ZMX Series 3D Time of Flight Sensor Product Manual

Original Instructions
p/n: 230551 Rev. F
12-Aug-25
© Banner Engineering Corp. All rights reserved. www.bannerengineering.com

ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

Contents

Chapter 1 Product Description 4
1.1 Models 4
1.2 Features and Indicators 4
1.3 Sample Application: Bin Fill 5

Chapter 2 Specifications and Requirements 6
2.1 Specifications 6
2.2 Class 1 Laser Description and Safety Information 7
2.3 FCC Part 15 Class A for Unintentional Radiators 8
2.4 Industry Canada ICES-003(A) 8
2.5 Performance Curves 9
2.6 PC Requirements 9
2.7 Dimensions 10
2.8 Field of View Charts 11
2.9 Factory Defaults 11

Chapter 3 Installation Instructions 12
3.1 Installation Best Practices 12
3.2 Mount the Device 13
3.3 Wiring 13
3.4 Install the Software 14

Chapter 4 Getting Started 15
4.1 Connect to the Sensor 15
4.2 Set Up the ZMX Sensor 16

Chapter 5 Banner 3D Configuration Workspace 17
5.1 Image Pane Parameters 18
5.2 **Connection** Pane 19
5.3 **Sensor Controls** Pane 20
5.4 **Fill Level** Pane 21
5.5 **Communications** Pane 23
5.5.1 DHCP 23
5.6 **Sensor Maintenance** Pane 24

Chapter 6 Industrial Ethernet Overview 25
6.1 EtherNet/IP™ 25
6.1.1 Configuring the Sensor to use an Industrial Protocol 25
6.1.2 ZMX Series 3D Time of Flight Sensor EDS File Installation in ControlLogix Software 26
6.1.3 EtherNet/IP Configuration Using Generic Ethernet Module 32
6.1.4 Assembly Objects 35
6.1.5 Controlling the ZMX Sensor 38
6.2 Modbus® TCP 39
6.1.1 Configuring the Sensor to use an Industrial Protocol 25
6.2.2 Using Input Bits 40
6.2.3 ZMX Sensor Output Values 41
6.2.4 ZMX Sensor Input Values 42
6.3 Troubleshooting 43
6.3.1 Sensor Fault Codes 43
6.3.2 Configuration Error Codes 44

Chapter 7 Accessories 46
7.1 Cordsets 46
7.2 Brackets 47

Chapter 8 Product Support 48
8.1 Cleaning Instructions 48
8.2 Back Up the Sensor 48
8.3 Restore the Sensor 48
8.4 Repairs 49
8.5 Contact Us 49

© Banner Engineering Corp. All rights reserved. www.bannerengineering.com

8.6 Banner Engineering Corp Limited Warranty 49
8.7 Banner Engineering Corp. Software Copyright Notice 49

© Banner Engineering Corp. All rights reserved. www.bannerengineering.com

Chapter Contents

1.1 Models 4
1.2 Features and Indicators 4
1.3 Sample Application: Bin Fill 5

Chapter 1 Product Description

Simple, reliable, volume and height monitoring with ZMX Series 3D Time of Flight Sensor. Patent pending.



- 3D Time of Flight technology detects peak fill height and calculates an estimate of volume within a large field of view
- Fits many applications with adjustable sensing height and field of view
- Sensor monitors entire sensing region of interest, not a single point like an ultrasonic or laser sensor
- Completely self-contained, no controller or PC required
- Deploy in minutes with only a few settings to define
- Configurable sensing range up to 2.5 m for height monitoring
- Define sensor field of view to monitor specific area of interest
- Available in discrete and Pulse Pro outputs for simplified deployment; industrial Ethernet communications available to integrate with the Smart Factory
- Compact, rugged IP65 housing designed for industrial environments

WARNING:

- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

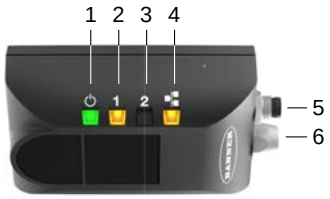
1.1 Models

Models	Resolution	Field of View	Range	Connection
ZMX-3DE2500HF-Q7	272 × 208 pixels	60 × 45 degrees	200 mm to 2500 mm (7.9 in to 8.2 ft)	Integral 4-pin M8
ZMX-3DE2500HF-Q8				Integral 5-pin M12

1.2 Features and Indicators

LED indicators provide ongoing indication of sensing status.

Figure 1. Features



1. Power and Fault LED (off, green, red, or flashing red)
2. Ready LED
3. Image Transmitted LED
4. Ethernet Activity LED
5. Ethernet connection
6. Power connection

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

1.3 Sample Application: Bin Fill

Use the ZMX Series 3D Time of Flight Sensor in a variety of applications.

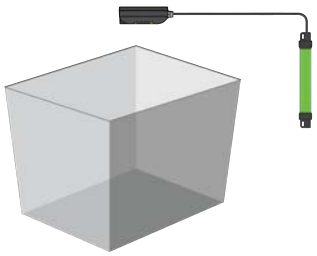
- Gaylord volume fill level monitoring at a material handling facility
- Continually monitoring the height of packages in a shipping container
- Level monitoring of consumer or grocery items in a tote
- Determine if an item is protruding over the top of a bin
- Detect overfill of items within a defined region of interest

When boxes or other solid objects are collected in a bin, the true amount of space consumed is not accurately measured by measuring the height at any one point. Inconsistent shapes and uneven stacking are common, leaving an uneven top surface. Many other types of distance measurement sensors can give inconsistent readings. Sometimes their measurements vary based on whether they hit a top surface object or a hole between objects. The ZMX sensor measures distance over a large rectangular area and calculates an estimate of the fill level as well as the peak height of the whole area, allowing better control of how the bin space is used and preventing overfill.

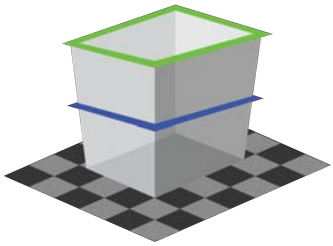
Figure 2. ZMX Sensor and Tower Light At the Bottom of a Chute



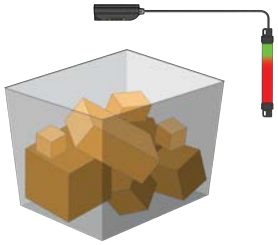
Container monitoring in three simple steps, up and running within minutes.



Step 1—Mount and connect to sensor – mounting is ultra-simple with built-in mounting holes or a variety of mounting brackets to choose from. Once mounted, connect the cables and begin communicating with Banner Banner 3D Configuration software.



Step 2—Define Sensing Conditions – only a few inputs need to be defined for the sensor to accurately monitor container height. Start by defining the anchor point for measurements at the bottom of the container, then define the size of the sensing region of interest. Finally, choose the sensing criteria for the application such as peak height or volume.



Step 3—Monitor fill level – Once mounted and configured, the sensor is completely self-contained and does not require any external controllers or PC. Begin sensing and integrate with chosen PLC, controller, or indication light.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Chapter Contents

2.1 Specifications 6
2.2 Class 1 Laser Description and Safety Information 7
2.3 FCC Part 15 Class A for Unintentional Radiators 8
2.4 Industry Canada ICES-003(A) 8
2.5 Performance Curves 9
2.6 PC Requirements 9
2.7 Dimensions 10
2.8 Field of View Charts 11
2.9 Factory Defaults 11

Chapter 2 Specifications and Requirements

2.1 Specifications

Sensing Range
200 mm to 2500 mm (7.9 in to 8.2 ft) on a 90% reflectance white target

200 mm to 2500 mm (7.9 in to 8.2 ft) on a 20% reflectance gray target

200 mm to 1700 mm (7.9 in to 5.6 ft) on a 6% reflectance black target

Supply Voltage
12 V DC to 30 V DC

Current: 200 mA average, 2.5 A peak (exclusive of load and lights)

Use only with a suitable Class 2 power supply, or current-limiting power supply rated 12 V DC to 30V DC, 2.5 A

Discrete I/O Configuration
Channel 1: Push-pull, PNP or NPN discrete output, or Pulse Pro/Pulse Frequency Modulation (PFM) output

Channel 2: PNP or NPN discrete output, or Pulse Pro/Pulse Frequency Modulation (PFM) output, or remote trigger

Flatness (Pixel-to-Pixel Accuracy)[1]
±20 mm for > 10x excess gain

±60 mm for 2x to 10x excess gain

Response Time
150 ms in Free Run mode

Accuracy[1]
±30 mm for > 10x excess gain[2]

Repeatability (1-sigma)[1]
Peak excess gain: 2 mm

> 10x excess gain, 10 mm

> 2x excess gain, 40 mm

Communication Interface
Ethernet; 100 Mbps

Communication Protocol
Modbus® TCP/IP

EtherNet/IP™

Modbus® is a registered trademark of Schneider Electric USA, Inc. EtherNet/IP™ is a trademark of ODVA, Inc.

Boresighting
±20 mm at 1 m range

Delay at Power Up
< 10 s

[1] Accuracy, repeatability, and flatness specifications assume no saturation in the field of view.

Performance specifications are stated at room temperature, after the sensor warms up (15 minutes).

[2] For 6% to 90% diffuse targets in the center 25% of the field of view; ±60 mm accuracy for 2x to 10x excess gain.

Recommended Warm Up Time
15 minutes

Light Source
Infrared, 850 nm

Temperature Effect
< 0.5 mm/°C

Resolution
272 horizontal × 208 vertical pixels

Field of View
60 horizontal × 45 vertical degrees

Reading Rate, Full Resolution
Up to 6 frames per second in Free Run mode

Ambient Light Immunity
10,000 lux

Torque—Tapped Holes for Mounting Screws
8 in·lbf (0.904 Nm) maximum torque

Torque—Cables
Only finger tighten the connectors

Minimize cable pull or hanging weight, including right-angle installations

Construction
Housing: Aluminum

Lens Cover: Acrylic with optical coating

Light Pipe: Polycarbonate

Connections
4-pin M8 male or 5-pin M12 male for power and discrete I/O

4-pin M8 female or 4-pin M12 D-coded female for ethernet

Storage Conditions
–30 °C to +65 °C (–22 °F to +149 °F)

Operating Conditions
–10 °C to +40 °C (+14 °F to +104 °F), assuming adequate mounting and ventilation

Environmental Rating
IP65 per IEC60529

Vibration
MIL-STD-202G, Method 201A (Vibration: 10 Hz to 55 Hz, 0.06 inch (1.52 mm) double amplitude, 2 hours each along X, Y and Z axes), with device operating

Shock
MIL-STD-202G, Method 213B, Condition I (100G 6x along X, Y, and Z axes, 18 shocks), with device operating

Weight
205 g

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Output Rating

Current rating: 50 mA maximum

White wire specifications per configuration		
PNP	Output High	≥ Vsupply − 2.5 V
	Output Low	≤ 2.5 V (loads ≤ 70 kΩ)
NPN	Output High	≥ Vsupply − 2.5 V
	Output Low	≤ 2.5 V

Required Overcurrent Protection

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.

Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.

Supply wiring leads < 24 AWG shall not be spliced.

For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

Certifications

Banner Engineering BV
Park Lane, Culliganlaan 2F bus 3
1831 Diegem, BELGIUM

Turck Banner LTD Blenheim House
Blenheim Court
Wickford, Essex SS11 8YT
GREAT BRITAIN

E526767

Advanced Capabilities

2.2 Class 1 Laser Description and Safety Information



Laser light. Do not stare into the beam.

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 56, dated May 8, 2019.

CLASS 1
LASER PRODUCT

CAUTION:

- **Never stare directly into the sensor lens.**
- Laser light can damage your eyes.
- Avoid placing any mirror-like object in the beam. Never use a mirror as a retroreflective target.

CAUTION:

- **Return defective units to the manufacturer.**
- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Do not attempt to disassemble this sensor for repair. A defective unit must be returned to the manufacturer.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

CAUTION:
- **Ne regardez jamais directement la lentille du capteur.**
- La lumière laser peut endommager la vision.
- Évitez de placer un objet réfléchissant (de type miroir) dans la trajectoire du faisceau. N'utilisez jamais de miroir comme cible rétro-réfléchissante.

CAUTION:
- **Tout dispositif défectueux doit être renvoyé au fabricant.**
- L'utilisation de commandes, de réglages ou de procédures autres que celles décrites dans le présent document peut entraîner une exposition dangereuse aux radiations.
- N'essayez pas de démonter ce capteur pour le réparer. Tout dispositif défectueux doit être renvoyé au fabricant.

Class 1 lasers are lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Complies with IEC 60825-1:2014 and EN 60825-1:2014+A11:2021.

For safe laser use:
- Do not stare at the laser.
- Do not point the laser at a person’s eye.
- Mount open laser beam paths either above or below eye level, where practical.
- Terminate the beam emitted by the laser product at the end of its useful path.

2.3 FCC Part 15 Class A for Unintentional Radiators

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

(Part 15.21) Any changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate this equipment.

2.4 Industry Canada ICES-003(A)

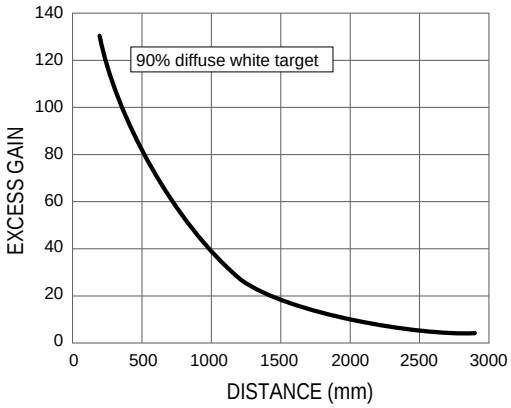
This device complies with CAN ICES-3 (A)/NMB-3(A). Operation is subject to the following two conditions: 1) This device may not cause harmful interference; and 2) This device must accept any interference received, including interference that may cause undesired operation.

Cet appareil est conforme à la norme NMB-3(A). Le fonctionnement est soumis aux deux conditions suivantes : (1) ce dispositif ne peut pas occasionner d'interférences, et (2) il doit tolérer toute interférence, y compris celles susceptibles de provoquer un fonctionnement non souhaité du dispositif.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

2.5 Performance Curves

Figure 3. Typical Excess Gain



2.6 PC Requirements

Operating System
Microsoft® Windows® operating system version 8, 10, or 11[3]

Hard Drive Space
100 MB

Screen Resolution
1024 × 768 pixels

Memory (RAM)
500 MB

Ports Needed
TCP/IP port 32000
TCP/IP port 32200
UDP/IP Port 19995

[3] Microsoft and Windows are trademarks of the Microsoft group of companies.

IMPORTANT: Administrative rights may be required to install the Banner 3D Configuration software.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

2.7 Dimensions

All measurements are listed in millimeters [inches], unless noted otherwise. The measurements provided are subject to change.

