sensor	101			This command restarts the iVu. If the iVu configuration data is currently being saved, this command is blocked until the save operation completes.	N/A
Save Configuration	102			This command saves all modified inspection and configuration parameters. This command blocks all other commands until all values have been persisted.	N/A
Info					
Sensor Name			10151	User-assigned device name.	Byte Array
Model Number			10152	Device model number.	Byte Array
Serial Number			10153	Device serial number.	Byte Array
Firmware Version			10154	Device firmware (software) version.	Byte Array
Hour Counter			10155	The total number of hours the device has been energized.	Byte Array
History					
Clear History	301			This command clears all history fields for the active inspection. History values include pass count, fail count, execution times and sensor-specific history values.	N/A
Inspection					
Inspection Name			10501	The name of the active inspection.	Byte Array

Trigger Mode	1000	Description
External	1	Inspections are initiated via the electrical trigger wire.
Internal	2	Inspections run continuously at the specified period (electrical trigger inputs are ignored).
Free Run	3	Inspections run continuously (electrical trigger inputs are ignored).
Industrial Ethernet	10	Inspections are only trigged by Industrial Ethernet coils and commands.
Command	20	Inspections are only trigged by the Command Channel trigger commands.

Error Codes

The iVu device provides error codes in cases when commands failed to execute successfully. If such an error occurs, the Execution Error flag is set in the Output Bits/Status Register. When this bit is set, read the Error Code register to know the reason for the failure. The following table lists the error codes:

Numeric ID	Text ID	Description
0	SUCCESS	Command processed successfully.
500	IE_TRIGGER_MODE_EXPECTED	The Trigger Mode must be set to **Industrial Ethernet** to perform this operation.
510	IE_COMMAND_NOT_FOUND	The numeric Command ID specified was not found.
520	IE_COIL_ACTION_FAILED	The coil action resulted in a failure.
521	IE_COIL_ALREADY_BUSY	The coil was asserted before the previous execution completed.
522	IE_COIL_NOT_FINISHED	The coil was de-asserted prior to the execution completing.
523	IE_COIL_ANOTHER_ACTION_PENDING	The coil was asserted prior to another coil execution completing.
524	IE_COIL_MULTIPLES_DETECTED	Multiple coils were asserted simultaneously.
525	IE_COIL_ACK_INHIBITED	The coil action's output ACK was inhibited because the input coil was no longer set.
10000	EMPTY_FRAME_RECEIVED	Indicates that the request was empty. The command channel requires a command, any arguments, and an end-of-frame delimiter.
10001	COMMAND_NOT_RECOGNIZED	The command specified is not recognized
10100	GROUP_MISSING	A Group ID must be specified immediately after the command
10101	GROUP_NOT_FOUND	The specified Group ID is invalid / unknown
10102	GROUP_ITEM_MISSING	A Group Item ID must be specified immediately after the Group ID
10103	GROUP_ITEM_NOT_FOUND	The specified Group Item ID is invalid / unknown
10152	NOT_READABLE	Attempt to get a value that is not readable
10153	NOT_WRITEABLE	Attempt to set a value that is not writeable
10250	NOT_A_METHOD	Method ID specified is not a method
10251	WRONG_ARGUMENT_COUNT	Total method arguments specified do not match method
10252	COMMAND_NOT_FINISHED	Attempt to issue command when a previous command has not finished
10300	INVALID_ARGUMENT_TYPE	Item ID specified must be an item (not a group or method)
10301	DATA_VALUE_MISSING	Command missing item's data value
10340	MINIMUM_VALUE_EXCEEDED	New item value is below the minimum
10341	MAXIMUM_VALUE_EXCEEDED	New items value is above the maximum
10350	ARGUMENTS_DETECTED	Get command received with unneeded arguments
10351	INVALID_ARGUMENT_TYPE	Item ID specified must be an item (not a group or method)
10500	DATA_SET_EMPTY	Data export operation returned no results.
10900	SENSOR_NOT_READY	Command specified requires iVu to be in the READY state.
10920	SENSOR_TYPE_NOT_ACTIVE	Command specified belongs to a different sensor type.
10950	DEVICE_TYPE_INVALID	Command not supported on this device type.
15000	VALUE_INVALID	Text value is invalid / unknown
15050	VALUE_INVALID	Text value is invalid - expecting True or False
15100	STRING_TOO_LONG	String value specified exceeds maximum allowable length
20200	NO_AREAS_FOUND	Attempt to obtain value when no areas were found.

Numeric ID	Text ID	Description
20600	NO_MATCHES_FOUND	Attempt to obtain value when no matches were found.
20800	NO_MATCHES_FOUND	Attempt to obtain value when no sort patterns were found.
80000	REMOTE_DISPLAY_NOT_CONNECTED	Remote Display must be connected to obtain this value
80001	REMOTE_DISPLAY_NOT_SUPPORTED	This device does not have Remote Display capability
80100	COMMAND_MODE_EXPECTED	The Trigger Mode must be set to "Command" perform this operation
80101	COMMAND_TIMED_OUT	The command timed out before finishing
80102	TRIGGER_REQUIRED	Access to the specified data requires a triggered inspection
80150	COMMAND_TIMED_OUT	The command timed out before finishing
80200	SYSTEM_ERROR_NOT_ACTIVE	The System Error must be active to execute this command
80300	TEACH_SENSOR_TYPE_INVALID	Teach requires Match sensor.
80350	MULTIPLE_INSPECTIONS_DISABLED	Requires multiple inspections to be enabled
80351	MULTIPLE_INSPECTIONS_EMPTY	No inspections are available in multiple inspection mode.
80400	PRODUCT_CHANGE_WHEN_NOT_READY	Sensor must be in the READY state to perform a product change.
80401	PRODUCT_CHANGE_INVALID_INSPECTION	Attempt to product change to an unknown or invalid inspection.
80402	PRODUCT_CHANGE_TIMEOUT	The Product Change operation timed out.
80403	PRODUCT_CHANGE_TO_SAME_INSPECTION	Attempt to product change to the same inspection.
80404	SENSOR_NAME_NOT_FOUND	Attempt to use a command without a sensor name in a multi-sensor inspection

Examples of Operation

The following examples show how to utilize the iVu Command Channel via the Industrial Ethernet connection.

