

VE Series Smart Camera



Quick Start Guide

Self-contained Smart Camera with User-Friendly Vision Manager Software

This guide is designed to help you set up and install the VE Series Smart Camera. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Instruction Manual at www.bannerengineering.com. Search for p/n 191666 to view the Instruction Manual. Use of this document assumes familiarity with pertinent industry standards and practices. More details are available in the online help.



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.



CAUTION: Hot Surface

Use caution when handling the camera. The surface of the camera may be hot during operation and immediately after use.

Models

| Model ¹ | Resolution |
|--------------------|--------------------------------------|
| VE200G1A | WVGA, 752 × 480 pixels grayscale |
| VE201G1A | 1.3 MP, 1280 × 1024 pixels grayscale |
| VE202G1A | 2 MP, 1600 × 1200 pixels grayscale |

Features



1. Display
2. Buttons
3. Pass/Fail indicator (green/red)
4. Ready/Trigger indicator (green/amber)
5. Power/Error indicator (green/red)
6. Ethernet indicator (amber), not shown
7. Ethernet connection
8. Light connection
9. Power, Discrete I/O connection

Figure 1. Sensor Features

¹ Model VE202G2A, 2 MP, 1600 × 1200 grayscale with 4-pin D-code M12 Ethernet connection is also available.



Display



Figure 2. Display with Home Screen

The display is a 2-line, 8-character LCD. The main screen is the Home Screen, which shows the name of the current inspection and the slot number (inspection location). Use the display to view or change several sensor settings.

Indicators

Four LED indicators provide ongoing indication of the sensing status.



Power/Error Indicator
Green = Normal operation
Red = System error



Ready/Trigger Indicator
Green = Ready for trigger
Yellow = Trigger is active
OFF = Not ready for a trigger, triggers will be missed







Pass/Fail Indicator
Green = Previous inspection passed
Red = Previous inspection failed
OFF = No trigger since power up



Ethernet Indicator
Amber solid = Ethernet connection
Amber flashing = Ethernet activity
OFF = no connection

Buttons

Use the sensor buttons Down , Up , Enter , and Escape  to configure several sensor settings and to access sensor information. See [Figure 11](#) on page 10 for additional information on using the buttons.

Vision Manager Software

The VE Series Smart Camera is set up using the free Vision Manager Software, available for download at www.bannerengineering.com.

This easy-to-use image processing software provides a variety of tools and capabilities to solve a wide range of vision applications such as item detection, part positioning, feature measurement and flaw analysis. Run-time editing allows you to make changes to an inspection while the sensor is running, reducing costly downtime. Vision Manager also includes a full software emulator, allowing users to develop or troubleshoot inspections offline, without a sensor.

Installation Instructions

Install the Accessories

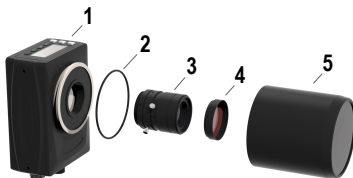


Figure 3. Install the Accessories

1. VE sensor
2. O-ring (used with the lens cover)
3. C-mount lens (available separately)
4. Filter (optional)
5. Lens cover (optional)

An external light (optional) is not shown.



NOTE: A lens cover and a ring light cannot be used together.

1. If you are using a lens cover: Remove the black thread protector (not shown) from the sensor (1).
2. If you are using a lens cover: Fit a single o-ring (2) into the undercut area behind the sensor threads.
3. Remove the yellow temporary imager cover (not shown) from the sensor.



CAUTION: Do not remove the imager cover until you are ready to install the lens. Do not touch the imager. Dirt or dust on the imager can affect sensing reliability.

4. Remove any protective covers from the lens. Handle the lens carefully to avoid smudges and dirt on the optical elements.
5. Thread the lens (3) onto the sensor.
6. Make sure that the lens is focused; see [Acquire a Good Image](#) on page 6.
7. Use the thumbscrews on the lens to lock the focus and aperture rings and to prevent movement that can occur during cleaning or accidental contact.