Figure 4. M8 Models

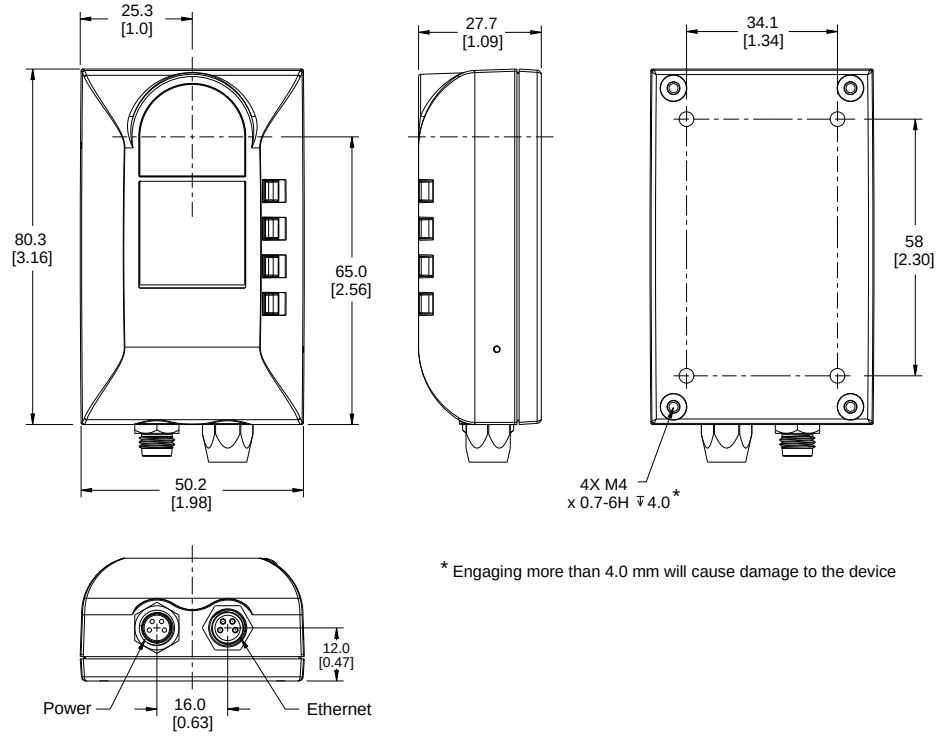
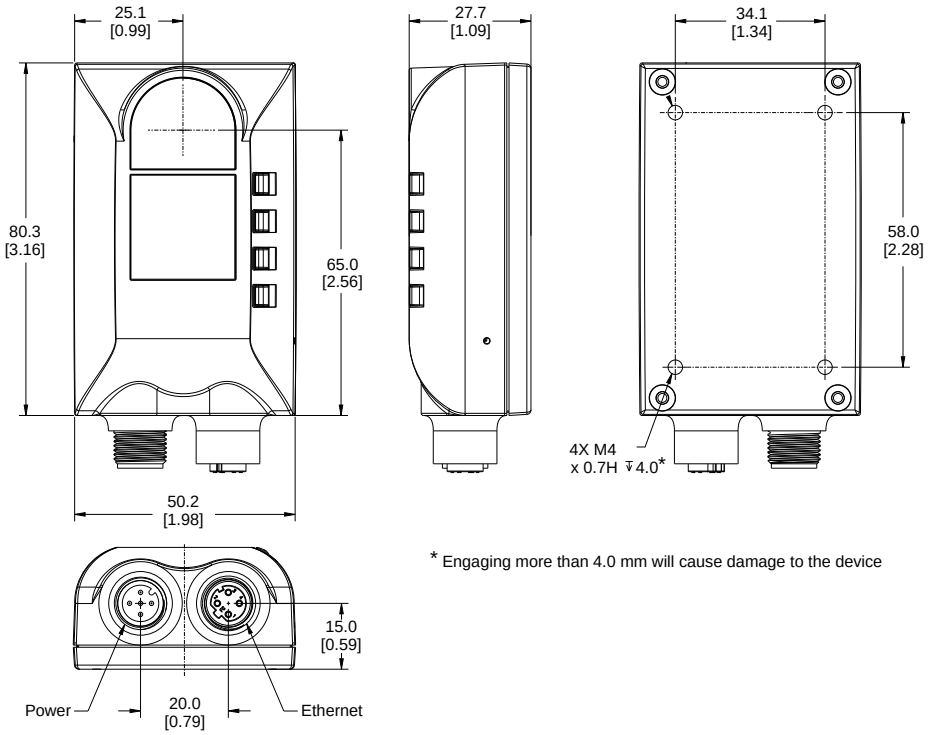


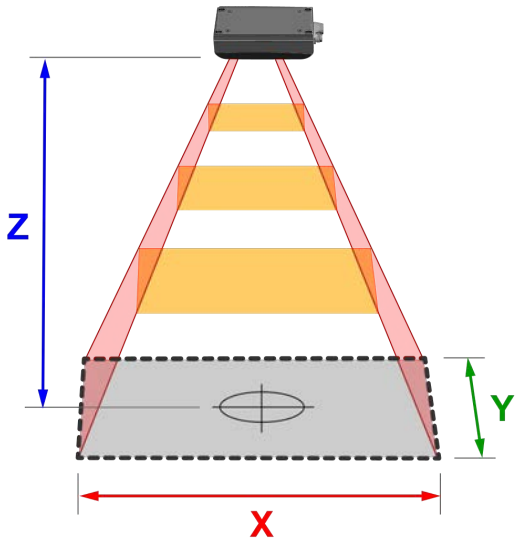
Figure 5. M12 Models



© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

2.8 Field of View Charts

Figure 6. Typical FOV Chart



Z (mm)	X (mm)	Y (mm)
250	250	200
500	600	450
750	900	700
1000	1200	900
1500	1850	1400
2000	2450	1850
2500	3100	2350
3000	3700	2850

2.9 Factory Defaults

The following table lists some of the factory default settings for both the device and the software.

Setting	Factory Default
IP Address	192.168.0.10
Subnet Mask	255.255.255.0
Gateway	0.0.0.0
Trigger Mode	Internal at 250 ms or 4 frames per second
Illumination Power	40%
Pitch	0°
Roll	0°
Yaw	0°
Discrete Output Polarity	PNP
DHCP	Disabled
Industrial Protocols	Off

To restore the sensor to the factory default settings, go to the **Sensor Maintenance** pane and click **Reset To Factory Defaults**.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Chapter Contents

3.1 Installation Best Practices 12
3.2 Mount the Device 13
3.3 Wiring 13
3.4 Install the Software 14

Chapter 3 Installation Instructions

3.1 Installation Best Practices

The following diagrams show best practices for installing the ZMX sensor.

Fill level measurements are calculated estimates and may vary depending on the mounting specifications or the target conditions and physical features.

Figure 7. Sensor Height

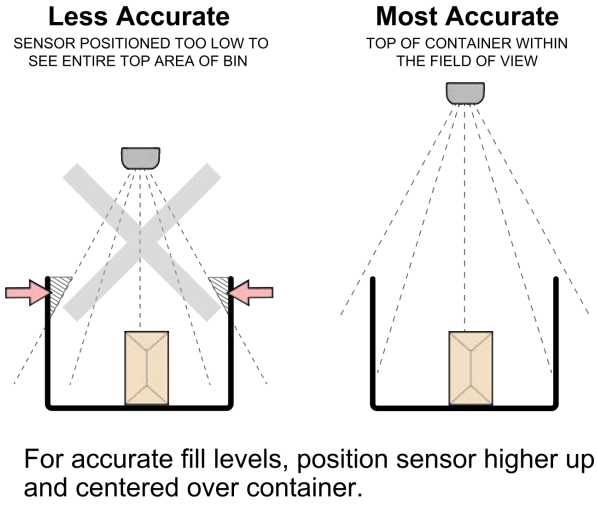
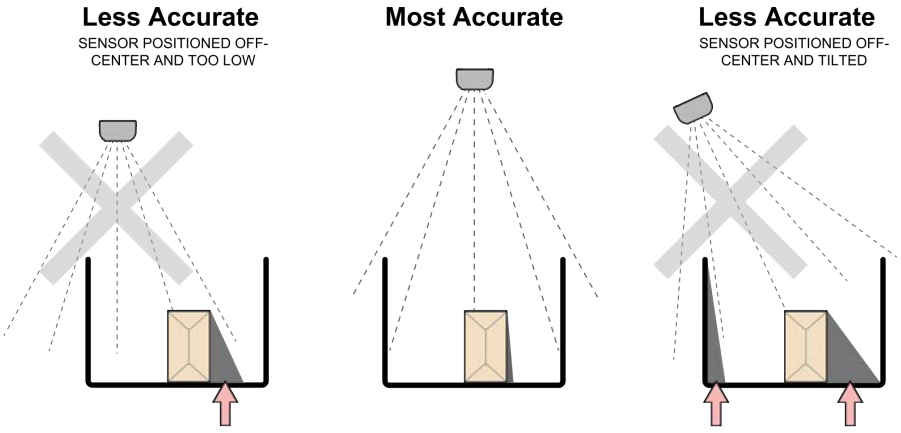


Figure 8. Minimize Blind Spots



© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

3.2 Mount the Device

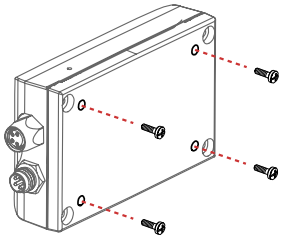
1. If a bracket is needed, mount the device onto the bracket.
2. Mount the device (or the device and the bracket) to the machine or equipment at the desired location. Do not tighten the mounting screws at this time.

CAUTION: This device accepts M4 screws. Engaging the screws more than 4 mm will damage the device.

CAUTION: 8 in·lbf (0.904 Nm) maximum torque

3. Check the device alignment.
4. Tighten the mounting screws to secure the device (or the device and the bracket) in the aligned position.

Figure 9. Mounting Holes



NOTE: Do not remove the housing screws.

NOTE: Provide adequate dissipation of heat. A good heat conductor, such as aluminum, may be required.

Mounting Surface Thickness	Length of Mounting Screws
≤ 2 mm	4 mm
2 mm to 4 mm	6 mm
4 mm to 6 mm	8 mm

3.3 Wiring

To maintain the ratings listed in the Specifications, the ZMX Series 3D Time of Flight Sensor requires using a specific type of shielded cable. Refer to the Instruction Manual's accessories list for more information.

Tighten the cables finger tight only.

Figure 10. Channel 1 as PNP Output, Channel 2 as Trigger Input

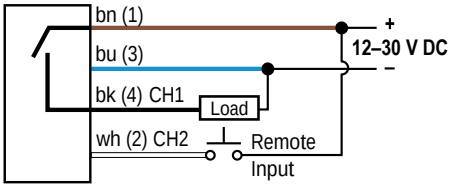


Figure 11. Channel 1 as NPN Output, Channel 2 as Trigger Input

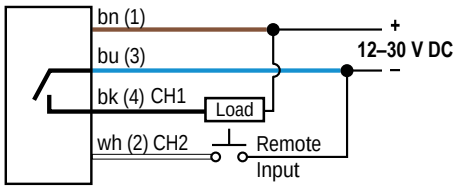


Figure 12. M8 Male Connector

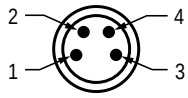
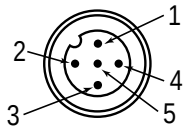


Figure 13. M12 Male Connector



© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Table 1. Power and I/O Pinouts

Pin	Wire Color	Description
1	Brown	12 V DC to 30 V DC
2	White	Trigger Input or Output (selectable PNP, NPN, or push-pull)
3	Blue	Common
4	Black	Output (selectable PNP, NPN, or push-pull)
5 (M12 only)	Gray	Not connected

3.4 Install the Software

Use the following instructions to install the Banner 3D Configuration software on your computer.

IMPORTANT: Administrative rights may be required to install the Banner 3D Configuration software.

1. Download the latest version of the software from www.bannerengineering.com.
2. Navigate to and open the downloaded file.
3. Run the downloaded installer.
4. Check the agreement for license terms and conditions.
5. Click **Install** to install the software.
   A Windows security message displays. This indicates that the installer is signed and is from Banner.
6. Click **Yes**.
7. Click **Close** to exit the installer when the installation is complete.
8. Locate the program icon on the desktop or in the **Start** menu and open the Banner 3D Configuration software.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Chapter Contents

4.1 Connect to the Sensor 15
4.2 Set Up the ZMX Sensor 16

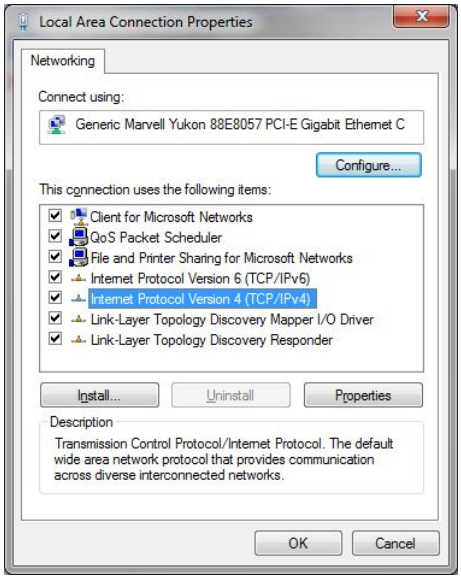
Chapter 4 Getting Started

4.1 Connect to the Sensor

These instructions use Windows® operating system version 8, 10, or 11.[4]

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 14. 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 (or an unused IP address within the 192.168.0.x subnet), and the subnet mask is 255.255.255.0.
2. Open the Banner 3D Configuration software from the desktop or the **Start** menu.
3. Connect to the ZMX sensor using one of the following options:
   - From the **Connection** pane, enter the IP address of the desired ZMX sensor into the **Sensor IP Address** field, then click **Connect**.
   - From the **Connection** pane, locate the IP address of the desired sensor in the list of discovered sensors, then click ➡ next to **IP Address**.

   The default IP address for the sensor is 192.168.0.10.

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

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

4.2 Set Up the ZMX Sensor

Use the following basic steps to set up an application in the Banner 3D Configuration software.

1. Make sure the container is in place and is empty.
2. Adjust the pitch/roll/yaw if an angle correction is needed.
   See "Sensor Controls Pane" on page 20.
3. From the **Amplitude** view, click in the center of the container.
   A green cursor displays in the center of the container and the coordinates of the cursor are shown in the lower right.
4. Copy the X, Y, and Z coordinates from the lower right of the **Image** pane into the **Anchor Point** X, Y, and Z fields in the **Fill Level** pane.
5. Enter the dimensions of the container (in mm) in the **Size** field.
   It is best practice to use slightly smaller X and Y measurements than the inner dimensions of the container.
   The white box in the view updates in size.

   > **NOTE:** If the box is not visible, click .

6. Enter the desired **Fill Level** and **Peak Height** limits.
   The lines on the **Fill** and **Peak** bar graphs update.

   > **NOTE:** Allow the sensor to warm up for 15 minutes to ensure optimal sensor performance.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

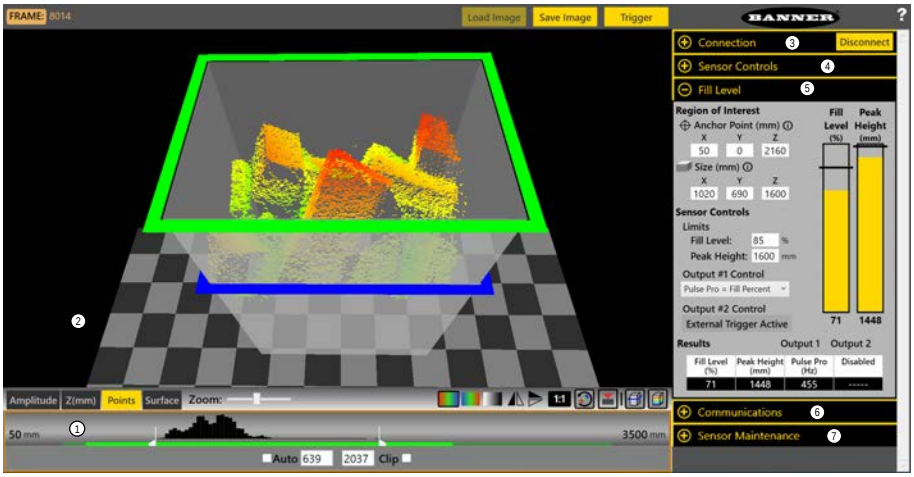
Chapter Contents

5.1 Image Pane Parameters 18
5.2 **Connection** Pane 19
5.3 **Sensor Controls** Pane 20
5.4 **Fill Level** Pane 21
5.5 **Communications** Pane 23
5.6 **Sensor Maintenance** Pane 24

Chapter 5 Banner 3D Configuration Workspace

The Banner 3D Configuration software displays the information needed to modify sensor parameters.