Clear System Error

1. Write the number `81` as a 16-bit integer into the Command ID register.
2. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
3. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
4. Verify that the Execution Error flag is not set (that is, the value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
5. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register).

Get/Set Trigger Mode

Get the current Trigger Mode from the iVu.

1. Write the number `10001` as a 16-bit integer into the Command ID register.
2. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
3. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
4. Verify that the Execution Error flag is not set (that is, the value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
5. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register). Read the current Trigger Mode value in the Command Response Int16 register.

iVu model	Trigger Mode	Int16 value
TG/Color/Color, BCR	External	1
TG/Color	Internal	2
TG/Color	Free Run	3
TG/Color, BCR	Industrial Ethernet Only	10

iVu model	Trigger Mode	Int16 value
TG/Color, BCR	Command	20
BCR	Continuous Scan	5
BCR	External Gated	4

Set the desired Trigger Mode for the iVu.

1. Write the number **1** as a 16-bit integer into the Command ID register.
2. Write the desired Trigger Mode's Int16 value from the table above into the Command Parameter Int16 register.
3. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
4. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
5. Verify that the Execution Error flag is not set (that is, the value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
6. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register).

Get/Set Exposure Time

Get the current Exposure Time from the iVu.

1. Write the number `10052` as a 16-bit integer into the Command ID register.
2. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
3. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
4. Verify that the Execution Error flag is not set (that is, the value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
5. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register). Read the current Exposure Time value (in microseconds) in the Command Response Int32 register.

Set the desired Exposure Time for the iVu.

1. Write the number `52` as a 16-bit integer into the Command ID register.
2. Write the desired Exposure Time (in microseconds) as a 32-bit integer value into the Command Parameter Int32 register. The minimum acceptable value is 117 µsec and the maximum value is 1,000,000 µsec.
3. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
4. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
5. Verify that the Execution Error flag is not set (that is, the value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
6. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register). The new exposure time will be used for the next inspection. Note that this value is not saved to the iVu device's permanent memory unless the Save Configuration task is completed.

Save iVu Configuration

This command saves all modified inspection and configuration parameters to the iVu, including Command Channel changes to exposure time and gain, trigger mode, and Remote Teach sessions.

1. Write the number `102` as a 16-bit integer into the Command ID register.
2. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
3. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
4. Verify that the Execution Error flag is not set (that is, the value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
5. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register).

16 Troubleshooting

16.1 LED Indicator Troubleshooting

In normal operation, the Power LED is green, and the Pass/Fail is green or red depending on the triggered inspection. The Ethernet I/O LED is on or off depending on connection status.

Figure 291. iVu LEDs



1. Power LED
   Green: Ready/Power
   Red (blinking or steady): Error
2. Pass/Fail LED
   Green (steady): Pass
   Green (blinking): Error
   Red: Fail
3. Ethernet I/O LED
   Green: Connected
   Off: Disconnected

The iVu LEDs also indicate abnormal conditions as described in Errors on p. 216.

16.1.1 Errors

Indicator	Solution
The Pass/Fail LED blinks green deveral times, separated by an LED red blink, and the iVu repeats this pattern over and over. This indicates that no inspections are occurring.	Reboot the iVu device.
The Power LED is on steady red. Errors indicated by the Power LED are reported in the System log and appear highlighted in red.	1. Look at the System Log to see the error. 2. Clear the LED. a. Go to **Main Menu** > **Logs** > **System Logs** . b. Click **Clear System Error**. A device reboot is not required. 3. If the error occurs again, try rebooting the iVu to see if that fixes the problem. If the problem persists, contact Banner Engineering.

16.1.2 Warnings

Warnings are atypical conditions that the iVu detects and fixes. Warnings are highlighted in yellow in the **System Log**, and can typically be ignored.

16.2 How to Round-Trip Debug Using the Emulator

This section describes the procedures for performing round-trip debugging using the iVu Emulator in Vision Manager.

Note: This section refers to saving configuration and inspection logs in folders based on the device name. If the device is not named, folders are named using the first eight characters of the device serial number.

Two options are available:

- How to Debug Using Inspection Logs on p. 217
- How to Debug Using Bitmap Files on p. 217

16.2.1 How to Debug Using Inspection Logs

Use this procedure to debug using the inspection logs and the configuration from the iVu. Using the inspection logs and configuration file is helpful when evaluating intermittent failures.

This procedure requires a USB flash drive and a USB cable, PSG-4M-4xx-USB (see Accessories on p. 227).

1. Connect a USB cable to the iVu device.
2. Connect a USB flash drive to the USB cable.
3. Save the Inspection Logs to the USB flash drive.
   a) Go to **Main Menu** > **Inspection Logs** > **View Logs**, and click the **Save** button to save the inspection logs.
   b) When prompted, click **Yes** to save device configuration along with the Inspection Logs.
   The location of these files on the USB flash drive displays after the operation is completed. The Inspection Logs are saved in `[USB:]\BANNER\[SENSOR_NAME]\InspLog` and the device configuration is saved in `[USB:]\BANNER\[SENSOR_NAME]`. For example, if the device name is *myName*:
   - Configuration File (CONFIG.CFG) path: `[USB:]\BANNER\myName`
   - Inspection Logs path: `[USB:]\BANNER\myName\InspLog`