8. If you are using a filter: Thread the filter (4) onto the front of the C-mount lens.
9. If you are using a linear polarization filter: Rotate the outer portion of the filter mount to determine the position where glare is reduced the most, and use the locking thumbscrew to fasten the filter in position.
10. If you are using a lens cover: Thread the lens cover (5) onto the threaded portion of the sensor.
11. Or, if you are using an external light bracket: Attach an external light bracket to the sensor using the provided hardware kit.



NOTE: For optimal imaging, provide adequate dissipation of heat. A good heat conductor, such as aluminum, may be required.

Mount the Sensor

1. If a bracket is needed, mount the sensor onto the bracket.
2. Mount the sensor (or the sensor and the bracket) to the machine or equipment at the desired location. Do not tighten the mounting screws at this time.
3. Check the sensor alignment.
4. Tighten the mounting screws to secure the sensor (or the sensor and the bracket) in the aligned position.

Connect the Cables

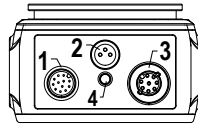


Figure 4. Cable Connections

1. Power, Discrete I/O connection
2. Light connection
3. Ethernet connection
4. Ethernet indicator



1. Connect the Ethernet cable to the sensor (3) and to the computer or Ethernet switch.
2. Connect the power, discrete I/O cable to the sensor (1), and the leads to the appropriate locations. See [Table 1](#) on page 3 for the power, discrete I/O connections.
3. Connect the external light cable (optional) to the light connection (2) if the light is powered by the sensor.



CAUTION: Use Appropriate Power

If the light is powered by the sensor, the sensor power source must be 24 V dc. This connection is for Banner lights only.

Table 1: Power and I/O Pinouts

| Pin | Wire Color | Description | Direction |
|--|------------|--|--------------|
| 1 | White | Discrete I/O #3 | Input/Output |
| 2 | Brown | 12 V dc to 30 V dc | Input |
| 3 | Green | I/O output common  | - |
| Important: For PNP (sourcing) outputs connect pin 3 to +V dc, for NPN (sinking) outputs connect pin 3 to 0 V dc. The discrete I/O pins are 1, 5, 8, 10, and 11. | | | |
| 4 | Yellow | Reserved | - |
| 5 | Gray | Discrete I/O #5 | Input/Output |
| 6 | Pink | Trigger input | Input |
| 7 | Blue | Common | Input |
| 8 | Red | Discrete I/O #2 | Input/Output |
| 9 | Orange | I/O input common  | - |
| Important: For PNP (sourcing) inputs connect pin 9 to 0 V dc, for NPN (sinking) inputs connect pin 9 to +V dc. The discrete I/O pins are 1, 5, 6, 8, 10, and 11. | | | |
| 10 | Light Blue | Discrete I/O #4 | Input/Output |
| 11 | Black | Discrete I/O #1 | Input/Output |
| 12 | Violet | Reserved | - |
| Shield | Bare metal | Chassis ground | - |

Wiring Diagrams

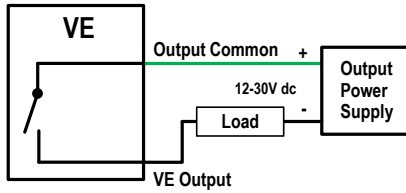


Figure 5. PNP Output

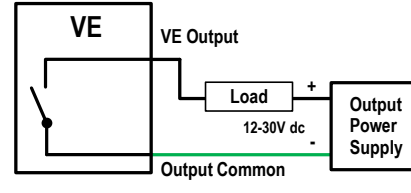


Figure 6. NPN Output

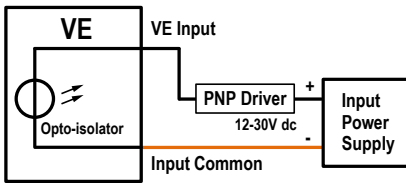


Figure 7. PNP Input

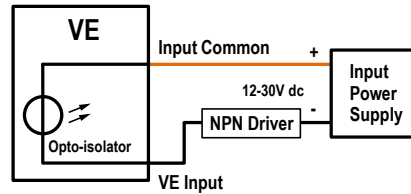


Figure 8. NPN Input

Install the Software

PC Requirements

Operating System

Microsoft® Windows® operating system version 7, 8, or 10²

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.