Figure 15. Banner 3D Configuration Software



The workspace is divided into several panes.

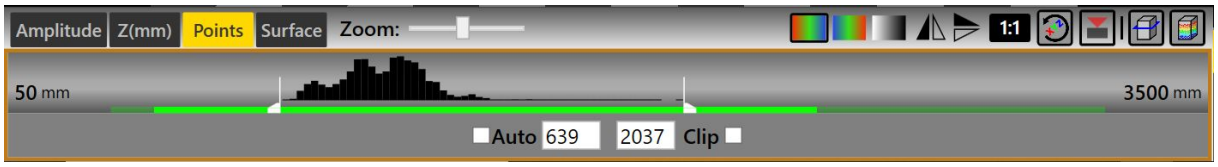
1. Image Pane Parameters—Includes zoom; x, y, z coordinates; image color; view selection (Amplitude, Z(mm), Points, Surface). The options vary depending on the selected view. See "Image Pane Parameters" on page 18.
2. Image pane—Displays the current image captured by the sensor and includes the buttons:
   - **Load Image**—Loads a previously saved file for viewing while disconnected from the sensor
   - **Save Image**—Save file as a .t3f
   - **Trigger**—Manually triggers the sensor when Trigger mode is set to **External** or **Software**
3. **Connection** pane—Enables connection to a sensor and includes settings and information related to the sensor's IP address. See "Connection Pane" on page 19.
4. **Sensor Controls** pane—Controls the trigger mode and illumination output. See "Sensor Controls Pane" on page 20.
5. **Fill Level** pane— Includes options for the region of interest and sensor controls, as well as live fill and peak height data. See "Fill Level Pane" on page 21.
6. **Communications** pane—Sets the communication protocol and DHCP option for the sensor. See "Communications Pane" on page 23.
7. **Sensor Maintenance** pane—Includes sensor information and options to update the firmware, restore the sensor to the default settings, to backup the current sensor settings, or restore the sensor to previously saved settings. See "Sensor Maintenance Pane" on page 24.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

5.1 Image Pane Parameters

Use the **Image Pane Parameters** to change how the Image pane displays.

Figure 16. Image Pane Parameters



Click a view selection button to change the view and the available options:

Amplitude
Shows a top down 2D pseudo-grayscale image of the container.

Z(mm)
Shows a top down 2D color-coded Cartesian Z image of the container.

Points
Shows the individual measurement points in 3D.

Surface
Shows a smoothed out view of the measurement points in 3D.

When using either the **Points** view or the **Surface** view, left-click, hold, and drag inside the image pane to rotate the image three-dimensionally. Right-click, hold, and drag to move the image horizontally and vertically.

The histogram graph in the center of the Image Pane Parameters graphically displays the distribution of pixels in the current image on a scale of amplitude or Z distance, depending on the current view. The white bars can be adjusted left or right to adjust the shading of the pixels. The histogram is available in all views. The specified operating distance of the sensor is colored green. A portion of the green bar is a lighter shade of green. The sensor may still return data from this region, but it may not adhere to the stated accuracy specifications of the device. The green bar is available in **Z(mm)**, **Points**, and **Surface** views.

Use the **Auto** checkbox to automatically scale the pixels to view the entire field of view. When checked, the white shading control bars are adjusted for each image to start the shading range just before the left-most pixels, and end the shading range after the right-most pixels in the histogram.

Use the **Clip** checkbox to change what is outside of the histogram graph markers to purple (**Amplitude** and **Z(mm)** views) or to disappear (**Points** and **Surface** views) to indicate that these areas are not of interest.

The two numbers between the **Auto** and **Clip** checkboxes show the locations of the two white markers in the histogram graph. These markers can be dragged to the desired location.

 Red is Near, Blue is Far—Displays objects closest to the sensor as red, while objects further from the sensor display as blue. Objects between these points display in various colors, depending on their distance from the sensor. Available in **Z(mm)**, **Points**, and **Surface** views.

 Blue is Near, Red is Far—Displays objects closest to the sensor as blue, while objects further from the sensor display as red. Objects between these points display in various colors, depending on their distance from the sensor. Available in **Z(mm)**, **Points**, and **Surface** views.

 Grayscale Overlays Distance—Changes the image color scheme to grayscale. Available in **Z(mm)**, **Points**, and **Surface** views.

 Horizontal Flip Mode—Changes the view to a horizontal mirror image of the true view—the objects that were on one side of the view are now shown on the other side. Available in all views.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

 Vertical Flip Mode—Changes the view to a horizontal mirror image of the true view - the objects that were on one side of the view are now shown on the other side—what was showing on the top of the screen is now showing on the bottom of the screen. Available in all views.

 Bubble Level On/Off—Shows or hides a level on screen at the cursor location that updates as the sensor is tilted. Available in **Amplitude** and **Z(mm)** views. Default is off.

 Image Center Crosshairs On/Off—Shows or hides crosshairs that indicate the center of the field of view of the sensor. Available in **Amplitude** and **Z(mm)** views. Default is off.



Toggle 3D point cloud display decimation levels—Changes the size of the points shown. Available in **Points** and **Surface** views. Does not change image acquisition parameters. Default is 2:1.

 Show or hide the 3D camera—Shows or hides the position of the sensor over the container as well as the field of view. Available in **Points** and **Surface** views. Default is hidden.

 and  Hide or show the application working volume sidewalls—Shows or hides the user-defined boundaries of the container. This view also shows two colored boxes. The first is the Z-height setting shown as a green box. This box turns to red when the peak height is reached. The second is the fill level shown as a blue box that moves as the container is filled or emptied. Available in **Points** and **Surface** views. Default is show.

 and  Hide or show all points outside of the application 3D Space—Show or hide objects that are within the field of view of the sensor but are located outside of the defined boundaries of the container. Available in **Points** and **Surface** views. Default is show.

 and  Reset 3D camera view—Resets the 3D view to the default X, Y, and Z positions.

Coordinates in the Amplitude and Z(mm) Views—The following display in the lower right in the Amplitude view.

Amp
: Brightness level of the selected pixel. The Amplitude range is 10 to 3000.

X(mm)
: Horizontal distance from the surface visible in the selected pixel to the center of the image, along the X axis.

Y(mm)
: Horizontal distance from the surface visible in the selected pixel to the center of the image, along the Y axis.

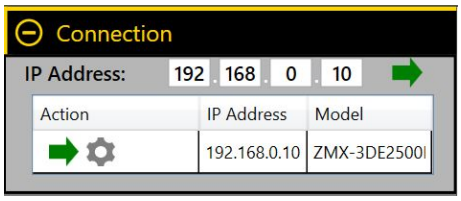
Z(mm)
: Depth from the surface visible in the selected pixel to the face of the sensor.

Cursor(x,y)
: Pixel coordinates of the selected pixel on the image sensor chip.

5.2 **Connection** Pane

Use the **Connection** pane parameters to change the sensor IP address and to connect to the sensor.

*Figure 17. **Connection** Pane*



The default IP address for the ZMX sensor is 192.168.0.10.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

The Banner 3D Configuration software remembers the IP address of the last connected sensor. The software also searches the local Ethernet subnetwork to find any available sensors. These sensors are listed in the **Connection** pane.

Hover over to view sensor name, serial number, MAC address, Gateway, firmware version, etc. To change a sensor's IP address, click .

To connect to a sensor, enter the IP address of the desired ZMX sensor into the **Sensor IP Address** field, then click next to the IP address. Alternately, locate the IP address of the desired sensor in the list of discovered sensors, then click in the **Action** column.

The model number of the sensor also displays.

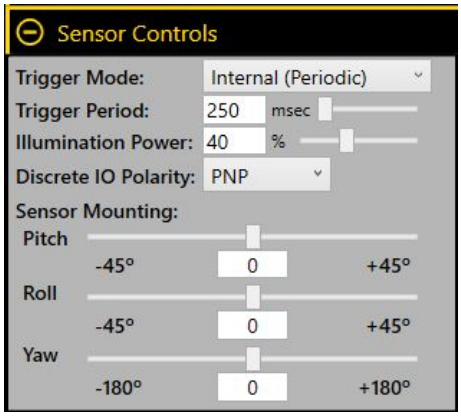
To disconnect from a sensor, click .

Click to reboot a connected sensor.

5.3 Sensor Controls Pane

Use the **Sensor Controls** pane parameters to set the trigger mode and illumination output.

*Figure 18. **Sensor Controls** Pane*



Trigger Mode

The **Trigger Mode** drop-down menu displays both the name for a given trigger mode and additional information in parentheses. There are four trigger modes for the sensor:

- **External (White Wire)**—In External trigger mode the sensor waits for a discrete input signal to arrive via the dedicated trigger input wire. The trigger is defined as the rising edge of a PNP signal. The software **Trigger** button also provides a sensor trigger while in this mode.
- **Internal (Periodic)**—In Internal trigger mode the sensor triggers at a user-defined Trigger Interval (from 200 milliseconds to 10,000 milliseconds). The software **Trigger** button also provides a sensor trigger while in this mode. In this mode, it is possible to provide triggers at a rate faster than the sensor can act on them. See the missed trigger count value available via an industrial protocol connection.
- **Free Run**—In Free Run trigger mode the sensor triggers as fast as possible. When a software connection is present, after one image is taken and transmitted to the software, the sensor moves immediately to take the next. When no connection is present, the sensor uses a 125 millisecond delay between triggers to simulate the image transfer time delays and avoid overheating.
- **Software (Protocols)**—In Software trigger mode the sensor is triggered by via an industrial protocols connection. The Banner 3D Configuration software **Trigger** button also provides a sensor trigger while in this mode.

Trigger Period

The time between each trigger. Use the slider or enter the desired trigger period in milliseconds. Available for **Internal (Periodic)** trigger modes.

Illumination Power

Control the illumination power of the sensor. Targets that are dark or farther away require higher illumination power. Use the slider or enter the desired power as a percentage. The default is 40%.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Discrete IO Polarity

Select

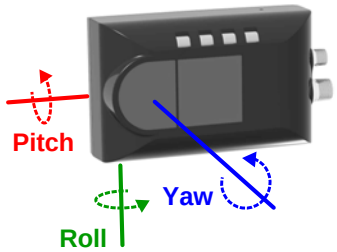
- **PNP**
- **NPN**
- **Push-Pull**

Sensor Mounting

Adjust the view of the sensor using the following controls.

Pitch—Adjust the up-and-down view of the sensor. The view (angle) setting is in degrees.
Roll—Adjust the view of the sensor along the longitudinal axis. The view (angle) setting is in degrees.
Yaw—Adjust the side-to-side view of the sensor. The view (angle) setting is in degrees.

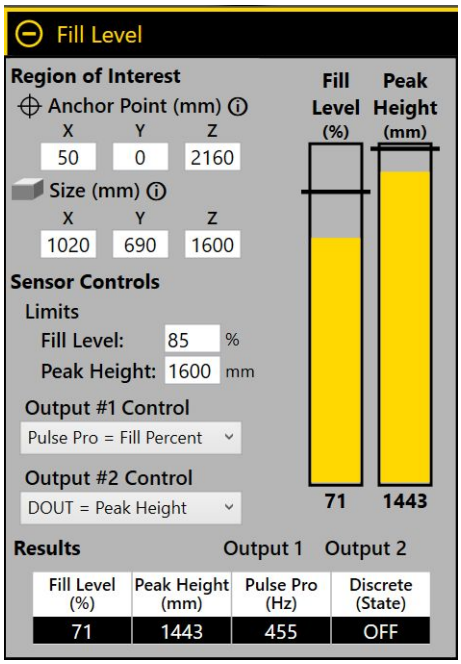
Figure 19. Pitch, Roll, Yaw Diagram



5.4 Fill Level Pane

Use the **Fill Level** pane to set the parameters for the region of interest (ROI) and to view live estimated fill and peak information.

*Figure 20. **Fill Level** Pane*



Fill Level (%)

This bar displays live information regarding the estimated volume percent of the objects in the container. The line corresponds to the set Fill Level Limit. The number below the bar is the estimated percent full.

Peak Height (mm)

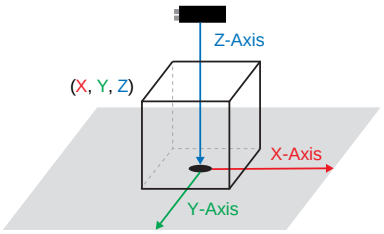
This bar displays live information regarding the estimated height of the tallest point in the container. The line corresponds to the set Peak Height Limit. The number below the bar is the measured height in millimeters.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Region of Interest

Anchor Point (mm)—Define the X, Y and Z points of the sensor region of interest. From the **Z(mm)** view (Image Pane parameters), click the center of the container region of interest. Record the X(mm), Y(mm), and Z(mm) values from the software. These represent the bottom of the container. Pay attention to positive and negative values.

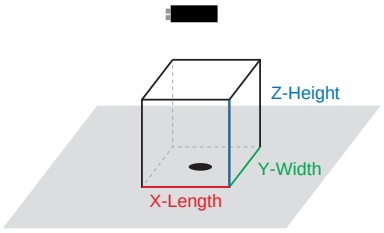
Figure 21. Anchor Point Diagram



X = Center X point of container
Y = Center Y point of container
Z = The Z measurement from the bottom, or furthest point, of the container

Size (mm)—Define the length, width, and height of the container region of interest. The entire region of interest should be contained within the walls of the container.

Figure 22. Dimensions Diagram



X = X-Length size dimension
Y = Y-Width size dimension
Z = Z-Height of container or desired detection limit

Sensor Controls

Limits—Fill Level: The threshold percentage that activates the Fill Level Limit Output.
Limits—Peak Height: The threshold height, in millimeters, that activates the Peak Height Limit Output.

Output #1 Control and **Output #2 Control**—Select the desired behavior for the sensor output wire. When set to Pulse Pro, the sensor can generate pulses whose frequency are proportional to the sensor's measured Fill Level or Peak Height, thereby providing a method for representing an analog signal with only a discrete counter.

Wire	Name	Available Functions
Black Wire (pin 4)	Channel 1	Output 1
White Wire (pin 2)	Channel 2	Output 2 or Trigger Input

Output 2 is disabled when the external trigger is enabled."External Trigger Active" shows in **Output #2 Control** when this occurs.

Disabled
DOUT = Fill Percent: The Output turns ON when the Fill Level exceeds the Limit setting, and turns OFF when the Fill Level drops below the Limit setting.
DOUT = Peak Height: The Output turns ON when the Peak Height exceeds the Limit setting, and turns OFF when the Peak Height drops below the Limit setting.
DOUT = Fill or Peak: The Output turns ON when either the Fill Level or the Peak Height exceeds their Limit settings, and turns OFF when both the Fill Level and the Peak Height are below their Limit settings.
Pulse Pro = Fill Level: The pulse frequency is scaled from 100 Hz at 0% full and 600 Hz at 100% full.
Pulse Pro = Peak Height: The pulse frequency is scaled from 100 Hz at 0 mm peak height and 600 Hz at peak height equal to the height of the region of interest.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Results

Fill Level (%): A calculated estimate of the volume percentage filled within the ROI.