   Note: If the device name is longer than eight characters, only the first eight characters are used in the folder name. If the device has no name, the folder name is the first eight characters of the device serial number.
4. Disconnect the USB flash drive from the iVu device.
5. Connect the USB flash drive to a Windows PC that has Vision Manager installed.
6. If desired, Inspection Log files or bitmap files previously stored on the PC can be copied to the InspLog folder on the USB flash drive.
7. Start Vision Manager and click **Emulators**.
8. For the desired Emulator, click and select the path on USB flash drive to which the device configuration was saved. For example, `[USB:]\BANNER\myName`.
9. Click to connect to the Emulator.
   The Emulator runs with the configuration on the USB flash drive using the saved Inspection Logs in the InspLog folder. Inspections occur depending the Trigger Mode settings.
10. Make the desired adjustments to the inspection or inspections.
11. On the **Home** screen, click to disconnect the Emulator.
    All configuration changes are automatically saved to the CONFIG.CFG file on the USB flash drive.
12. Disconnect the USB flash drive from the PC.
13. Connect the USB flash drive to the iVu device.
14. Restore the configuration to the iVu device.
    a) Go to **Main Menu** > **System** > **Sensor Configuration** > **Load Configuration**.
    b) Select the configuration to restore.
    c) Click **Load** to start the restore device configuration.
    d) Restart the device when the restore is complete.

16.2.2 How to Debug Using Bitmap Files

Use this procedure to debug using bitmap (.bmp) files stored on a PC. The .bmp files are commonly saved to a PC through the **Image Export** function over Ethernet I/O.

This procedure requires a USB flash drive and a USB cable, PSG-4M-4xx-USB (see Accessories on p. 227).

To use .bmp images with this procedure, see How to Use Bitmap Image Files with the iVu Emulator on p. 24.

1. Connect a USB cable to the iVu device.
2. Connect a USB flash drive to the USB cable.
3. Go to **Main Menu** > **System** > **Configuration** > **Save to USB** and click the **Save** button
   The device configuration is saved to the USB flash drive. The location of these files on the USB flash drive displays after the operation is completed. The configuration file is saved in the `[USB:]\BANNER\[SENSOR_NAME]` folder. For example, if the device name is myName, the configuration file (CONFIG.CFG) path is `[USB:]\BANNER\myName`

   Note: If the device name is longer than eight characters, only the first eight characters are used in the folder name. If the device has no name, the folder name is the first eight characters of the device serial number.

4. Disconnect the USB flash drive from the iVu device.
5. Connect the USB flash drive to a Windows PC that has Vision Manager installed.
6. Copy the device configuration file from USB flash drive to desired location on the PC.
   For example, when debugging inspections for an iVu Color device, the image files can be located at: `C:\Users\Public\Documents\Banner Vision Manager\iVu Series\iVu Color`.
7. Make sure the bitmap (.bmp) files to be used for debugging are located in "InspLog" subfolder at that location. For example, C:\Users\Public\Documents\Banner Vision Manager\iVu Series\iVu Color\InspLog. To avoid confusion, remove the bitmap (.bmp) or Inspection Log files (.log) files in the InspLog folder so that those files will not be used for debugging. The iVu Emulator automatically uses all .bmp and .log files sequentially according to filename.
8. Start Vision Manager and click **Emulators**.
9. For the desired Emulator, click and select the path on USB flash drive to which the device configuration was saved. For example, `[USB:]\BANNER\myName`.
10. Click to connect to the Emulator.
    The Emulator runs with the configuration on the USB flash drive using .bmp files in the InspLog folder. Inspections occur depending the Trigger Mode settings.
11. Make the desired adjustments to the inspection or inspections.
12. On the **Home** screen, click to disconnect the Emulator.
    All configuration changes are automatically saved to the CONFIG.CFG file on the PC.
13. Copy the modified device configuration file from the PC to the USB flash drive (`[USB:]\BANNER\myName`).
14. Disconnect the USB flash drive from the PC.
15. Connect the USB flash drive to the iVu device.
16. Restore the configuration to the iVu device.
    a) Go to **Main Menu** > **System** > **Sensor Configuration** > **Load Configuration**.
    b) Select the configuration to restore.
    c) Click **Load** to start the restore device configuration.
    d) Restart the device when the restore is complete.

16.3 Vision Manager Error Codes

Error Code	Description	Recommended Solution
10000	The sensor's feature set is too old to work with this version of Vision Manager.	• Update the sensor firmware to a version compatible with this application • Install an older version of this application
10001	The sensor's feature set is too new to work with this version of Vision Manager.	• Install an newer version of this application • Downgrade the sensor firmware to a version compatible with this application
10005	The sensor was not found at the specified IP address. Network PING results indicate no device present at the specified IP address.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify the sensor subnet is valid
10010	A connection to the sensor could not be established. One or more required channels failed to connect.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor

Error Code	Description	Recommended Solution
10011	A connection to the sensor could not be established. One or more required channels failed to connect	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10012	A connection to the sensor could not be established. A timeout occurred connecting required channels.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10020	A connection to the sensor could not be established. One or more required channels failed to connect.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10021	A connection to the sensor could not be established. One or more required channels failed to connect.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor

Error Code	Description	Recommended Solution
10022	The connection to the sensor was lost while sending data.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10023	The connection to the sensor was lost while receiving data.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10024	The connection to the sensor was lost while receiving data.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10025	The connection to the sensor was lost while receiving data.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor

Error Code	Description	Recommended Solution
10026	The connection to the sensor was lost while receiving data.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10027	The connection to the sensor was lost.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10040	The device at the specified IP address is already connected to another application. This can happen when another Vision Manager is already connected to the sensor.	• Disconnect the other application and try again • Verify there are no other devices using the same IP address
10041	The device at the specified IP address rejected the connection attempt. This can happen when the network device does not support the Vision Manager protocol.	• Verify the sensor's firmware version is compatible with this application • Verify the device at the specified IP address is a Banner Vision sensor
10050	The connection to the sensor was lost.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10051	The connection to the sensor was lost.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor

Error Code	Description	Recommended Solution
10053	The connection to the sensor was lost while receiving data.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10054	The Connection to the sensor was lost while receiving data.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10055	The Connection to the sensor was lost due to network keep alive expiration.	• Verify the network adaptor link speed and duplex settings • Verify the is sensor not stalled, or in shutdown mode
10070	The Connection to sensor was lost due to a receive state machine error.	• Verify the is sensor not stalled, or in shutdown mode • Verify the sensor is supported by this version
10071	The Connection to sensor was lost due to a receive state machine error.	• Verify the is sensor not stalled, or in shutdown mode • Verify the sensor is supported by this version
10080	The Connection to sensor was lost.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10085	A connection to the sensor could not be established. One or more required channels failed to connect.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor

Error Code	Description	Recommended Solution
10086	The connection to the sensor was lost while receiving data.	• Verify the sensor is energized • Verify the sensor communication cable is connected • Verify all inline network equipment is energized, properly configured and connected • Verify all required network equipment cables are connected • Verify the network adaptor is properly configured • Verify the sensor IP address is valid • Verify there are no other devices using the same IP address • Verify the sensor subnet is valid • Verify the sensor can be successfully pinged • Verify the network firewall settings support connection to the sensor
10091	Receiving data from the sensor timed out (no data was received). The connection to the sensor was aborted by this application.	• Verify the network adaptor link speed and duplex settings • Verify the is sensor not stalled, or in shutdown mode
10092	Receiving data from the sensor timed out (partial data was received). The connection to the sensor was aborted by this application.	• Verify the network adaptor link speed and duplex settings • Verify the is sensor not stalled, or in shutdown mode
10093	A parsing error was detected while receiving data from the sensor. The connection to the sensor was aborted by this application.	• Verify the network adaptor link speed and duplex settings • Verify the is sensor not stalled, or in shutdown mode
10094	A receive overrun was detected while receiving data from the sensor. The connection to the sensor was aborted by this application.	• Verify the network adaptor link speed and duplex settings • Verify the is sensor not stalled, or in shutdown mode
10095	Receiving data from the sensor timed out (internal error). The connection to the sensor was aborted by this application.	• Verify the network adaptor link speed and duplex settings • Verify the is sensor not stalled, or in shutdown mode
10096	A transmit timeout occurred while sending data to the sensor (no data was sent). The connection to the sensor was aborted by this application.	• Verify the network adaptor link speed and duplex settings • Verify the is sensor not stalled, or in shutdown mode
10097	A transmit timeout occurred while sending data to the sensor (partial data was sent). The connection to the sensor was aborted by this application.	• Verify the network adaptor link speed and duplex settings • Verify the is sensor not stalled, or in shutdown mode
10100	The connection to the sensor was lost while sending data.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor
10101	The connection to the sensor was lost while sending data.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor

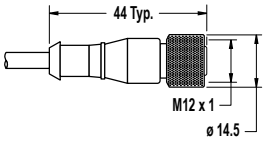
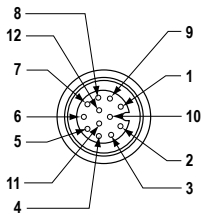
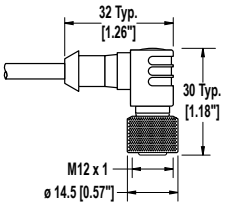
Error Code	Description	Recommended Solution
10110	The connection to the sensor was aborted by this application due to an internal processing error.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor
10111	The connection to the sensor was aborted by this application due to an internal processing error.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor
10120	The connection to the sensor was aborted by this application due to an internal processing error.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor
10125	The connection to the sensor was aborted by this application due to an internal processing error.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor
10126	The connection to the sensor was aborted by this application due to an internal processing error.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor
10140	The Connection to the sensor was lost due to network keep alive expiration.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor
10150	The connection to the sensor was aborted by this application due to an internal processing error.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor
10190	The connection to the sensor was aborted by this application due to an internal threading error.	• Install an newer version of this application • Verify the device at the specified IP address is a Banner Vision sensor • Verify the sensor's firmware version is compatible with this application • Check the firewall setup on computer • Go to Sensor Neighborhood and reconnect to the sensor

Error Code	Description	Recommended Solution
20000	An application error occurred while refreshing the display. An unhandled exception was detected.	• Go to Sensor Neighborhood and reconnect to the sensor
20001	An application error occurred while refreshing the display. There was a problem parsing data from the sensor.	• Go to Sensor Neighborhood and reconnect to the sensor
20010	An application error occurred while refreshing the display. There was a problem creating screen elements.	• Go to Sensor Neighborhood and reconnect to the sensor
20011	An application error occurred while refreshing the display. There was a problem releasing screen elements.	• Go to Sensor Neighborhood and reconnect to the sensor
20020	An application error occurred while refreshing the display. There was a problem synchronizing data.	• Go to Sensor Neighborhood and reconnect to the sensor
20021	An application error occurred while refreshing the display. There was a problem releasing data resources.	• Go to Sensor Neighborhood and reconnect to the sensor
20030	An application error occurred while refreshing the display. There was a problem synchronizing with the inspection.	• Go to Sensor Neighborhood and reconnect to the sensor
20040	An application error occurred while refreshing the display. There was a problem updating input data.	• Go to Sensor Neighborhood and reconnect to the sensor
20041	An application error occurred while refreshing the display. There was a problem updating result data.	• Go to Sensor Neighborhood and reconnect to the sensor
20050	This application detected an error while refreshing the display. There was a problem rendering the image.	• Go to Sensor Neighborhood and reconnect to the sensor
20060	An application error occurred while refreshing the display. There was a problem updating pixel annotations.	• Go to Sensor Neighborhood and reconnect to the sensor
20061	An application error occurred while refreshing the display. There was a problem updating pixel annotations.	• Go to Sensor Neighborhood and reconnect to the sensor
20070	An application error occurred while refreshing the display. There was a problem updating vector annotations.	• Go to Sensor Neighborhood and reconnect to the sensor
20071	An application error occurred while refreshing the display. There was a problem updating vector annotations.	• Go to Sensor Neighborhood and reconnect to the sensor
20072	An application error occurred while refreshing the display. There was a problem releasing vector annotations.	• Go to Sensor Neighborhood and reconnect to the sensor
20150	Connection to the emulator failed.	• Call Banner Customer Support
20151	There was an error starting the emulator.	• Reinstall this application • Check the firewall setup on computer