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.

Getting Started









Power up the sensor, and verify that the  power/error LED is ON green and that the Ethernet indicator is ON amber to verify the Ethernet connection.

Connect to the Sensor

These instructions use Windows® operating system version 7, 8, or 10.³

² Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.

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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.
 - 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

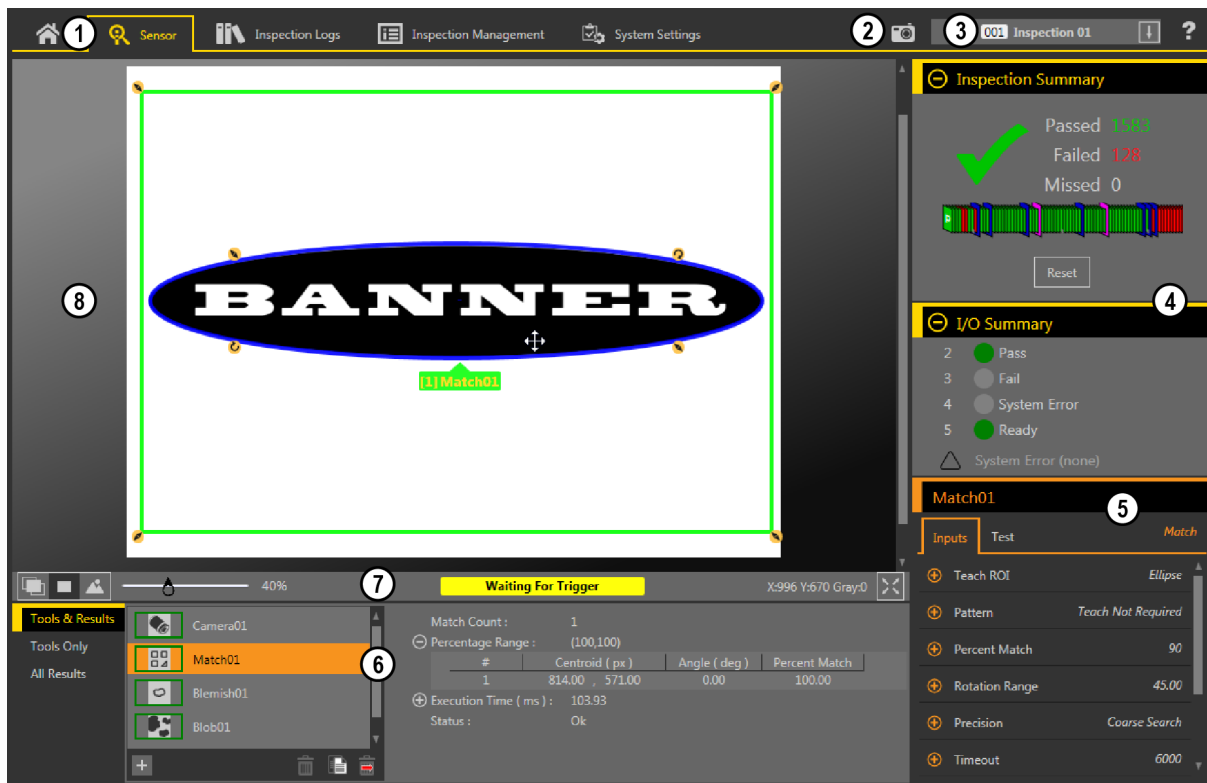
Or, manually enter the sensor's IP address.



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

Sensor Screen

The  Sensor screen displays the information needed to create or modify an inspection.