Peak Height (mm): The peak height within the ROI.

Output 1: Varies depending on what is selected from the **Output #1 Control** list.

Discrete (State)
Pulse Pro (Hz): The Pulse Pro frequency from 100 Hz to 600 Hz.
Not Used

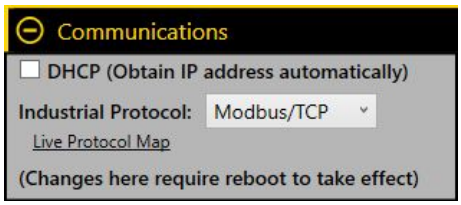
Output 2: Varies depending on what is selected from the **Output #2 Control** list. Output 2 is disabled (not used) when the external trigger is enabled.

Discrete (State)
Pulse Pro (Hz): The Pulse Pro frequency from 100 Hz to 600 Hz.
Not Used

5.5 Communications Pane

Use the **Communications** pane parameters to select the industrial protocol.

*Figure 23. **Communications** Pane*



DHCP (Obtain IP address automatically)

Select this checkbox to enable Dynamic Host Control Protocol (DHCP). For additional information, see "DHCP" on page 23.

Industrial Protocol

Select the desired industrial protocol from the list.

- Off
- EtherNet/IP
- Modbus/TCP

Note that any changes to the parameters in this pane require a sensor reboot to take effect.

To view live industrial protocol data, click **Live Protocol Map**.

5.5.1 DHCP

This option allows a Dynamic Host Control Protocl (DHCP) client (for example, the ZMX sensor) to obtain its IP address, subnet, and gateway from a DHCP Server.

For this feature to work, the following criteria must be met:

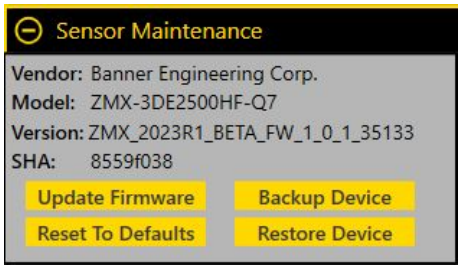
1. The DHCP server is running, configured properly, and connected to the same network as the ZMX sensor.
   a. Often the DHCP server is embedded into a router, smart switch or other industrial IT network equipment.
   b. Banner does not provide this hardware or server software.
2. The ZMX sensor is connected by Ethernet cable to a location that has a running DHCP server.
3. The ZMX sensor is powered on.
   a. The sensor continues to request its DHCP network settings up to approximately two minutes.
   b. During the request period, the ZMX is not reachable and will not show up on the Banner 3D Configuration software discovered sensors list.
   c. If the DHCP server provides a leased IP address within the timeout period:
      - The sensor is reachable as a network device.
      - The DHCP network settings are not saved.
   d. If the DHCP server fails to provide the leased IP address within the timeout period:
      i. The sensor goes to the “Auto-IP” address, which will be in the range of 169.254.*.*.
      ii. The sensor is available at this new, temporary IP address.
      iii. Reboot the ZMX sensor to repeat the DHCP IP address assignment process.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

5.6 Sensor Maintenance Pane

Use the **Sensor Maintenance** pane to update the firmware, restore to factory default settings, and backup or restore the sensor.

*Figure 24. **Sensor Maintenance** Pane*



Click the desired option and follow the prompts to complete the action.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Chapter Contents

6.1 EtherNet/IP™ 25
6.2 Modbus® TCP 39
6.3 Troubleshooting 43

Chapter 6 Industrial Ethernet Overview

6.1 EtherNet/IP™

In this context, references to EtherNet/IP™[5] 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®[6] family of PLCs uses this communication protocol. The programming software used by these PLCs is RSLogix5000® or Studio 5000 Logix Designer™[7].

The ZMX is controlled via EtherNet/IP using assembly objects.

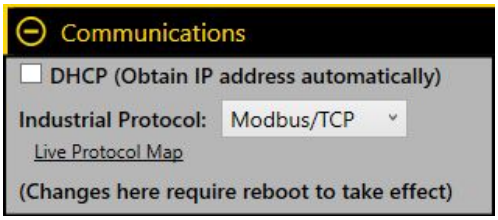
The Originator of the EtherNet/IP connection is the PLC. The Target of the EtherNet/IP connection is the ZMX. The direction of communication can be described as T > O or O > T (sometimes also shown as T2O or O2T).

6.1.1 Configuring the Sensor to use an Industrial Protocol

Use the following instructions to enable the Modbus TCP protocol or the EtherNet/IP protocol on the ZMX sensor.

1. Go to the **Communications** pane in the Banner 3D Configuration software.

   *Figure 25. **Communications** Pane*

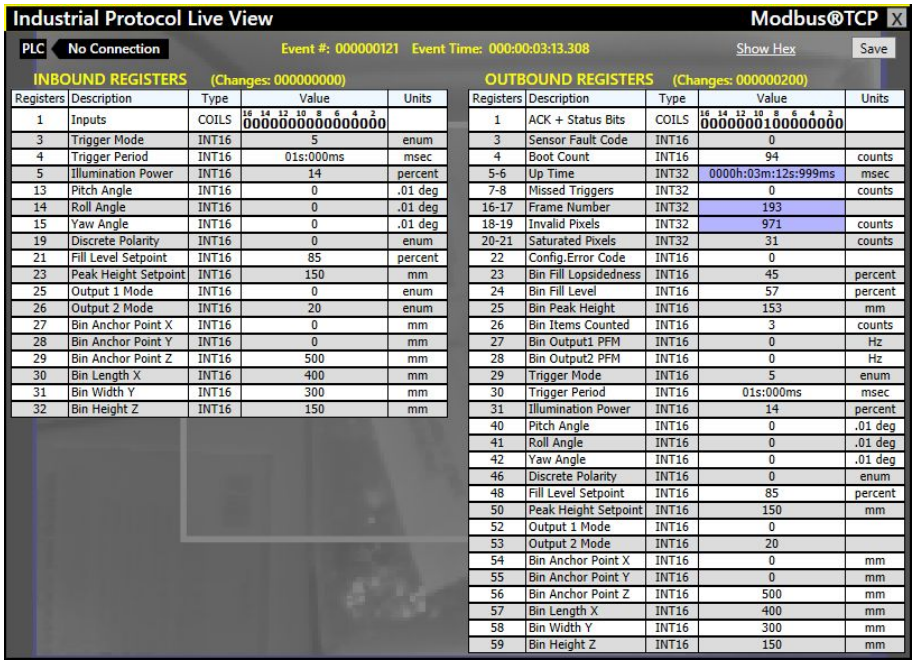
   

2. From the **Industrial Protocol** menu, select the desired protocol.
   A sensor reboot may be required.
3. Click **Live Protocol Map** to open a view of the data.

[5] EtherNet/IP™ is a trademark of ODVA, Inc.
[6] CompactLogix® and ControlLogix® are registered trademarks of Rockwell Automation.
[7] RSLogix5000® and Studio 5000 Logix Designer™ are registered trademarks of Rockwell Automation.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Figure 26. Industrial Protocol Live View—Modbus TCP Shown



Registers	Description	Type	Value	Units
1	Inputs	COILS	0000000000000000	
3	Trigger Mode	INT16	5	enum
4	Trigger Period	INT16	01s:000ms	msec
5	Illumination Power	INT16	14	percent
13	Pitch Angle	INT16	0	.01 deg
14	Roll Angle	INT16	0	.01 deg
15	Yaw Angle	INT16	0	.01 deg
19	Discrete Polarity	INT16	0	enum
21	Fill Level Setpoint	INT16	85	percent
23	Peak Height Setpoint	INT16	150	mm
25	Output 1 Mode	INT16	0	enum
26	Output 2 Mode	INT16	20	enum
27	Bin Anchor Point X	INT16	0	mm
28	Bin Anchor Point Y	INT16	0	mm
29	Bin Anchor Point Z	INT16	500	mm
30	Bin Length X	INT16	400	mm
31	Bin Width Y	INT16	300	mm
32	Bin Height Z	INT16	150	mm

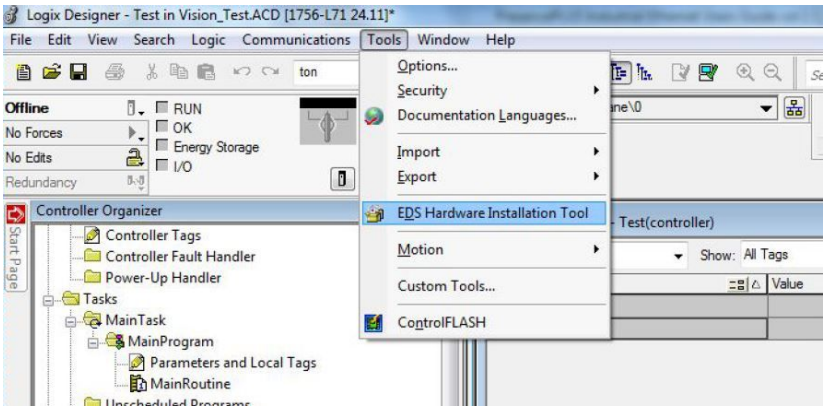
Registers	Description	Type	Value	Units
1	ACK + Status Bits	COILS	0000000100000000	
3	Sensor Fault Code	INT16	0	
4	Boot Count	INT16	94	counts
5-6	Up Time	INT32	0000h:03m:12s:999ms	msec
7-8	Missed Triggers	INT32	0	counts
16-17	Frame Number	INT32	193	
18-19	Invalid Pixels	INT32	971	counts
20-21	Saturated Pixels	INT32	31	counts
22	Config.Error Code	INT16	0	
23	Bin Fill Lopsidedness	INT16	45	percent
24	Bin Fill Level	INT16	57	percent
25	Bin Peak Height	INT16	153	mm
26	Bin Items Counted	INT16	3	counts
27	Bin Output1 PFM	INT16	0	Hz
28	Bin Output2 PFM	INT16	0	Hz
29	Trigger Mode	INT16	5	enum
30	Trigger Period	INT16	01s:000ms	msec
31	Illumination Power	INT16	14	percent
40	Pitch Angle	INT16	0	.01 deg
41	Roll Angle	INT16	0	.01 deg
42	Yaw Angle	INT16	0	.01 deg
46	Discrete Polarity	INT16	0	enum
48	Fill Level Setpoint	INT16	85	percent
50	Peak Height Setpoint	INT16	150	mm
52	Output 1 Mode	INT16	0	
53	Output 2 Mode	INT16	20	
54	Bin Anchor Point X	INT16	0	mm
55	Bin Anchor Point Y	INT16	0	mm
56	Bin Anchor Point Z	INT16	500	mm
57	Bin Length X	INT16	400	mm
58	Bin Width Y	INT16	300	mm
59	Bin Height Z	INT16	150	mm

6.1.2 ZMX Series 3D Time of Flight Sensor 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 27. Tools—EDS Hardware Installation Tool



2. Click **Next**.
3. Select the **Register an EDS file(s)** option.

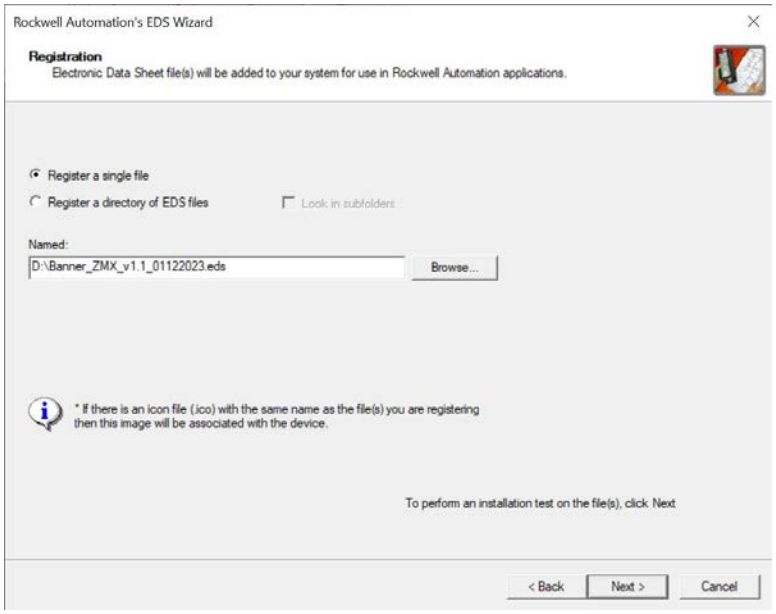
© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Figure 28. Rockwell Automation's EDS Wizard—Options



4. Browse to locate the EDS file and click **Next**.

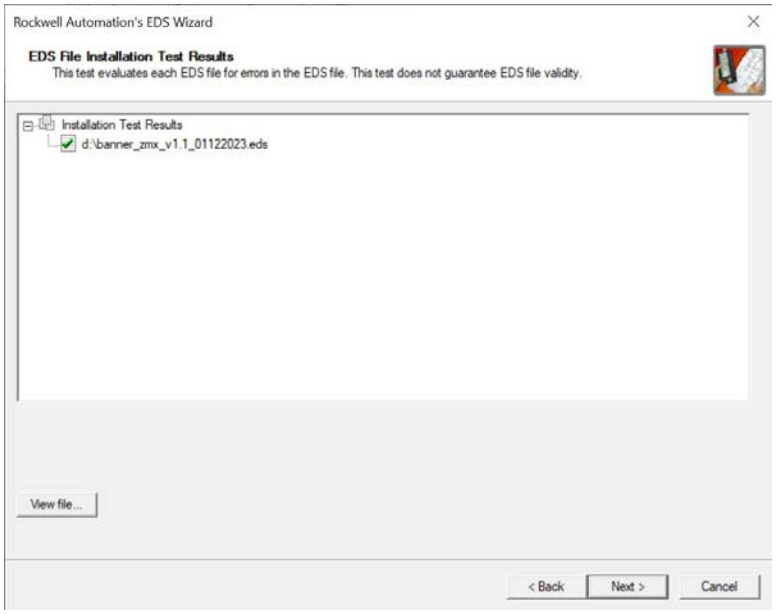
Figure 29. Select File to Register



5. Click **Next** to register the tested file.

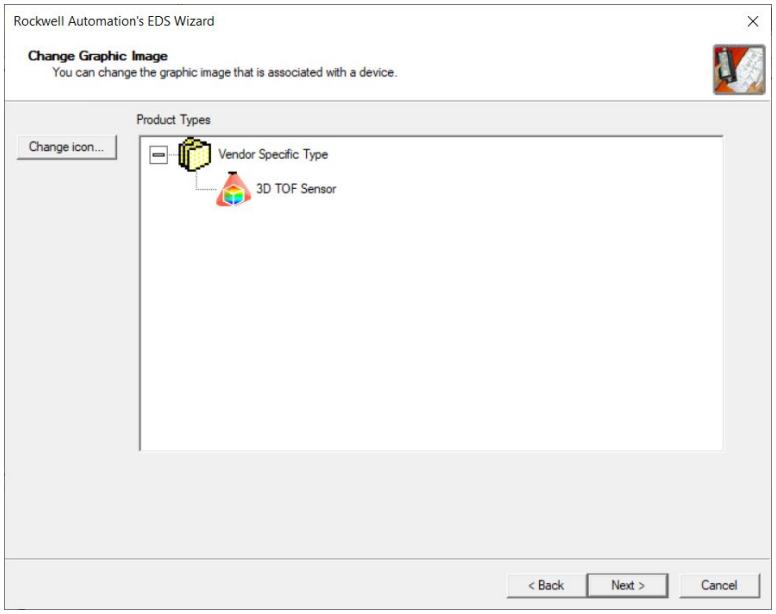
© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Figure 30. Register the Tested File