Error Code	Description	Recommended Solution
20152	The selected emulator could not be found.	• Reinstall this application • Check the firewall setup on computer
20153	There was a problem closing the previous emulator session.	• Reboot the computer to end any processes which did not shut down properly
20154	There was a problem closing the previous emulator session.	• Reboot the computer to end any processes which did not shut down properly
20155	There was a problem closing the previous emulator session.	• Reboot the computer to end any processes which did not shut down properly
20156	There was a problem closing the previous emulator session.	• Reboot the computer to end any processes which did not shut down properly
20157	There was an error starting the emulator.	• Reinstall this application • Check the firewall setup on computer
20158	There was an error starting the emulator.	• Reinstall this application • Check the firewall setup on computer
20159	There was an error starting the emulator.	• Reinstall this application • Check the firewall setup on computer
20160	Another emulator session is currently running. Only one emulator session can be run at a time.	• Close the other Vision Manager currently connected to the emulator • Reboot the computer to end any processes which did not shut down properly
20233	A maintenance service internal error was detected.	• Go to Sensor Neighborhood and reconnect to the sensor • Reboot the sensor • Update the sensor firmware to the latest version • Update the Vision Manager Application to the latest version

17 Accessories

17.1 Power Cable — Required

12-Pin M12/Euro-Style Cordsets with Open Shield				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQDC2S-1206	2 m (6.56 ft)	Straight		 1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Pink 7 = Blue 8 = Red 9 = Orange 10 = Light Blue 11 = Black 12 = Violet
MQDC2S-1215	5 m (16.40 ft)			
MQDC2S-1230	9 m (29.53 ft)			
MQDC2S-1250	16 m (52.49 ft)			
MQDC2S-1275	23 m (75.46 ft)			
MQDC2S-1206RA	2 m (6.56 ft)	Right Angle		
MQDC2S-1215RA	5 m (16.40 ft)			
MQDC2S-1230RA	9 m (29.53 ft)			
MQDC2S-1250RA	16 m (52.49 ft)			

Note: The cables listed above must be used to meet CE.

17.2 Remote Display—Required for Setup (Remote Display Models Only)

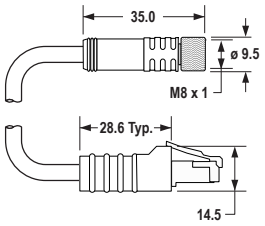
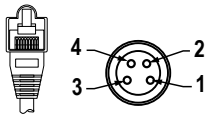
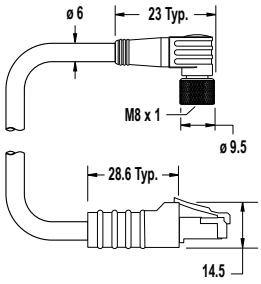
Model	Description	Data Sheet
RDM35	89 mm (3.5 in) Diagonal Machine-Mountable Remote Touchscreen Display	p/n 166096

17.2.1 RDM35 Remote Display Accessory Kit

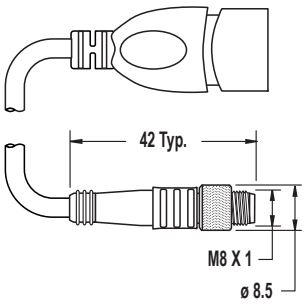
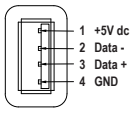
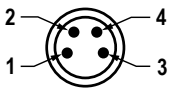
Table 86: ***Cordset Kits***

Model	Length	Description
IVURDM-QDK-803	0.91 m (3 ft)	8-pin cable, straight, M12-M12 Mounting bracket (SMBRDM35) Stylus
IVURDM-QDK-806	1.83 m (6 ft)	
IVURDM-QDK-815	4.57 m (15 ft)	
IVURDM-QDK-830	9.14 m (30 ft)	
IVURDM-QDK-850	15.2 m (50 ft)	
IVURDM-QDK-803RA	0.91 m (3 ft)	8-pin cable, right-angle, M12-M12 Mounting bracket (SMBRDM35) Stylus
IVURDM-QDK-806RA	1.83 m (6 ft)	
IVURDM-QDK-815RA	4.57 m (15 ft)	
IVURDM-QDK-830RA	9.14 m (30 ft)	
IVURDM-QDK-850RA	15.2 m (50 ft)	

17.3 Ethernet Cable Options

RJ45 Ethernet to 4-Pin Threaded M8/Pico-Style Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout**
IVUC-E-406	1.83 m (6 ft)	Straight Cat5e Shielded		 1 = Blue 2 = White/Blue 3 = White/Orange 4 = Orange
IVUC-E-415	4.57 m (15 ft)			
IVUC-E-430	9.14 m (30 ft)			
IVUC-E-450	15.2 m (50 ft)			
IVUC-E-475	22.9 m (75 ft)			
IVUC-E-406R	1.83 m (6 ft)	Right Angle Cat5e Shielded		
IVUC-E-415R	4.57 m (15 ft)			
IVUC-E-430R	9.14 m (30 ft)			
IVUC-E-450R	15.2 m (50 ft)			

17.4 USB Cable — Optional

4-Pin Threaded M8/Pico-Style to USB Cordsets with Shield—Double Ended				
Model	**Length**	**Style**	**Dimensions**	**Pinout**
PSG-4M-4005-USB	0.15 m (0.5 ft)	Straight Pico QD/ USB		 Male  1 = Red 2 = White 3 = Black 4 = Green
PSG-4M-401-USB	0.31 m (1 ft)			
PSG-4M-403-USB	0.91 m (3 ft)			
PSG-4M-410-USB	3 m (10 ft)			