1. Screens—Home, Sensor, Inspection Logs, Inspection Management, System Settings
2. Manual Trigger button—Click to manually trigger the sensor
3. Inspection list—Select the desired inspection to start, and to view or modify the inspection
4. Summary pane—Includes the Inspection Summary and the I/O Summary
5. Parameters pane—Includes user-adjustable Inputs parameters or Test parameters for the tools in an inspection, depending on what is selected in the Tools and Results pane
6. Tools and Results pane—Includes Tools and Results, Tools Only, and All Results, which display the camera tool, the tools that are included in the current inspection, and the results of the inspection
7. Image Pane Parameters panel—Includes ROI view buttons, zoom, x and y coordinates, grayscale value, and full image display button, as well as sensor messages
8. Image pane—Displays the current image captured by the sensor; this includes the region of interest (ROI) for the tool for the selected inspection

Figure 9. Sensor Screen

Acquire a Good Image

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

1. Make sure that the lighting is appropriate for your target. Use supplementary lighting, such as a ring light, if necessary.
2. Click the  Sensor screen.
3. Click the  camera tool on Tools and Results. The Inputs parameters display.
4. Set the trigger.
 - a) Expand the Trigger parameters.
 - b) In the Trigger Mode list, click Internal (continuous images).
5. Run Auto Exposure.
 - a) Expand the Imager parameters.
 - b) Expand the Auto Exposure parameters, and click Start to run.
6. Check the lighting on the part.
 - 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 the feature of interest from the background. Depending on the target, consider other Banner lights.
 - Adjust the mounting angle to provide the clearest image of the part features you are inspecting.

7. After checking and adjusting the lighting, run Auto Exposure a second time or adjust the exposure manually by expanding the Exposure parameters and moving the slider or entering a specific exposure time.
8. Adjust the focus.
 - a) Place the part so that the area to be focused appears in the center of the Image pane.
 - b) Expand the Focus Info parameters.
 - c) Make sure that the Focus Info checkbox is selected.
 - d) Adjust the focus of the lens while monitoring the focus number.

The focus number is a number between 1 and 255. Use the Image pane to determine when the image is sharp enough, or use the focus number as a guide. Turn the focus ring on the lens until the focus number is at the highest possible number between 1 and 255. The focus number is also available on the sensor display.





NOTE: There is no optimal value for this number, but it can be used as a guide if you are setting up more than one sensor that are focused on the same target.


- e) Tighten the locking thumbscrews to secure the lens at the desired focus.












Set Up an Inspection

Vision Manager allows you to set up or make changes to an inspection while the sensor is running. Changes are automatically saved as they are made.



1. From the  Sensor screen, click  in the upper right corner to view the inspection list.
2. Click Add New Inspection.
A new inspection is added to the list, the Image pane updates, and the Tools & Results tab shows only the camera tool.
3. Add tools and adjust them as needed for the inspection.

Add a Tool

1. Click  on the Tools & Results tab.
The Add Tool window opens.
2. Click the desired tool.

| Tool Name | Description |
|--|---|
|  Average Gray | Evaluates pixel brightness within an ROI and computes the average grayscale value. |
|  Bead | Inspects parts for uniformity of adhesive or sealant material, or for uniformity of a gap. |
|  Blemish | Determines whether flaws are present on a part, or detects whether a feature exists on a part. |
|  Blob | Detects and counts/locates groups of connected light or dark pixels within the ROI and designates them as blobs (Binary Large Objects). After blobs are found, they can be characterized by size and shape. |
|  Edge | Detects and counts transitions between bright and dark pixels (edges). Counts the total number of edges, and determines the position of each edge. |
|  Locate | Finds the first edge on a part and compensates for translation and rotation of downstream tools (if selected). |
|  Match | Verifies that a pattern, shape, or part in any orientation matches a reference pattern. Can also compensate for translation and rotation of downstream tools (if selected). |
|  Object | Detects the edges of dark and bright segments and locates their midpoints. Counts dark and bright segments, and measures the width of each dark and bright segment. |
|  Math | Performs mathematical operations using tool data or user-supplied constants. Includes basic arithmetic, inequality expressions, and statistical information. |
|  Measure | Measures distance, calculates angles, and creates points and lines for use as inputs to other tools. |
|  Logic | Uses Boolean logic to combine or convert tool results, or to drive discrete outputs from tool results. Logic tool data can be used to evaluate the results of a single tool or multiple tools. |




The tool is added to Tools & Results and the region of interest (ROI) appears on the Image pane.