6. Click **Next** when you see the icon associated with the EDS file.

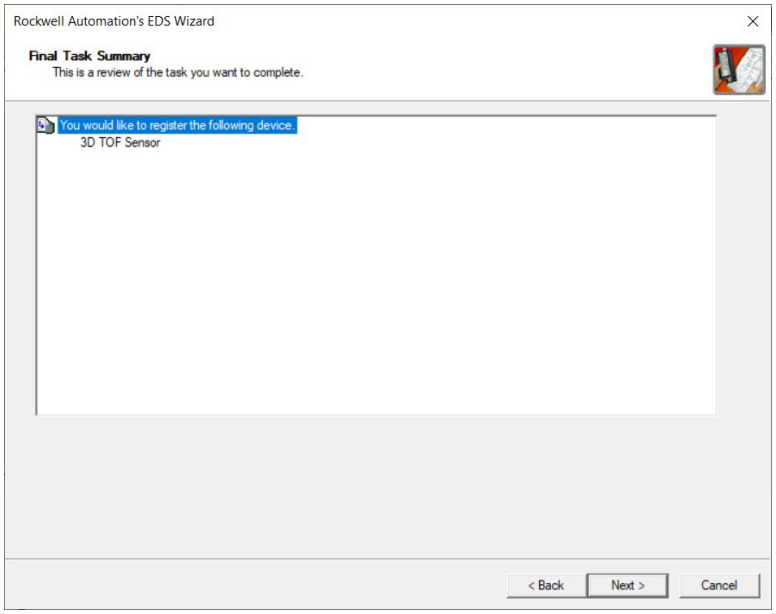
Figure 31. Rockwell Automation's EDS Wizard



7. Click **Next** to register the EDS file.

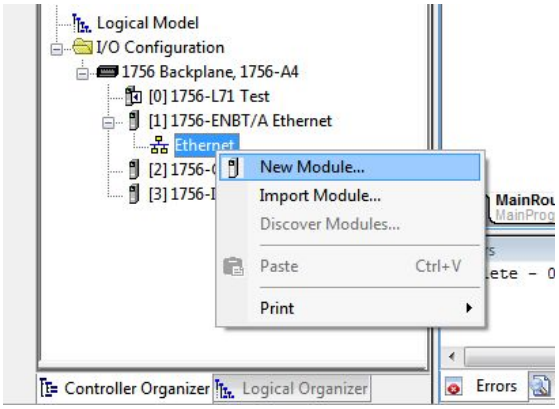
© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Figure 32. 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...**

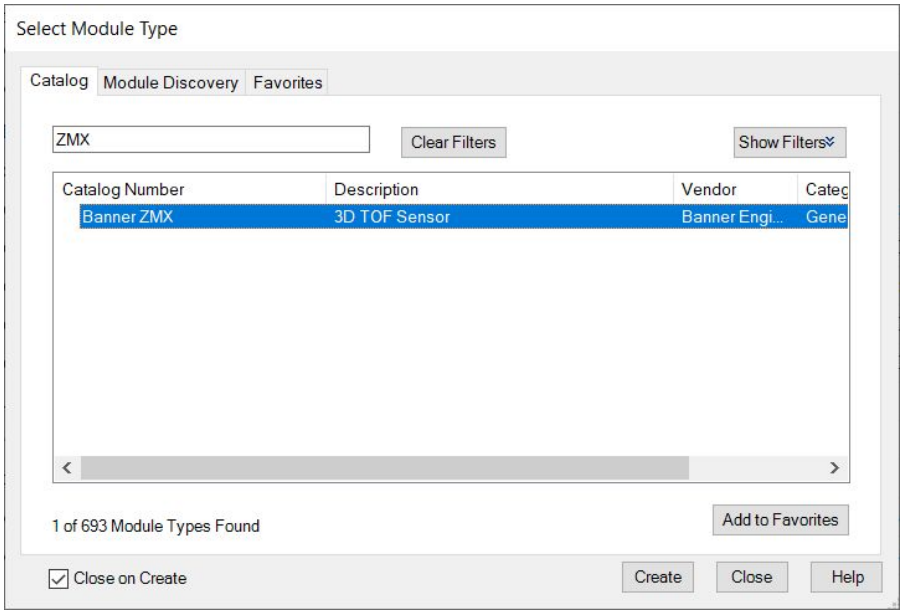
Figure 33. New Module



10. Locate the device in the catalog and click **Create**.

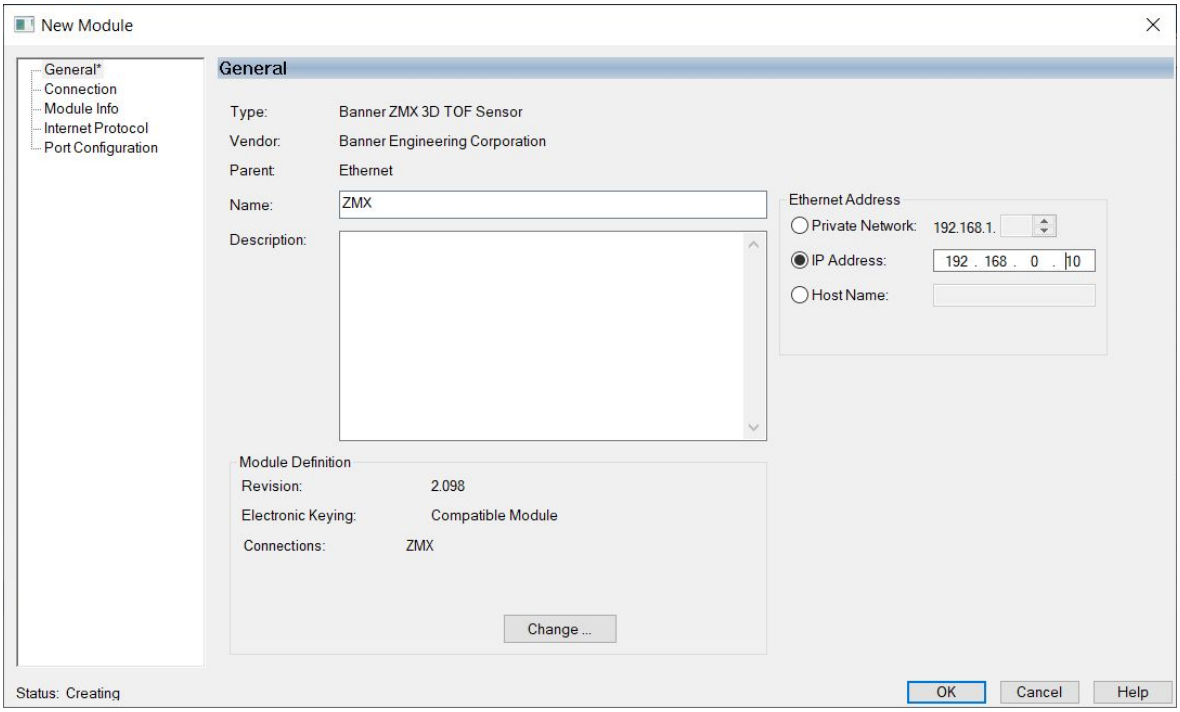
© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Figure 34. Select Module Type



11. Enter a name, description (optional), and IP address for the device.

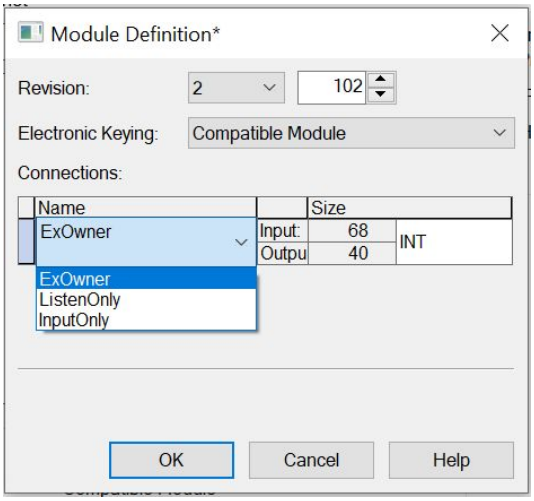
Figure 35. New Module



12. Click **Change** in the **Module Definition** field.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Figure 36. Module Definition



NOTE: The ZMX supports three types of EtherNet/IP connections: Exclusive Owner (ExOwner), Listen Only, and Input Only. Most users select Exclusive Owner because it provides full control of both the input and output data. An Input Only connection provides the T > O (ZMX output data) to the PLC. A Listen Only connection provides the T > O (ZMX output data) to a device wishing to listen to an existing multicast connection.

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:

    ExOwner

    - T > O PLC Input/ZMX Output Assembly 100 (0×64), size 68 16-bit registers
    - O > T PLC Output/ZMX Input Assembly 112 (0×70), size 40 16-bit registers

    Listen Only

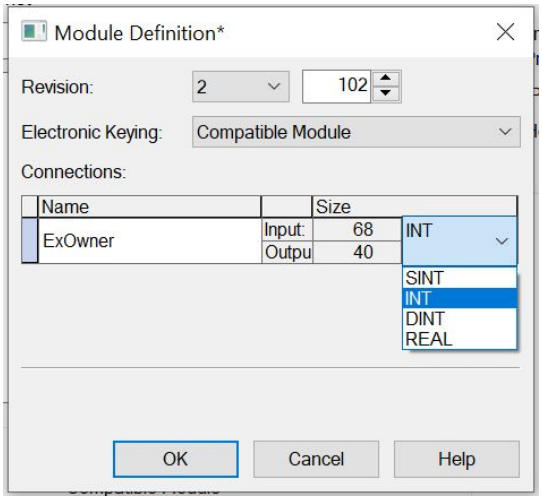
    T > O PLC Input/ZMX Output Assembly 100 (0×64)

    Input Only

    T > O PLC Input/ZMX Output Assembly 100 (0×64)

14. Select **INT** as the data type.

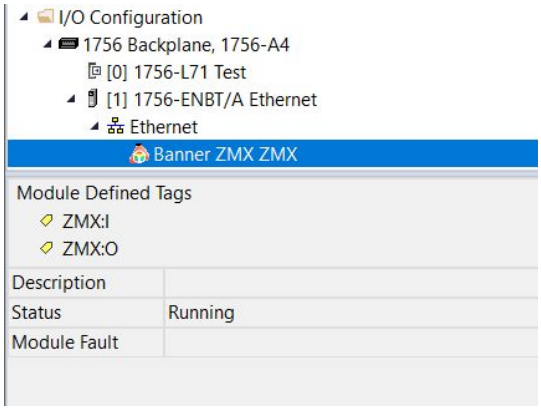
    Figure 37. Module Definition—Data Type



15. Click **OK** twice and download the program to the PLC.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Figure 38. Download to the PLC



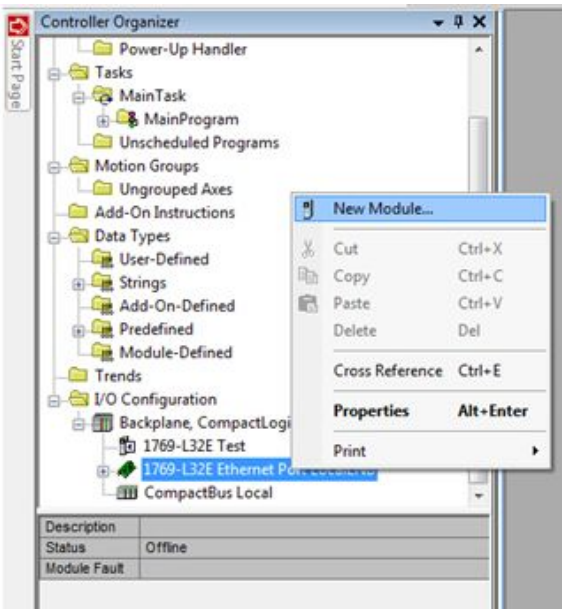
The connection looks like the one in "Figure: Download to the PLC" on page 32.

6.1.3 EtherNet/IP Configuration Using Generic Ethernet Module

To create an implicit Class 1 configuration to the ZMX using EtherNet/IP when using a ControlLogix family PLC, configure the ZMX as a “Generic Ethernet Module”. The following is a sample setup of a Banner device using RSLogix5000® or Studio 5000 Logix Designer software:

1. Add a generic Ethernet module to the PLC's Ethernet card.
   a. Right-click and select **New Module**.

Figure 39. Add Ethernet Module

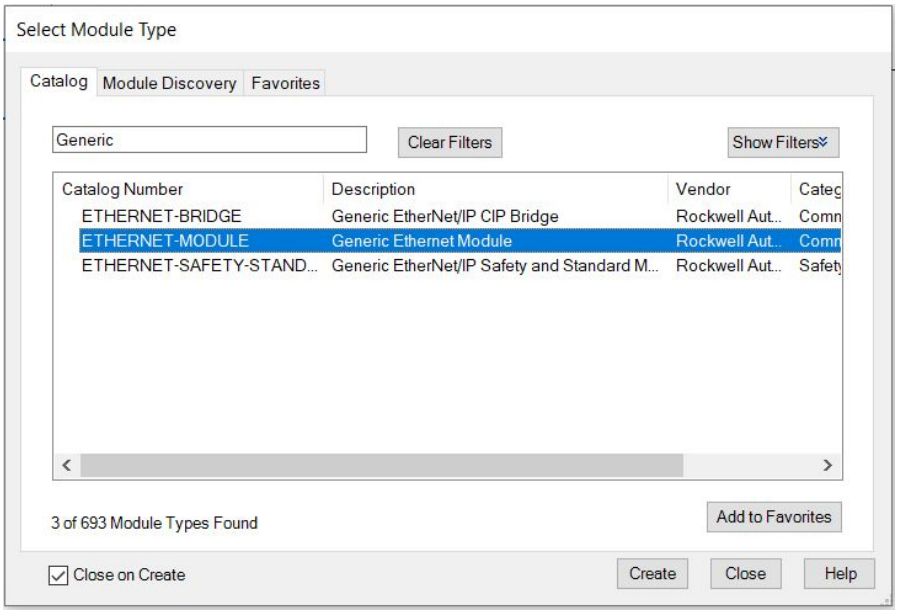


   The **Select Module Type** window opens.

   b. Select **Generic Ethernet Module**.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

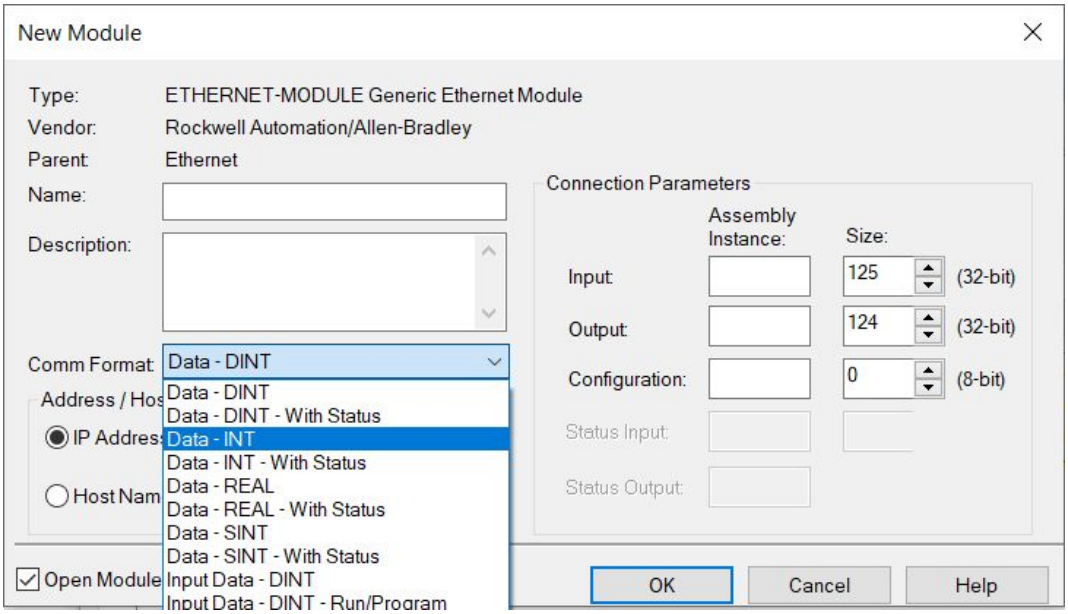
Figure 40. Select Module Type



The **New Module** window opens.