17.5 USB Flash Drive — Optional

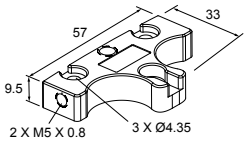
Model	Description
IVU-USBFD2	USB Flash Drive 2 GB

17.6 Brackets

For Use with Integrated Display Models

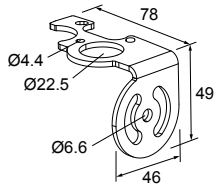
SMBIVUB

- Bottom mounting bracket
- Black anodized aluminum
- Hardware included



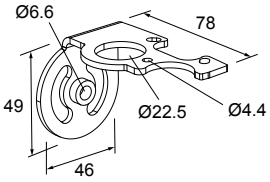
SMBIVURAL

- Right-angle bracket for mounting the device from the left
- 12-ga. stainless steel
- Hardware included



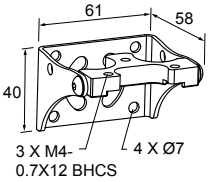
SMBIVURAR

- Right-angle bracket for mounting the device from the right
- 12-ga. stainless steel
- Hardware included



SMBIVUU

- U-shaped swivel bracket kit
- 14-ga. stainless steel
- Hardware included
- Bottom mounting bracket, SMBIVUBP, can be ordered separately

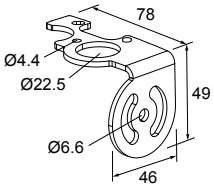


Note: Use cables with right-angle connectors with this bracket kit.

For Use with Remote Display Models

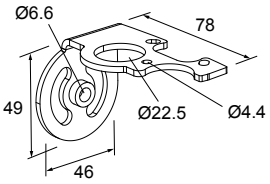
SMBIVURAL

- Right-angle bracket for mounting the device from the left
- 12-ga. stainless steel
- Hardware included



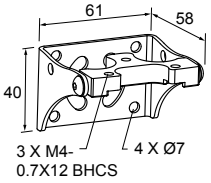
SMBIVURAR

- Right-angle bracket for mounting the device from the right
- 12-ga. stainless steel
- Hardware included



SMBIVUU

- U-shaped swivel bracket kit
- 14-ga. stainless steel
- Hardware included
- Bottom mounting bracket, SMBIVUBP, can be ordered separately



Note: Use cables with right-angle connectors with this bracket kit.

17.7 Micro Video Lens Accessories

17.7.1 Micro Video Lens Models

Model	Lens Description
LMF04 [28]	4.3 mm lens
LMF06	6 mm lens
LMF08	8 mm lens
LMF12	12 mm lens
LMF16	16 mm lens
LMF25	25 mm lens

17.7.2 Micro Video Lens Filters — Optional

Model	Description
FLTMR2	Red and dark red filter kit
FLTMI	Infrared filter kit
FLTMB	Blue filter kit
FLTMG	Green filter kit

17.8 C-Mount Lens Accessories

17.8.1 C-Mount Lens Models

Model	Lens Description
LCF04	4 mm Lens - no threads for filter
LCF08	8 mm Lens - no threads for filter
LCF12	12 mm Lens - no threads for filter
LCF16	16 mm Lens, aperture lock - no threads for filter
LCF25R	25mm lens
LCF25LR	25mm lens with focus locking
LCF50L1R	50mm lens with focus locking, plastic
LCF50L2R	50mm lens with focus locking, metal (will not fit ring)
LCF75LR	75mm lens with focus locking, metal (will not fit ring)

[28] Due to the flexibility of the replaceable lenses, focus mechanism, and imager field-of-view settings, it is possible with the 4.3 mm lens to experience reflections from the internal strobe on the inspection image. To eliminate this effect, the field-of-view can be limited to the system default of 320×240 (or 640×480 for fine), the working distance to the object should be no more than about 8 inches, or an external strobe should be used instead of the internal ring light.

17.8.2 C-Mount Lens Enclosure Models

Model	Description
IVUSLC50-P	Sealed C-mount lens enclosure
IVUSLC75-P	

17.8.3 C-Mount Lens Filters — Optional

Model	Description
FLTR	Red filter kit
FLTB	Blue filter kit
FLTG	Green filter kit
FLTI	IR Filter kit

18 Product Support and Maintenance

This section provides general Banner resources and specific documentation for installers and operators of this iVu.

18.1 Product Support

Banner provides the following resources for quickly setting up and operating the device.

Online Help

When setting up or monitoring inspections using the iVu device's display, view online help on any screen by clicking the **Help** icon in the upper-right corner of the display.

PDF Documentation

The product documentation is available in a convenient printable format (PDF) in the iVu installation package or at www.bannerengineering.com.

Banner Website

The most current product information, documentation, and software updates are available on the Banner website: www.bannerengineering.com.

Warranty Service

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.

Important: If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

Factory Support

To help Banner better assist you, be ready to provide the following information:

- iVu firmware version (to find the version number, go to **Main Menu** > **System** > **Sensor Information**)
- Device model number and date code, which are found on the bottom of the device.
- Exact wording of any messages that appeared on your screen
- A description of what you were doing and what happened
- A description of how you tried to solve the problem
- Error Codes (see LED Indicator Troubleshooting on p. 216)

18.2 Maintenance

Maintenance tasks include keeping the hardware free of dust and dirt and updating the iVu firmware as needed.

18.2.1 Clean the iVu

Regularly remove any dust or dirt from the sensor using a soft cloth.

If needed, slightly dampen the cloth with a weak solution of neutral detergent. Avoid getting dirt on the imager (the area behind the lens). If the imager is dirty, use anti-static compressed air to blow off the dust.

18.2.2 Update the iVu Firmware

Use the following steps to update the iVu firmware.