3. Configure the tool as needed for your application.
 - a) Resize  and rotate  the ROI around the feature to be analyzed.
 - b) Define or view parameters for the tool on the Input tab, such as ROI shape, threshold, or view the histogram.
 - c) Define pass or fail criteria on the Test tab, such as the count, size, or match.

Save an Inspection to a Computer, Network Drive, or Storage Device

Vision Manager automatically saves inspections to the VE as they are created and modified. Save a copy of the inspection to your computer or another network location if you want to be able to go back to previous settings.

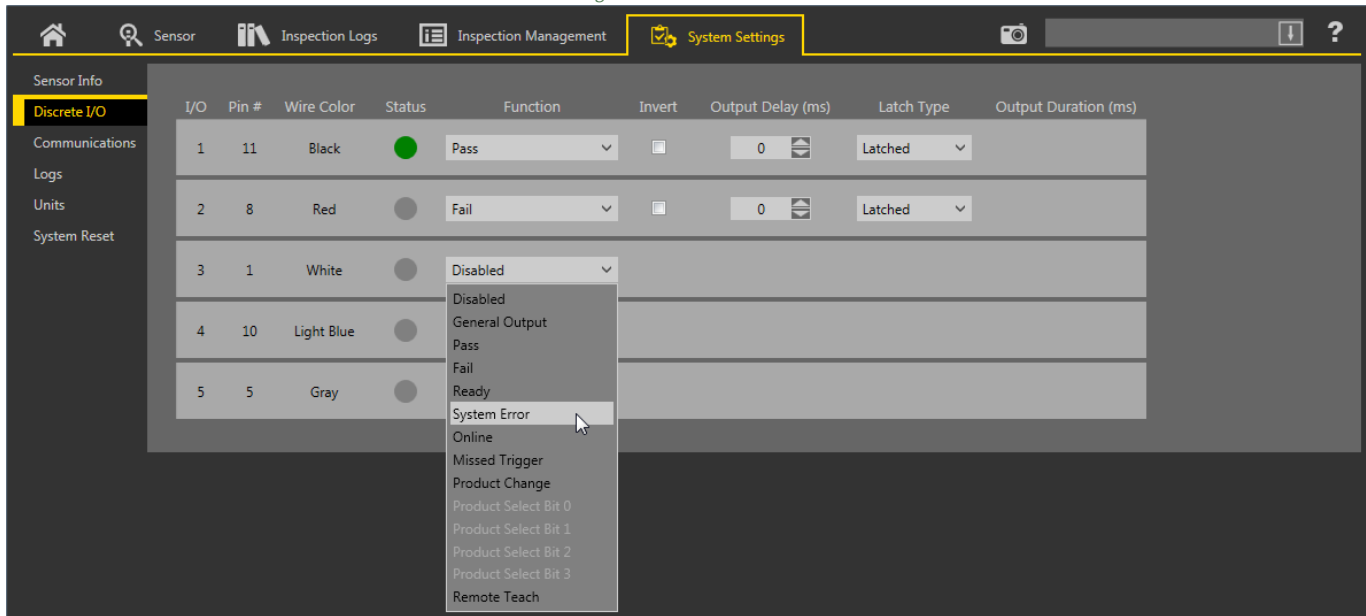
Use the following procedure to save a copy of an inspection to your computer or a network location.

- On the  Inspection Management screen, click Transfer.
- Change the destination folder, if desired.
 - Click  above the right column.
An explorer window opens.
 - Navigate to the desired location, network location, or storage device.
 - Click Select Folder.
The folder is selected and the window closes.
The path to the location displays above the right column.
- Select the desired inspection from the inspection list in the left column.
- Click .
Inspection name.idb displays in the right column and the inspection is transferred (saved) to the selected location.

Configure the Discrete I/O

From the  System Settings screen, select Discrete I/O to change the discrete I/O settings.

Figure 10. Discrete I/O




For more details, see the Instruction Manual.

Sensor Display

The LCD display on the top of the sensor provides access to view or change several settings without using Vision Manager. The display provides limited programming options:

- ETHER—Ethernet settings
- PCHANGE—Product change
- IO—Input/Output settings
- IMAGE—Image settings
- INFO—Sensor information
- SYSERROR—System errors, if present
- DISPLAY—Display settings
- REBOOT—Reboot

Access the sensor menu by pressing Enter  from the Home Screen.