2. Configure the Module Properties.
   a. Change the **Comm Format** to **Data - INT**.

Figure 41. Comm Format



   b. Enter a module **Name** and **IP address**.

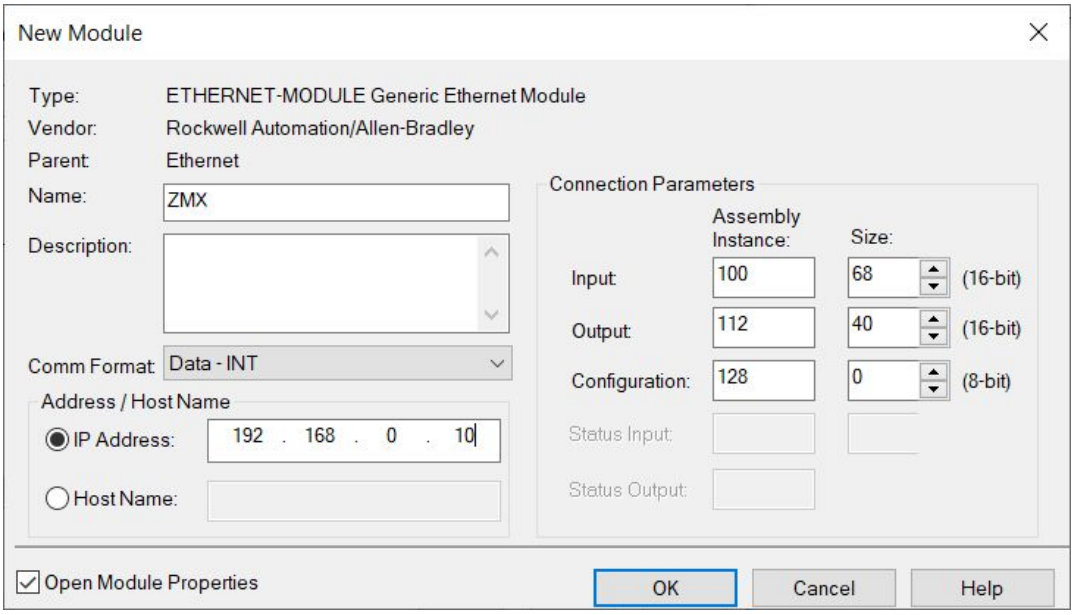
      The default IP address is 192.168.0.10 with a subnet mask of 255.255.255.0.

   c. Under Connection Parameters, enter the **Assembly Instance** parameters and **Size** parameters.

      PLC Input Assembly 100 (0×64), size 68 words
      PLC Output Assembly 112 (0×70), size 40 words
      PLC Configuration Assembly 128 (0×80), size 0 words

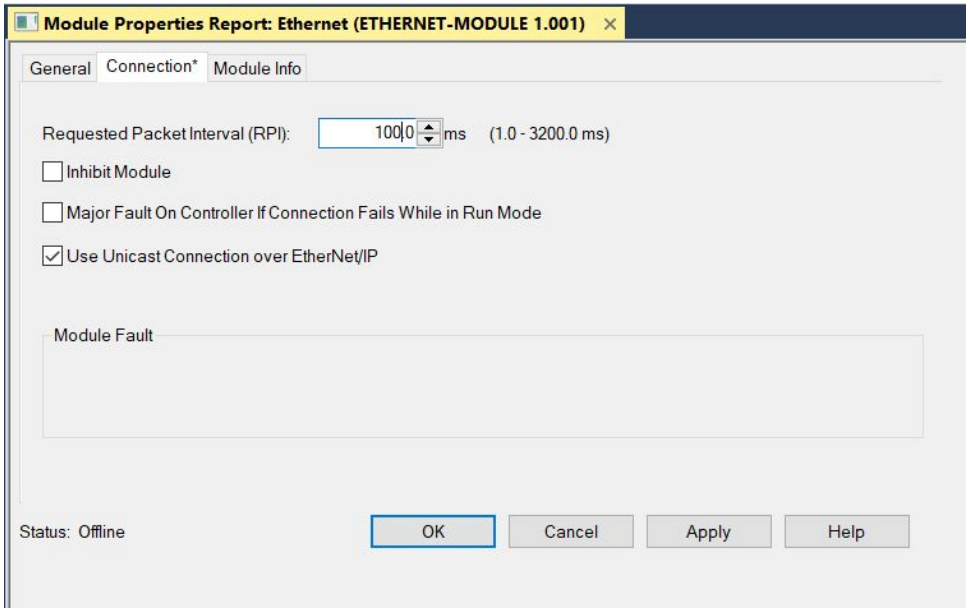
© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Figure 42. New Module Window



d. On the **Connection** tab, set the **Requested Packet Interval (RPI)** and select the **Use Unicast Connect over EtherNet/IP** checkbox.

*Figure 43. **Connection** Tab*

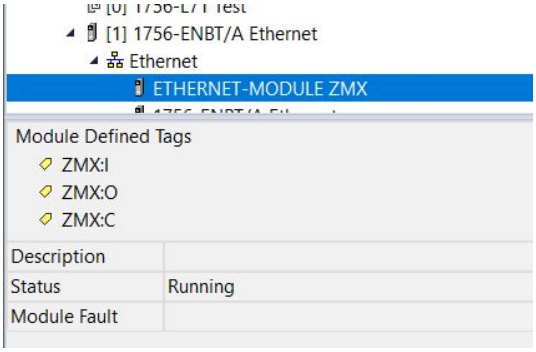


NOTE: The recommended minimum RPI is 100 msec.

3. If the module configuration was successful, the following information displays:

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Figure 44. Successful Configuration



Module Defined Tags

C = Configuration (not used)
I = Inputs to PLC (outputs from the device)
O = Outputs from PLC (inputs to the device)

6.1.4 Assembly Objects

Inputs to the Sensor (Outputs from the PLC)

PLC Assembly Instance 112 (0×70) - 40 Registers (ZMX Inputs/PLC Outputs) O > T

This Assembly Instance includes parameters to control the ZMX sensor.

Table 2. PLC Assembly Instance 112 (0×70)

WORD #	WORD NAME	DATA TYPE	RELEVANT INPUT BITS	RANGE & INFO
0	Input bits (see "Flags" on page 37)	16 bits		
1	*reserved*	16-bit INT		
2	Trigger Mode[8]	16-bit INT	14, 1	**Trigger Mode:** 1 = External 5 = Internal (uses Trigger Period in ms) 6 = Free Run 10 = Software (EIP)
3	Trigger Period (ms)[8]	16-bit INT	14, 1	100 … 30,000
4	Illumination Power (%)[8]	16-bit INT	14, 1	1 … 100
5–11	*reserved*	16-bit INT		
12	Pitch Angle (degrees × 100)[8]	16-bit INT	14, 1	-4,500 … 4,500
13	Roll Angle (degrees × 100)[8]	16-bit INT	14, 1	-4,500 … 4,500
14	Yaw Angle (degrees × 100)[8]	16-bit INT	14, 1	-18,000 … 18,000
15–17	*reserved*	16-bit INT		
18	Discrete I/O Polarity[8]	16-bit INT	14, 1	**Polarity Mode:** 0 = PNP 1 = NPN 2 = Push-Pull
19	*reserved*	16-bit INT		
20	Fill Level Limit Setpoint (%)[9]	16-bit INT	0, 1	0 … 200
21	*reserved*	16-bit INT		
22	Peak Height Limit Setpoint (mm)[9]	16-bit INT	0, 1	0 … 2,950[10]
23	*reserved*	16-bit INT		

Continued on page 36

[8] These parameters use the Unlock Sensor Controls bit (bit 14 in word 0 of the PLC Output Assembly). See "Using Input Bits" on page 38.
[9] These parameters use the Update ROI Parameters bit (bit 0 in word 0 of the PLC Output Assembly). See "Using Input Bits" on page 38.
[10] Maximum value is reduced to not extend past the minimum sensing distance.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Continued from page 35

WORD #	WORD NAME	DATA TYPE	RELEVANT INPUT BITS	RANGE & INFO
24	Discrete Output 1 Control Mode[9]	16-bit INT	0, 1	**Discrete Output 1 & 2 Mode:** 0 = Disabled 1 = Fill percent above setpoint 2 = Peak height above setpoint 9 = Fill percent above setpoint **OR** peak height above setpoint 10 = Pulse Pro 100Hz to 600Hz scaled to fill percent 0 to 100 11 = Pulse Pro 100Hz to 600Hz scaled to peak height above bottom of container 20 = No output, channel used as input
25	Discrete Output 2 Control Mode[9]	16-bit INT	0, 1	
26	ROI Anchor Point X (mm)[9]	16-bit INT	0, 1	-2,500 … 2,500
27	ROI Anchor Point Y (mm)[9]	16-bit INT	0, 1	-2,500 … 2,500
28	ROI Anchor Point Z (mm)[9]	16-bit INT	0, 1	200 … 3,000
29	ROI Length (X) (mm)[9]	16-bit INT	0, 1	50 … 5,000
30	ROI Width (Y) (mm)[9]	16-bit INT	0, 1	50 … 5,000
31	ROI Height (Z) (mm)[9]	16-bit INT	0, 1	50 … 5,000
32–39	*reserved*	16-bit INT		

Outputs from the Sensor (Inputs to the PLC)

PLC Assembly Instance 100 (0×64) - 68 Registers (ZMX Outputs/PLC Inputs) T > O

This Assembly Instance includes the readbacks from the ZMX sensor.

Table 3. PLC Assembly Instance 100 (0×64)

WORD #	WORD NAME	DATA TYPE	RELEVANT INPUT BITS	RANGE & INFORMATION
0	Input ACK & Status bits (see "Flags" on page 37)	16 bits		
1	*reserved*	16-bit INT		
2	Sensor Fault Code (see "Sensor Fault Codes" on page 43)	16-bit INT		
3	Boot Count	16-bit INT		1 … 65,535
4–5	Up Time (ms)	32-bit DINT		1 … 4,294,967,295
6–7	Missed Trigger Count	32-bit DINT		1 … 4,294,967,295
8–14	*reserved*	16-bit INT		
15–16	Frame Number	32-bit DINT		1 … 4,294,967,295
17–18	Invalid Pixel Count	32-bit DINT		0 … 56,576
19–20	Saturated Pixel Count	32-bit DINT		0 … 56,576
21	Configuration Error Code (see "Configuration Error Codes" on page 44)	16-bit INT		
22	Bin Fill Lopsidedness	16-bit INT		0 … 100
23	Fill Level %	16-bit INT	2	0 … 200
24	Peak Height (mm)	16-bit INT	2	0 … 3,500
25	Estimated Item Count	16-bit INT	2	
26	Output 1 PFM Frequency (Hz)	16-bit INT		0 | 100 ... 600
27	Output 2 PFM Frequency (Hz)	16-bit INT		0 | 100 ... 600
28	Trigger Mode[11]	16-bit INT		**Trigger Mode:** 1 = External 5 = Internal (uses Trigger Period in ms) 6 = Free Run 10 = Software (EIP)
29	Trigger Period (ms)[11]	16-bit INT		100 … 60,000
30	Illumination Power (%)[11]	16-bit INT		1 … 100

Continued on page 37

[11] Readbacks of the current application settings.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Continued from page 36

WORD #	WORD NAME	DATA TYPE	RELEVANT INPUT BITS	RANGE & INFORMATION
31–38	*reserved*	16-bit INT		
39	Pitch Angle (degrees × 100)[11]	16-bit INT		-4,500 … 4,500
40	Roll Angle (degrees × 100)[11]	16-bit INT		-4,500 … 4,500
41	Yaw Angle (degrees × 100)[11]	16-bit INT		-18,000 … 18,000
42–44	*reserved*	16-bit INT		
45	Discrete I/O Polarity[11]	16-bit INT		**Polarity Mode:** 0 = PNP 1 = NPN 2 = Push-Pull
46	*reserved*	16-bit INT		
47	Fill Level Limit Setpoint (%)[11]	16-bit INT		0 … 200
48	*reserved*	16-bit INT		
49	Peak Height Limit Setpoint (mm)[11]	16-bit INT		0 … 2,950[12]
50	*reserved*	16-bit INT		
51	Discrete Output 1 Control Mode[11]	16-bit INT		**Discrete Output 1 & 2 Mode:** 0 = Disabled 1 = Fill percent above setpoint 2 = Peak height above setpoint 9 = Fill percent above setpoint **OR** peak height above setpoint 10 = Pulse Pro 100Hz to 600Hz scaled to fill percent 0 to 100 11 = Pulse Pro 100Hz to 600Hz scaled to peak height above bottom of container 20 = No output, channel used as input
52	Discrete Output 2 Control Mode[11]	16-bit INT		
53	ROI Anchor Point X (mm)[11]	16-bit INT		-2,500 … 2,500
54	ROI Anchor Point Y (mm)[11]	16-bit INT		-2,500 … 2,500
55	ROI Anchor Point Z (mm)[11]	16-bit INT		200 … 3,000
56	ROI Length (X) (mm)[11]	16-bit INT		50 … 5,000
57	ROI Length (Y) (mm)[11]	16-bit INT		50 … 5,000
58	ROI Length (Z) (mm)[11]	16-bit INT		50 … 3,000
59–67	*reserved*	16-bit INT		

Configuration Assembly Object

The ZMX sensor does not use a Configuration Assembly Object.

Because some EtherNet/IP clients require one, use Instance 128 (0×80) with a size of zero registers (16-bit).

Flags

Word 0 in both Assembly Instances is a collection of individual bit values, as shown in the following table.

Table 4. Input Bits and Input ACK & Status Bits

Input bits (PLC Outputs, word 0)			Input ACK & Status bits (PLC Inputs, word 0)	
Bit #	**Name**		**Bit #**	**Name**
0	Update ROI Parameters		0	Update ROI Parameters ACK
1	Save Parameters Permanent		1	Save Parameters Permanent ACK
2	Reset Application Results		2	Reset Application Results ACK
3	Trigger		3	Trigger ACK
4	*reserved*		4	*reserved*
5	*reserved*		5	*reserved*

Continued on page 38

[12] Maximum value is reduced to not extend past the minimum sensing distance.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Continued from page 37

Input bits (PLC Outputs, word 0)			Input ACK & Status bits (PLC Inputs, word 0)	
Bit #	Name		Bit #	Name
6	*reserved*		6	Fill Level Limit
7	*reserved*		7	*reserved*
8	*reserved*		8	Peak Height Limit
9	*reserved*		9	*reserved*
10	*reserved*		10	Discrete Output State (1)
11	*reserved*		11	Discrete Output State (2)
12	*reserved*		12	*reserved*
13	*reserved*		13	*reserved*
14	Unlock Sensor Controls		14	*reserved*
15	*reserved*		15	Configuration Error

6.1.5 Controlling the ZMX Sensor

Using Input Bits

Writeable Input Bits are inputs to the sensor (outputs from the PLC or HMI). They are used for basic control of the sensor. Toggle them from 0 to 1, one at a time, to request the associated action. Most bits have a corresponding ACK Output bit that changes to 1 in response, to indicate that the action has been completed. The ACK bits reset to 0 when the command bit is reset to 0.