The current version of iVu firmware is available through Vision Manager. Download the latest version of Vision Manager from www.bannerengineering.com.

Note: iVu firmware is packaged with Vision Manager version 1.5.0 and later.

This procedure requires a USB flash drive and a USB cable, PSG-4M-4xx-USB (see Accessories on p. 227).

1. Connect a USB flash drive to a Windows PC that has Vision Manager installed.
2. In Vision Manager, go to **Sensor Maintenance** and click for the sensor to be updated.

   Note: Vision Manager cannot be connected to the sensor to be updated.

   The folder `C:\Users\Public\Documents\Banner Vision Manager\Firmware\[Vision sensor model]` opens.
3. Copy the folder called "BANNER" to the root of the USB flash drive.
4. Disconnect the USB flash drive from the PC.
5. Connect the USB cable to the iVu.
6. Connect the USB flash drive to the USB cable.
7. On the iVu, go to **Main Menu** > **System** > **Firmware Update**.
   The name of the firmware file you copied to the USB flash drive displays.
8. Select the correct iVu firmware file and click **Load**.
9. Follow the on-screen instructions to update the firmware.

18.2.3 How to Set or Modify a Device Name using the Emulator

You can set a device name for your iVu device or modify an existing name on the device using the keypad. You can also change the device name this using the iVu Emulator as described below.

Note: If you are in a language other than English, you cannot modify the device name using the keypad. Use the procedure described below.

Note: If you have not set the device name previously, folders are named using the first 8-characters of the device serial number.

This procedure requires a USB flash drive and a USB cable, PSG-4M-4xx-USB (see Accessories on p. 227).

1. Connect a USB cable to the device.
2. Connect a USB flash drive to the USB cable.
3. Save the Device Configuration to the USB flash drive. Go to **Main Menu** > **System** > **Configuration** > **Save to USB**.

   The location of these files on the USB flash drive displays after the operation is complete. The device configuration is saved in `[USB:]\BANNER\[DEVICE_NAME]`. For example, if the device name is *myName*, the path is `[USB:]\BANNER\myName`.
4. Disconnect the USB flash drive from the device.
5. Connect the USB flash drive to a Windows PC.
6. If you are running the Emulator installed on a PC, make sure the Emulator is **not** running, and copy the Device Configuration from the USB flash drive to the folder where the Emulator is installed on the PC.

   For example, if the device name is myName and the iVu Emulator is installed in the default location on the PC, copy the file `[USB:]\BANNER\myName\CONFIG.CFG` to `C:\Program Files\Banner Engineering\iVu Series`.
7. Launch the iVuEmulator.exe program (either from the USB flash drive or from the Windows PC, depending on which one you are using).
8. Go to **Main Menu** > **System** > **Information**.
9. Click inside the **Device Name** field, and enter the desired `name`.
10. Click the **Back** button on the lower-left corner of the display to save the device name.
11. Close the Emulator program. The device name is automatically saved to the CONFIG.CFG file.
12. If you are running the Emulator on the PC, copy the CONFIG.CFG file back to the original folder on the USB flash drive, `[USB:]\BANNER\[DEVICE_NAME]`. For example `[USB:]\BANNER\myName`.

    Note: The device looks in the original folder (for example, myName) for the CONFIG.CFG file.
13. Remove the USB flash drive from the PC, and connect it to the device.
14. Restore the configuration to the device.
    a. Go to **Main Menu** > **System** > **Configuration** > **Load from USB**.
    b. Select the configuration to restore.
    c. Click **Load** to start the restore device configuration.

    Note: After the new device name is restored in the device, all files saved to USB flash drive will now reside in the folder corresponding to the new device name.

d. Restart the device when the restore is complete.

Note: If a device configuration from one device is loaded onto another device, the device name from the device configuration is not be stored in the device.

18.2.4 How to Reset the Device Password

If you forget the password for your device, contact Banner Engineering for assistance.

18.3 Contact Us

Banner Engineering Corp. headquarters is located at:

9714 Tenth Avenue North
Minneapolis, MN 55441, USA
Phone: + 1 888 373 6767

For worldwide locations and local representatives, visit www.bannerengineering.com.

18.4 Banner Engineering Corp Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to: www.bannerengineering.com.

For patent information, see www.bannerengineering.com/patents.

18.5 FCC Part 15 and CAN ICES-3 (A)/NMB-3(A)

This device complies with part 15 of the FCC Rules and CAN ICES-3 (A)/NMB-3(A). Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

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 and CAN ICES-3 (A)/NMB-3(A). 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 instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Index

A

Active Sensors tab 21
advanced 50
Advanced Display screen 72
Area menu 38, 39
area range 39, 48
Area sensor
  area range 39, 48
  intensity range 39
  sensor-specific data
    (PROFINET) 174
area_history command group 116
area_result command group 116
auto exposure 53
Average Color menu 43–46
Average Color sensor
  color space 44
  intensity range 44
  sensor-specific data
    (PROFINET) 175, 176
average_color_history command group 119
average_color_result command group 119

B

Blemish menu 39, 40
Blemish sensor
  edge length range 40
  sensitivity 40
  sensor-specific data
    (PROFINET) 175
blemish_history command group 117
blemish_result command group 117

C

calibration
  touchscreen 72
color 47
Color Area menu 47, 48
Color Area sensor
  area range 39, 48
  color 47
  sensor-specific data
    (PROFINET) 176
  tolerance 48
Color Compare menu 46, 47
Color Compare sensor
  color tolerance 46
  intensity tolerance 47
  percent match 41, 43
  sensor-specific data
    (PROFINET) 176
color space 44
color tolerance 46
color_area_history command group 122
color_area_result command group 121
color_command_result command group 120
color_compare_history command group 121
command channel
  image export 100
  data export 98
command channel log 78, 107
command channel sample application 98
command group
  area_history 116
  area_result 116
  average_color_history 119
  average_color_result 119
  blemish_history 117
  blemish_result 117
  color_area_history 122
  color_area_result 121
  color_compare_history 121
  color_compare_result 120
  history 115
  info 112
  inspection 116
  match_history 118
  match_result 117
  productchange 115
  sort_history 118
  sort_result 118
  status 113
  system 113
  trigger 114
  imager 114
  teach 115
communication channel
  command channel 97
  data export 97, 98
  image export 97, 100
  command channel 97
  data export 97, 98
  image export 97, 100
  Industrial Ethernet 61, 62, 64, 65, 97
communication logs 77–79
communications channels 97
Communications menu 60–62, 64–68
Configuration menu 58, 59