See the Instruction Manual, p/n 191666, for more information.

Sensor Display Interface



Down and Up Buttons

Press Down and Up to:

- Navigate the menu systems
- Change programming settings


When navigating the menu systems, the menu items loop.



Enter Button

Press Enter to:

- Access the Sensor Menu
- Access the submenus
- Save changes

In the Sensor Menu, a check mark  in the lower right corner of the display indicates that pressing Enter accesses a submenu.




Escape Button

Press Escape to:

- Leave the current menu and return to the parent menu
- Leave the current menu and return to the Home Screen from any menu

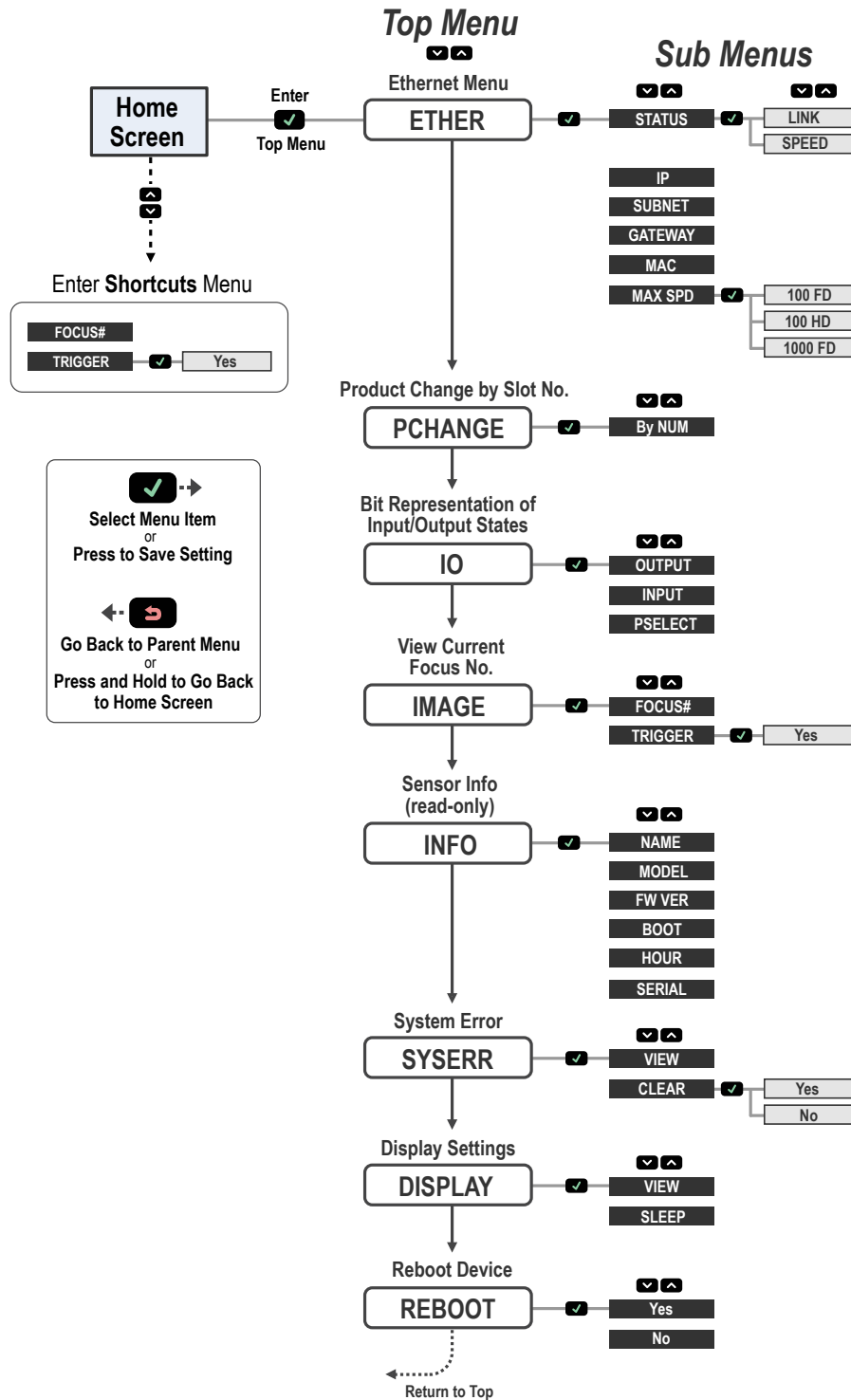


Important: Pressing Escape discards any unsaved changes.