Update ROI Parameters—This action tells the sensor to take all of the new bin fill parameters, as a group, and apply them to the sensor.

1. Enter the desired PLC Output values for all bin fill parameters:
   - Fill Level Setpoint (word 20)
   - Peak Height Limit Setpoint (word 22)
   - Discrete Output 1 Control Mode (word 24)
   - Discrete Output 2 Control Mode (word 25)
   - ROI Anchor Point X (word 26)
   - ROI Anchor Point Y (word 27)
   - ROI Anchor Point Z (word 28)
   - ROI Length (X) (word 29)
   - ROI Width (Y) (word 30)
   - ROI Height (Z) (word 31)
2. Toggle the Update ROI Parameters bit (word 0, bit 0, PLC Outputs) from 0 to 1.
3. Look for the corresponding Update ROI Parameters ACK bit (word 0, bit 0, PLC Inputs) to go from 0 to 1.
4. Confirm that the Configuration Error bit (word 0, bit 15, PLC Inputs) is still 0.
   If it is a 1, read the Configuration Error Code (word 21, PLC Inputs) and correct the error. See "Configuration Error Codes" on page 44.

Save Parameters Permanent— This action tells the sensor to take all editable parameters modifiable over EtherNet/IP and save them in the sensor's permanent memory. This includes the size and position of the Region of Interest, as well as settings such as Trigger Mode and Output Control Mode.

Reset Application Results—This action resets all measurement output values to 0 in the EtherNet/IP registers.

Trigger—This action triggers an immediate image acquisition and measurement.

Unlock Sensor Controls—This bit unlocks the parameters in the Sensor Controls pane so that they can be changed. To adjust these parameters on the fly:

1. Toggle the Unlock Sensor Controls bit from 0 to 1 (word 0, bit 14, PLC Outputs).
2. Adjust any of the Sensor Controls parameters by writing a new value to the PLC output registers. For example, Word 2 to change Trigger Mode.
   The new value takes effect immediately if the Unlock Sensor Controls bit is a 1 at the moment when a new value is written that is different from the previous value in the register.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

6.2 Modbus® TCP

The Modbus®[13] TCP protocol provides device information using register and coil banks defined by the slave device. Modbus TCP can also be used to modify parameters of the sensor.

> **IMPORTANT:** Parameter changes over Modbus TCP are only stored in temporary memory and are not retained through a reboot unless the Save Parameters Permanent Input Bit is used.

This section defines the register and coil banks. By specification, Modbus TCP uses TCP port 502.

The Modbus Client must use a UNIT ID of 1 or higher to connect to the ZMX sensor. The Modbus TCP remote unit identifier is used with Modbus TCP devices that are composites of several Modbus devices. For example, on Modbus TCP to Modbus RTU gateways. In this case, the unit identifier tells the Slave Address of the device behind the gateway. Most Modbus TCP Clients use a Unit ID of 1 or higher.

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 5. Modbus TCP Input and Output Bits

Input Bits			Output Bits	
Function Code 05: Force Single Coil			Function Code 02: Read Input Status	
Coil	NAME		Input	NAME
00001	Update ROI Parameters		10001	Update ROI Parameters ACK
00002	Save Parameters Permanent		10002	Save Parameters Permanent ACK
00003	Reset Application Results		10003	Reset Application Results ACK
00004	Trigger		10004	Trigger ACK
00005	*reserved*		10005	*reserved*
00006	*reserved*		10006	*reserved*
00007	*reserved*		10007	Fill Level Limit
00008	*reserved*		10008	*reserved*
00009	*reserved*		10009	Peak Height Limit
00010	*reserved*		10010	*reserved*
00011	*reserved*		10011	Discrete Output State (1)
00012	*reserved*		10012	Discrete Output State (2)
00013	*reserved*		10013	*reserved*
00014	*reserved*		10014	*reserved*
00015	*reserved*		10015	*reserved*
00016	*reserved*		10016	Configuration Error

6.2.1 Configuring the Sensor to use an Industrial Protocol

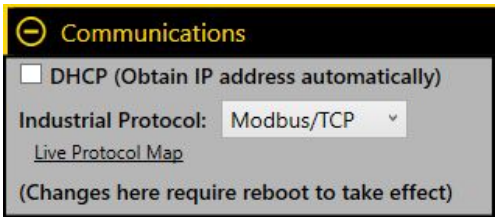
Use the following instructions to enable the Modbus TCP protocol or the EtherNet/IP protocol on the ZMX sensor.

1. Go to the **Communications** pane in the Banner 3D Configuration software.

[13] Modbus® is a registered trademark of Schneider Electric USA, Inc.

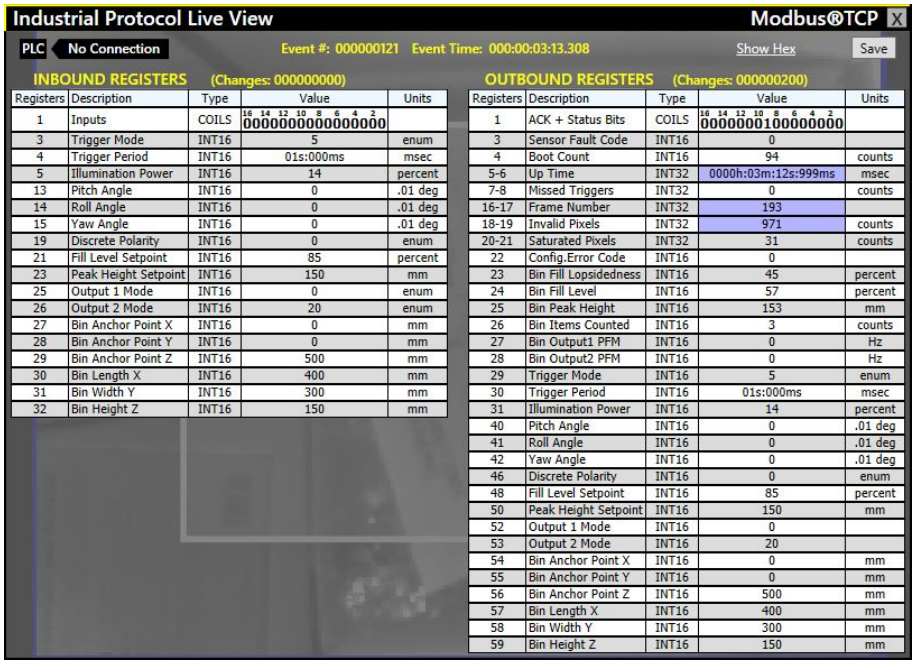
© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

*Figure 45. **Communications** Pane*



2. From the **Industrial Protocol** menu, select the desired protocol.
   A sensor reboot may be required.
3. Click **Live Protocol Map** to open a view of the data.

Figure 46. Industrial Protocol Live View—Modbus TCP Shown



Registers	Description	Type	Value	Units
1	Inputs	COILS	0000000000000000	
3	Trigger Mode	INT16	5	enum
4	Trigger Period	INT16	01s:000ms	msec
5	Illumination Power	INT16	14	percent
13	Pitch Angle	INT16	0	.01 deg
14	Roll Angle	INT16	0	.01 deg
15	Yaw Angle	INT16	0	.01 deg
19	Discrete Polarity	INT16	0	enum
21	Fill Level Setpoint	INT16	85	percent
23	Peak Height Setpoint	INT16	150	mm
25	Output 1 Mode	INT16	0	enum
26	Output 2 Mode	INT16	20	enum
27	Bin Anchor Point X	INT16	0	mm
28	Bin Anchor Point Y	INT16	0	mm
29	Bin Anchor Point Z	INT16	500	mm
30	Bin Length X	INT16	400	mm
31	Bin Width Y	INT16	300	mm
32	Bin Height Z	INT16	150	mm

Registers	Description	Type	Value	Units
1	ACK + Status Bits	COILS	0000000100000000	
3	Sensor Fault Code	INT16	0	
4	Boot Count	INT16	94	counts
5-6	Up Time	INT32	0000h:03m:12s:999ms	msec
7-8	Missed Triggers	INT32	0	counts
16-17	Frame Number	INT32	193	
18-19	Invalid Pixels	INT32	971	counts
20-21	Saturated Pixels	INT32	31	counts
22	Config.Error Code	INT16	0	
23	Bin Fill Lopsidedness	INT16	45	percent
24	Bin Fill Level	INT16	57	percent
25	Bin Peak Height	INT16	153	mm
26	Bin Items Counted	INT16	3	counts
27	Bin Output1 PFM	INT16	0	Hz
28	Bin Output2 PFM	INT16	0	Hz
29	Trigger Mode	INT16	5	enum
30	Trigger Period	INT16	01s:000ms	msec
31	Illumination Power	INT16	14	percent
40	Pitch Angle	INT16	0	.01 deg
41	Roll Angle	INT16	0	.01 deg
42	Yaw Angle	INT16	0	.01 deg
46	Discrete Polarity	INT16	0	enum
48	Fill Level Setpoint	INT16	85	percent
50	Peak Height Setpoint	INT16	150	mm
52	Output 1 Mode	INT16	0	
53	Output 2 Mode	INT16	20	
54	Bin Anchor Point X	INT16	0	mm
55	Bin Anchor Point Y	INT16	0	mm
56	Bin Anchor Point Z	INT16	500	mm
57	Bin Length X	INT16	400	mm
58	Bin Width Y	INT16	300	mm
59	Bin Height Z	INT16	150	mm

6.2.2 Using Input Bits

Writeable Coil Bits are inputs to the sensor (outputs from the PLC or HMI). They are used for basic control of the sensor. Toggle them from 0 to 1, one at a time, to request the associated action. Each bit has a corresponding ACK Output bit that changes to 1 in response, to indicate that the action has been completed. The ACK bits reset to 0 when the command bit is reset to 0.

The Input bits can be found in Holding Register 1 or as Coils 00001–00016.

The ACK bits can be found in Input Register 1, Holding Register 1001, or as Inputs 10001–10016.

Update ROI Parameters—This action tells the sensor to take all of the new bin fill parameters, as a group, and apply them to the sensor.

1. Enter the desired PLC Output values for all bin fill parameters:
   - Fill Level Setpoint (Holding Register 21)
   - Peak Height Limit Setpoint (Holding Register 23)
   - Discrete Output 1 Control Mode (Holding Register 25)
   - Discrete Output 2 Control Mode (Holding Register 26)
   - ROI Anchor Point X (Holding Register 27)
   - ROI Anchor Point Y (Holding Register 28)
   - ROI Anchor Point Z (Holding Register 29)
   - ROI Length (X) (Holding Register 30)
   - ROI Width (Y) (Holding Register 31)
   - ROI Height (Z) (Holding Register 32)
2. Toggle the Update ROI Parameters bit (Holding Register 1, bit 0 **or** Coil 00001) from 0 to 1.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

3. Look for the corresponding Update ROI Parameters ACK bit (Input Register 0, bit 0 **or** Holding Register 1001, bit 0 **or** Input 10001) to go from 0 to 1.
4. Confirm that the Configuration Error bit (Input Register 1, bit 15 **or** Holding Register 1001, bit 15 **or** Input 10016) is still 0.
   If it is a 1, read the Configuration Error Code (Holding Register 1022 **or** Input Register 22) and correct the error. See "Configuration Error Codes" on page 44.

Save Parameters Permanent—This action tells the sensor to take all editable parameters modifiable over Modbus TCP and save them in the sensor's permanent memory. This includes the size and position of the Region of Interest, as well as settings such as Trigger Mode and Output Control Mode.

Reset Application Results—This action resets all measurement output values to 0 in the Modbus TCP registers.

Trigger—This action triggers an immediate image acquisition and measurement.

6.2.3 ZMX Sensor Output Values

The ZMX sensor sends output data to the PLC or HMI via a bank of Input Registers (30000).

Some devices, such as the Modicon family of PLCs, cannot access data using the 30000 range of register addresses. For these devices, the ZMX sensor 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).

Table 6. Sensor Output Values

Input REG #	Holding REG #	WORD NAME	DATA TYPE	RELEVANT INPUT BITS	RANGE
1	1001	Input ACK & Status bits (Inputs 10001–10016)	16 bits		
2	1002	*reserved*	16-bit INT		
3	1003	Sensor Fault Code (see "Sensor Fault Codes" on page 43)	16 bit INT		
4	1004	Boot Count	16-bit INT		1 …. 32,767
5–6	1005–1006	Up Time (ms)	32-bit INT		1 … 2,147,483,647
7–8	1007–1008	Missed Trigger Count	32-bit INT		0 … 2,147,483,647
9–15	1009–1015	*reserved*	7 16-bit INTs		
16–17	1016–1017	Frame Number	32-bit INT		1 … 2,147,483,647
18–19	1018–1019	Invalid Pixel Count (pixels with too little light received to be able to measure)	32-bit INT		0 … 56,576
20–21	1020–1021	Saturated Pixel Count (pixels with too much light received to be able to measure)	32-bit INT		0 … 56,576
22	1022	Configuration Error Code (see "Configuration Error Codes" on page 44)	16-bit INT		
23	1023	Bin Fill Lopsidedness	16-bit INT		0 … 100
24	1024	Fill Level %	16-bit INT	3	0 … 200
25	1025	Peak Height (mm)	16-bit INT	3	0 … 3,500
26	1026	Estimated Item Count	16-bit INT	3	0 … 32,767
27	1027	Output 1 PFM Frequency (Hz)	16-bit INT		0 | 100 … 600
28	1028	Output 2 PFM Frequency (Hz)	16-bit INT		0 | 100 … 600
29	1029	Trigger Mode[14]	16-bit INT		**Trigger Mode:** 1 = External 5 = Internal (uses trigger period) 6 = Free run 10 = Software (Modbus TCP)
30	1030	Trigger Period (ms)[14]	16-bit INT		200 … 60000
31	1031	Illumination Power (%)[14]	16-bit INT		1 … 100
32–39	1032–1039	*reserved*	8 16-bit INTs		
40	1040	Pitch angle (degrees × 100)[14]	16-bit INT		-4500 … 4500
41	1041	Roll angle (degrees × 100)[14]	16-bit INT		-4500 … 4500

Continued on page 42

[14] Readbacks of the current application settings.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Continued from page 41

Input REG #	Holding REG #	WORD NAME	DATA TYPE	RELEVANT INPUT BITS	RANGE
42	1042	Yaw angle (degrees × 100)(14)	16-bit INT		-18000 … 18000
43–45	1043–1045	*reserved*	3 16-bit INTs		
46	1046	Discrete I/O Polarity(14)	16-bit INT		**Polarity Mode:** 0 = PNP 1 = NPN 2 = Push-Pull
47	1047	*reserved*	16-bit INT		
48	1048	Fill Level Limit Setpoint (%)(14)	16-bit INT		0 … 200
49	1049	*reserved*	16-bit INT		
50	1050	Peak Height Limit Setpoint (mm)(14)	16-bit INT		0 … 2,950**
51	1051	*reserved*	16-bit INT		
52	1052	Discrete Output 1 Control Mode(14)	16-bit INT		**Discrete Output 1 & 2 Mode:** 0 = Disabled 1 = Fill percent above setpoint 2 = Peak height above setpoint 9 = Fill percent above setpoint **OR** peak height above setpoint 10 = Pulse Pro 100 Hz to 600 Hz scaled from fill percent between 0% to 100% 11 = Pulse Pro 100 Hz to 600 Hz scaled to peak height above bottom of container 20 = No output, channel used as input
53	1053	Discrete Output 2 Control Mode(14)	16-bit INT		
54	1054	ROI Anchor Point X (mm)(14)	16-bit INT		-2,500 … 2,500
55	1055	ROI Anchor Point Y (mm)(14)	16-bit INT		-2,500 … 2,500
56	1056	ROI Anchor Point Z (mm)(14)	16-bit INT		200 … 3,000
57	1057	ROI Length (X) (mm)(14)	16-bit INT		50 … 5,000
58	1058	ROI Width (Y) (mm)(14)	16-bit INT		50 … 5,000
59	1059	ROI Height (Z) (mm)(14)	16-bit INT		50 … 3,000
60–67	1060–1067	*reserved*	8 16-bit INTs		

6.2.4 ZMX Sensor Input Values

Holding Registers (40000) are used by the PLC or HMI to write values to the ZMX sensor. To write, use function codes 06 (Preset Single Register) or 16 (Preset Multiple Registers).