D

DAP 169, 172–174, 176, 178, 179
data export 66–68, 97, 98
data export log 107
data export sample application 99
data model 169, 172–174, 176, 178, 179
Demo mode 8
Device Access Point
  , See DAP
device control 173
Discrete I/O menu 69, 70
Display Settings menu 71, 72

E

edge length range 40
edit pattern 42, 50
emulator 24
Ethernet
  communications 100–102, 104
Ethernet I/O 60, 61
Ethernet/IP 132–134, 136, 137, 139, 140, 145
exposure 53
external strobe 55

F

fail hold time 72
Favorites tab
  add 22
  remove 22
field of view
  , See FOV
firmware
  version 23
firmware update 73
focus number 54
FOV
  adjust 55

G

gain 53
General Station Description
  , See GSD
GSD
  Install 181

H

history command group 115
Home screen 21–25, 31–33
HSI 44
hue
  pass 45
  pass standard deviation 45

I

image export 68, 97, 100
image export log 79
image export sample application 100

imager
auto exposure 53
exposure 53
focus 54
FOV 55
gain 53
resolution 56
strobe 55
trigger 54
white balance 57
imager command group 114
Imager menu 53–57
Industrial Ethernet 61, 62, 64, 65, 97
Industrial Ethernet log 78
info command group 112
Information 59
inspection command group 116
inspection ID 50
Inspection Logs 76, 77
inspection menu 38–52
Inspection menu
Properties menu 50, 51
Sort menu 42, 43
inspection name 50
inspection results 173
intensity 45
intensity range 39, 44
intensity standard deviation 46
intensity tolerance 47
internal strobe 55

L

language
set 73
LCD display timeout 72
Load from USB 59
lock device 59
logs
command channel 78, 107
data export 107
command channel 78, 107
communication 77–79
image export 79
Industrial Ethernet 78
inspection 76, 77
system 77
Logs menu 76–79

M

Main menu 34, 35, 37
mask 39, 40, 44, 46, 47, 96
Match menu 41, 42
Match sensor
percent match 41, 43
rotation range 41, 43
sensor-specific data (PROFINET) 175
timeout 42, 43
match_history command group 118
match_result command group 117
maximum pass count 39, 40, 42, 48
menu
Display Settings 71, 72
Area 38, 39
Average Color 43–46
Blemish 39, 40
Color Area 47, 48
Color Compare 46, 47
Communications 60–62, 64–68
Configuration 58, 59
Discrete I/O 69, 70
Imager 53–57
Logs 76–79
Main 34, 35, 37
Match 41, 42
Mode 58
Motion 48–50
Properties 50, 51
Sensors 38–48
Sort 42, 43
Stored Inspections 51, 52
System 58–62, 64–74
minimum pass count 39, 40, 42, 48
Modbus/TCP 151, 153, 156–158
mode
Demo 8, 58
Live 58
Mode menu 58
module 172
motion 51
Motion menu 48–50
motion parameters
number of edges 49, 89
rotation 49, 89
sensitivity 49, 89

N

Network Adapters tab 23
number of edges 49, 89

P

pass
blue 45
blue standard deviation 45
green 45
green standard deviation 45
intensity standard deviation 46
red 45
red standard deviation 45
pass count 39, 42, 48
pass count parameter 40
pass criteria 43
pass hue 45
pass hue standard deviation 45
pass intensity 45
pass saturation 45
pass saturation standard deviation 46
pass total area 39, 48
pattern, edit 42, 50
patterns 42, 43
PC Requirements 11
PCCC 159, 163, 164, 166–168
percent match 41, 43
PLC5 159, 163, 164, 166–168
productchange command group 115
PROFINET 169, 172–174, 176, 178, 179, 181, 184, 187, 190, 192, 194, 195, 198
properties
inspection ID 50
inspection name 50
motion 51
Properties menu 50, 51

R

RBGI 44
reboot 72
Region of Interest
, See ROI
resolution 56
ROI 39–41, 44, 46, 47
rotation parameter 49, 89
rotation range 41, 43
RS-232 97, 98, 100

S

sample application
command channel 98
image export 100
data export 99
saturation
pass 45
pass standard deviation 46
Save to USB 59
saved patterns 43
screen
Home 21–25
sensitivity 40, 49, 89
sensor display 31–33
Sensor Maintenance 23
Sensor Neighborhood 21–23
Sensors menu 38–48
serial communications 104
serial I/O 61
SLC 5 159, 163, 164, 166–168
slot 172
software
information 25
version number 25
Sort menu 42, 43
Sort sensor
pass criteria 43
percent match 41, 43
rotation range 41, 43
saved patterns 43
sensor-specific data (PROFINET) 175
timeout 42, 43
sort_history command group 118
sort_result command group 118
status command group 113

Stored Inspections menu 51, 52
strobe
external 55
internal 55
submodule 172–174, 176, 178, 179
subslot 172
system command group 113
System Logs 77
System menu 58–62, 64–74

T

tab
About 25
Active Sensors 21
Favorites 22
Network Adapters 23
teach command group 115
timeout
LCD display 72
tolerance 48
total area 39, 48
touchscreen calibration 72
trigger 54, 80
trigger command group 114

U

USB
loading from 59
saving to 59

V

Vision Manager
about 25
version number 25

W

waveforms 73, 74
white balance 57