In the Sensor Menu, a return arrow  in the upper left corner of the display indicates that pressing Escape returns to the parent menu.

Press and hold Escape for 2 seconds to return to the Home Screen from any menu.

Sensor Menu



VE Series User Interface

Figure 11. Menu Map

Specifications

Power

12 V dc to 30 V dc (24 V dc \pm 10% if a Banner light source is powered by the sensor)
Current: 400 mA maximum (exclusive of load and lights)
Use only with a suitable Class 2 power supply, or current limiting power supply rated 12 V to 30 V dc, 1 A

Supply Protection Circuitry

Protected against reverse polarity and transient overvoltages

Discrete I/O

1 Trigger IN
5 Programmable I/O

Output Configuration

Optically isolated

Output Rating

Output Resistance: < 2 Ω
Strobe Output Resistance: < 13 Ω
Programmable Output: 100 mA
External Strobe Output: 100 mA
Off-State Leakage Current: < 100 μ A

External Light Maximum Current Draw

600 mA

Exposure Time

0.02 ms to 500 ms

Imager

VE200G1A: 6.9 mm \times 5.5 mm, 8.7 mm diagonal (1/1.8-inch CMOS)
VE201G1A: 6.9 mm \times 5.5 mm, 8.7 mm diagonal (1/1.8-inch CMOS)
VE202G1A: 7.2 mm \times 5.4 mm, 9.0 mm diagonal (1/1.8-inch CMOS)
VE202G2A: 7.2 mm \times 5.4 mm, 9.0 mm diagonal (1/1.8-inch CMOS)

Lens

C-mount

Pixel Size

VE200G1A: 5.3 μ m
VE201G1A: 5.3 μ m
VE202G1A: 4.5 μ m
VE202G2A: 4.5 μ m

Communication

10/100/1000⁴ Mbps Ethernet

Memory

Device Settings and Inspection Storage Memory: 500 MB
Number of inspection files: 999

Acquisition

256 grayscale levels

| Model | Frames Per Second ⁵ | Image Size |
|----------|--------------------------------|-----------------------|
| VE200G1A | 60 fps, maximum | 752 \times 480 px |
| VE201G1A | 60 fps, maximum | 1280 \times 1024 px |
| VE202G1A | 50 fps, maximum | 1600 \times 1200 px |
| VE202G2A | 50 fps, maximum | 1600 \times 1200 px |

Torque—Tapped Holes for Mounting Screws

8 lbf-in (0.9 N-m) maximum torque

Construction

Housing: Aluminum
Display Label: Polyester

Connections

Ethernet: M12, 8-pin or 4-pin D-code Euro-style female
Light Connector: M8, 3-pin Pico-style female
Power, Discrete I/O: M12, 12-pin Euro-style male

Environmental Rating

IEC IP67 with an optional lens cover properly installed

Operating Conditions

Operating Temperature: 0 °C to +50 °C (+32 °F to +122 °F)
95% maximum relative humidity (non-condensing)
Stable Ambient Lighting: No large, quick changes in light level; no direct or reflected sunlight
Storage Temperature: -30 °C to +70 °C (-22 °F to +158 °F)

Vibration and Mechanical Shock

Meets EN 60947-5-2: 30 G Shock per IEC 60068-2-27; 1 mm amplitude from 10 - 60 Hz per IEC 60068-2-6

Certifications



Information
Technology
Equipment
E365235



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⁴ 1000 Mbps communication speed not available on 4-pin Ethernet models

⁵ This value can vary based on inspection settings.