Table 7. Sensor Input Values

Holding REG #	WORD NAME	DATA TYPE	RELEVANT INPUT BITS	RANGE & INFO
1	Input bits (Coils 00001–00016)	16 bits		
2	*reserved*	16-bit INT		
3	Trigger Mode	16-bit INT	2	**Trigger Mode:** 1 = External 5 = Internal (uses trigger period) 6 = Free run 10 = Software (Modbus TCP)
4	Trigger Period (ms)	16-bit INT	2	100 … 30,000
5	Illumination Power (%)	16-bit INT	2	0…100
6–12	*reserved*	7 16-bit INTs		
13	Pitch angle (degrees × 100)	16-bit INT	2	-4500 … 4500
14	Roll angle (degrees × 100)	16-bit INT	2	-4500 … 4500
15	Yaw angle (degrees × 100)	16-bit INT	2	-18000 … 18000
16–18	*reserved*	3 16-bit INTs		

Continued on page 43

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Continued from page 42

Holding REG #	WORD NAME	DATA TYPE	RELEVANT INPUT BITS	RANGE & INFO
19	Discrete I/O Polarity	16-bit INT	2	**Polarity Mode:** 0 = PNP 1 = NPN 2 = Push-Pull
20	*reserved*	16-bit INT		
21	Fill Level Limit Setpoint (%)(15)	16-bit INT	1, 2	0 … 200
22	*reserved*	16-bit INT		
23	Peak Height Limit Setpoint (mm)(15)	16-bit INT	1, 2	0 … 2,950(16)
24	*reserved*	16-bit INT		
25	Discrete Output 1 Control Mode(15)	16-bit INT	1, 2	**Discrete Output 1 & 2 Mode:** 0 = Disabled 1 = Fill percent above setpoint 2 = Peak height above setpoint 9 = Fill percent above setpoint **OR** peak height above setpoint 10 = Pulse Pro 100 Hz to 600 Hz scaled from fill percent between 0% to 100% 11 = Pulse Pro 100 Hz to 600 Hz scaled to peak height above bottom of container 20 = No output, channel used as input
26	Discrete Output 2 Control Mode(15)	16-bit INT	1, 2	
27	ROI Anchor Point X (mm)(15)	16-bit INT	1, 2	-2,500 … 2,500
28	ROI Anchor Point Y (mm)(15)	16-bit INT	1, 2	-2,500 … 2,500
29	ROI Anchor Point Z (mm)(15)	16-bit INT	1, 2	200 … 3,000
30	ROI Length (X) (mm)(15)	16-bit INT	1, 2	50 … 5,000
31	ROI Width (Y) (mm)(15)	16-bit INT	1, 2	50 … 5,000
32	ROI Height (Z) (mm)(15)	16-bit INT	1, 2	50 … 3,000
33–40	*reserved*	8 16-bit INTs		

6.3 Troubleshooting

6.3.1 Sensor Fault Codes

The following is a list of the possible error codes from Word 2 in the PLC Input (ZMX Output) Assembly Instance.

Table 8. Sensor Fault Codes

Sensor Fault Code	Description	Recommended Solution
0	Online, No Fault	
1	EEPROM Timeout	• Reboot the sensor • If the fault persists, call Banner Customer Support
2	EEPROM Failure	• Reboot the sensor • If the fault persists, call Banner Customer Support
4	Acquisition Error	• Reboot the sensor • If the fault persists, call Banner Customer Support
5	Internal Temperature Error	• Turn off the power and allow the sensor to cool • Use a lower frame rate • Use a better heat sink or better airflow
6	Illumination Temperature Error	• Turn off the power and allow the sensor to cool • Use a lower frame rate • Use a better heat sink or better airflow

Continued on page 44

(15) These parameters use the Update ROI Parameters bit (bit 1 in holding register 1 of the PLC Output Assembly). See "Using Input Bits" on page 38.
(16) Maximum value is reduced to not extend past the minimum sensing distance.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Continued from page 43

Sensor Fault Code	Description	Recommended Solution
7	Main Sensor Temperature Error	• Turn off the power and allow the sensor to cool • Use a lower frame rate • Use a better heat sink or better airflow
8	Acquisition Error 2	• Reboot the sensor • If the fault persists, call Banner Customer Support
11	Laser Operation Error	• Reboot the sensor • If the fault persists, call Banner Customer Support
20	Internal Test Error	• Reboot the sensor • If the fault persists, call Banner Customer Support • Reboot the sensor • If the fault persists, call Banner Customer Support
21	Internal Read Error	• Reboot the sensor • If the fault persists, call Banner Customer Support
22	Internal Write Error	• Reboot the sensor • If the fault persists, call Banner Customer Support
30	Laser Power Test Error	• Reboot the sensor • If the fault persists, call Banner Customer Support
31	Laser Power Read Error	• Reboot the sensor • If the fault persists, call Banner Customer Support
32	Laser Power Write Error	• Reboot the sensor • If the fault persists, call Banner Customer Support
1000	Acquisition Error 3	• Reboot the sensor • If the fault persists, call Banner Customer Support
1011–1017	Internal Flash Error 1–7	• Call Banner Customer Support
30000-32000	Boot Loader Error	• Call Banner Customer Support

6.3.2 Configuration Error Codes

The following is a list of possible error codes.

Modbus TCP: The codes are from input register 22 (holding register 1022).

EtherNet/IP: The codes are from word 21 in the PLC Input (ZMX Output) Assembly Instance

Table 9. Configuration Error Codes

Error Code	Description
110	Illumination Power < 1
111	Illumination Power > 100
120	Invalid Trigger Mode
130	Trigger Period < 200 ms
131	Trigger Period > 60000 ms
140	Pitch Angle < -4500
141	Pitch Angle > 4500
150	Roll Angle < -4500
151	Roll Angle > 4500
160	Yaw Angle < -18000
161	Yaw Angle > 18000

Continued on page 45

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Continued from page 44

Error Code	Description
300	Invalid Discrete Polarity
2000	Anchor Point X < -2500 mm
2001	Anchor Point X > 2500 mm
2010	Anchor Point Y < -2500 mm
2011	Anchor Point Y > 2500 mm
2020	Anchor Point Z < -2500 mm
2021	Anchor Point Z > 2500 mm
2030	Bin Length X < 50 mm
2031	Bin Length X > 5000 mm
2040	Bin Width Y < 50 mm
2041	Bin Width Y > 5000 mm
2050	Bin Height Z < 50 mm
2051	Bin Height Z > 5000 mm
2052	Invalid Bin Height
2060	Fill Level Setpoint < 0%
2061	Fill Level Setpoint > 200%
2080	Peak Height Setpoint < 0
2081	Peak Height Setpoint > Bin Height Z (mm)
2100	*Discrete Output 1 Selection Invalid*
2110	*Discrete Output 2 Selection Invalid*

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Chapter Contents

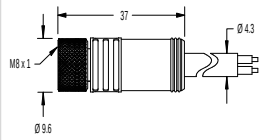
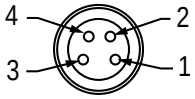
7.1 Cordsets 46
7.2 Brackets 47

Chapter 7 Accessories

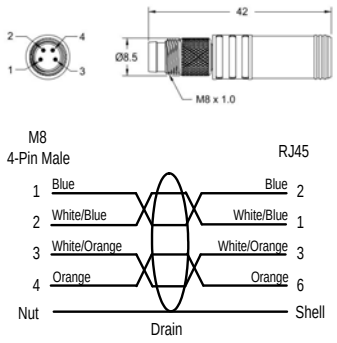
7.1 Cordsets

A ZMX Series 3D Time of Flight Sensor requires using shielded power and ethernet cables from the following lists. Performance cannot be guaranteed with cables that are not included in these lists.

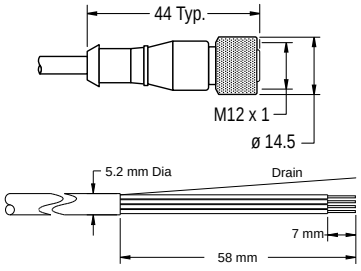
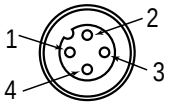
4-Pin Single-Ended M8 Female Cordsets with Shield (Tied to Coupling Nut), Straight

Models	Length	Dimensions	Pinout (Female)	
PKG4MS-2-22	2 m (6.56 ft)			1 = Brown 2 = White 3 = Blue 4 = Black
PKG4MS-4.6-22	4.6 m (15 ft)			
PKG4MS-9.1-22	9.1 m (29.5 ft)			

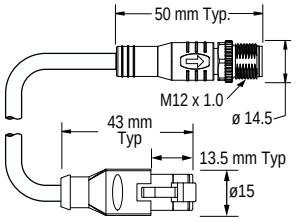
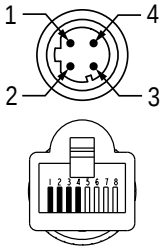
Double-Ended 8-Pin RJ45 Male to 4-Pin M8 Male Ethernet Cordsets

Model	Length	Dimensions and Wiring	Pinout (M8) (male)	Pinout (RJ45)
STP-M8MRJ45-406	1.83 m (6 ft)			
STP-M8MRJ45-415	4.57 m (15 ft)			
STP-M8MRJ45-430	9.14 m (30 ft)		1 = Blue 2 = White/Blue 3 = White/Orange 4 = Orange Nut = Shield	1 = White/Blue 2 = Blue 3 = White/Orange 4 = NC 5 = NC 6 = Orange 7 = NC 8 = NC Shell = Shield

4-pin Single-Ended M12 Female Shielded Cordsets

Model	Length	Dimensions (mm)	Pinout (Female)	
BC-M12F4-22-1-SF	1 m (3.28 ft)			1 = Brown 2 = White 3 = Blue 4 = Black
BC-M12F4-22-2-SF	2 m (6.56 ft)			
BC-M12F4-22-5-SF	5 m (16.4 ft)			
BC-M12F4-22-8-SF	8 m (26.25 ft)			
BC-M12F4-22-10-SF	10 m (30.81 ft)			

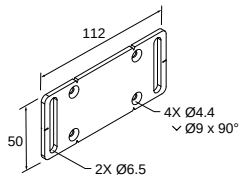
© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

4-Pin Double-Ended M12 D-Code Male to RJ45 Ethernet Cordsets			
Model	**Length**	**Dimensions**	**Pinout**
BCD-M12DM-RJ45-1	1 m		*Figure 47. M12 Male*  1 = Yellow 2 = White 3 = Orange 4 = Blue Shell = Braid
BCD-M12DM-RJ45-2	2 m		
BCD-M12DM-RJ45-5	5 m		
BCD-M12DM-RJ45-8	8 m		
BCD-M12DM-RJ45-10	10 m		

7.2 Brackets

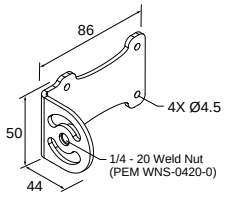
SMBZMXMP

- Plate for flush mounting sensor
- 10-gauge stainless steel
- M4 × 0.7 mounting hardware included
- ¼ - 20 thread included for mounting with bogen arm



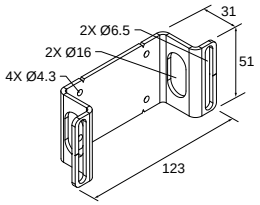
SMBZMXRA

- Right angle mounting bracket, with rotation available
- 12-gauge stainless steel
- M4 × 0.7 mounting hardware included



SMBZMXRM

- Recessed mounting bracket
- 12-gauge stainless steel
- M4 × 0.7 mounting hardware included



© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

Chapter Contents

8.1 Cleaning Instructions 48
8.2 Back Up the Sensor 48
8.3 Restore the Sensor 48
8.4 Repairs 49
8.5 Contact Us 49
8.6 Banner Engineering Corp Limited Warranty 49
8.7 Banner Engineering Corp. Software Copyright Notice 49

Chapter 8 Product Support

8.1 Cleaning Instructions

Handle the sensor with care during installation and operation. Sensor windows soiled by fingerprints, dust, water, oil, etc. may create stray light that may degrade the peak performance of the sensor.

Clean as necessary using:

- Optical lens cleaner designed for coated optics
- Optical wipes designed for coated optics

Alternatively, use a soft, clean cloth and isopropyl alcohol or a soft, clean cloth and a mild soap or detergent with lukewarm water. Do not use any other chemicals for cleaning (for example, avoid vinegar or ammonia-based products because they will damage the surface).

Canned air may also be used to blow dust from the sensor.

8.2 Back Up the Sensor

Use the following procedure to create a backup of the ZMX sensor.

1. Connect to the desired sensor.

   > **NOTE:** The sensor can be running, however, consider the status of the connected equipment (for example, the PLC) prior to creating a backup.

2. On the **Sensor Maintenance** pane, click **Backup Device**.
3. Navigate to the desired location.
4. Click **Start**.

   All settings, including sensor name, IP address, subnet mask, and gateway are saved. The backup is saved as a .bak file.

8.3 Restore the Sensor

Use the following procedure to restore the ZMX sensor from a saved file.

1. Connect to the desired sensor.

   > **NOTE:** The sensor can be running, however, consider the status of the connected equipment (for example, the PLC) prior to restoring the sensor.

2. On the **Sensor Maintenance** pane, click **Restore Device**.
3. Navigate to the desired .bak file.
4. Select options.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

a. Select the **Overwrite IP Address, Subnet Mask and Gateway** checkbox (default) if you do not want to keep the current information from the connected sensor.
b. Select the **Overwrite Sensor Name** checkbox (default) if you do not want to keep the current sensor name of the connected sensor.

5. Click **Start**.

   The sensor settings are restored to those from the .bak file.

6. Reboot the sensor.

8.4 Repairs

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.

8.5 Contact Us

Banner Engineering Corp. | 9714 Tenth Avenue North | Plymouth, MN 55441, USA | Phone: + 1 888 373 6767

For worldwide locations and local representatives, visit www.bannerengineering.com.

8.6 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.

8.7 Banner Engineering Corp. Software Copyright Notice

© Banner Engineering Corp., All Rights Reserved.

https://www.bannerengineering.com/us/en/company/terms-and-conditions.html

Disclaimer of Warranties. 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.

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

LinkedIn

X (formerly Twitter)

Facebook



© 2025. All rights reserved.
www.bannerengineering.com