# Quick Start Guide

*Imager-based barcode reader with superior decoding capability and a powerful array of lens and lighting options*

This guide is designed to help you set up and install the ABR 7000. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Instruction Manual at www.bannerengineering.com. Search for p/n 207634 to view the Instruction Manual and for p/n 207635 to view the Barcode Manager Software Instruction Manual. Use of this document assumes familiarity with pertinent industry standards and practices.

**WARNING: Not To Be Used for Personnel Protection**

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

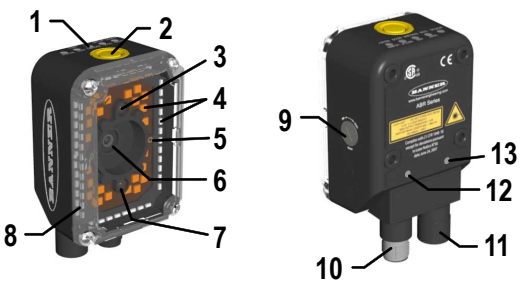
## Models

*Table 1: ABR 7000 Models*

| Model | Resolution | Lens | Lighting | Options | Communications | Codes |
|---|---|---|---|---|---|---|
| ABR7109-RSE2 | 1.3 MP (1280×1024 pixels) | 9 mm, manual focus | Red | Standard | Serial/Ethernet | 1D and 2D |
| ABR7109-MSE2 | | 9 mm, manual focus | Multicolored DPM [2] | | | |
| ABR7112-RSE2 | | 12 mm, manual focus | Red | | | |
| ABR7116-RSE2 | | 16 mm, manual focus | Red | | | |
| ABR7106-RSE2 | | 6 mm, manual focus | Red | | | |
| ABR7106-MSE2 | | 6 mm, manual focus | Multicolored DPM [2] | | | |
| ABR71L9-RSE2 | | 9 mm, Liquid Lens Autofocus | Red | | | |
| ABR71L9-MSE2 | | 9 mm, Liquid Lens Autofocus | Multicolored DPM [2] | | | |
| ABR71L9-WPE2 | | 9 mm, Liquid Lens Autofocus | White Polarized | | | |
| ABR72L9-RPE2 | 2 MP (1600×1200 pixels) | 9 mm, Liquid Lens Autofocus | Red Polarized | | | |
| ABR72L9-RDE2 | | 9 mm, Liquid Lens Autofocus | Red Diffused DPM [2] | | | |
| ABR72L16-WSE2 | | 16 mm, Liquid Lens Autofocus | White | | | |
| ABR72L16-RDE2 | | 16 mm, Liquid Lens Autofocus | Red Diffused DPM [2] | | | |

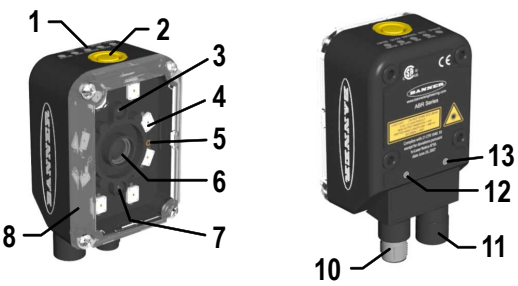
## Features

*Figure 1. Models with Manual Adjustable Focus*




1. Smart Teach Interface
2. Button
3. Good Read LED (green)
4. Internal Illuminator
5. Aiming System Laper Pointers
6. Lens
7. No Read LED (red)
8. Lens Cover
9. Focus Adjustment Screw
10. Power - Serial - I/O Connector
11. Ethernet Connector
12. Power ON LED
13. Ethernet Connection LED

*Figure 2. Models with Liquid Lens Autofocus*



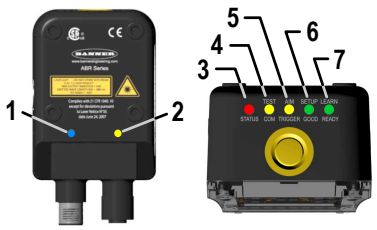

[2] Multicolored DPM models have red bright field lights and blue low angle lights for optimized reading of Direct Park Marked (DPM) codes. Red Diffused DPM models have both groups of lights as well, but both are red and behind a diffuser.

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## Indicators

*Figure 3. Indicators—Back and Top of Device*




| | Indicator | Color | Description |
|---|---|---|---|
| 1 | Power | Blue | Indicates that the reader is connected to the power supply |
| 2 | Ethernet Connection | Amber | Indicates connection to the Ethernet network |
| 3 | STATUS | Red | No read result |
| 4 | COM/Test | Amber | Active result output transmission on the Main serial port |
| 5 | TRIGGER/Aim | Amber | Reading in progress. Do not trigger a new reading attempt until the current attempt finishes |
| 6 | GOOD/Setup | Green | Reading successful |
| 7 | READY/Learn | Green | Ready |

During the reader startup, all of the LEDs turn on for one second.

See for the colors and meanings of the five LEDs when the reader is in Smart Teach mode.

## Laser Description and Safety Information

The ABR 7000 internal illuminators contain two aiming Laser LEDs used to position the reader. Disconnect the power supply when opening the device during maintenance or installation to avoid exposure to hazardous laser light. The laser beam can be switched on or off through a software command.

This product conforms to the applicable requirements of IEC 60825-1 and complies with 21 CFR 1040.10 except for deviations pursuant to Laser Notice N° 50, date June 24, 2007. This product is classified as a Class 2 laser product according to IEC 60825-1 regulations.

**CAUTION:** 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.

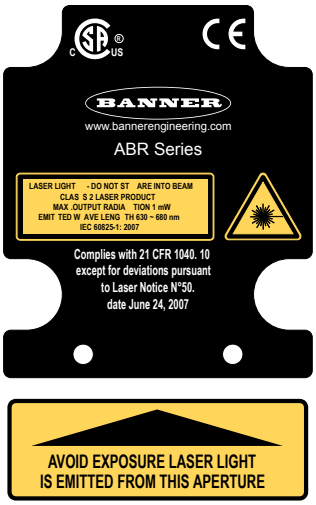
**For Safe Laser Use - Class 2 Lasers**

- 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.

Reference IEC 60825-1:2007, Section 8.2.

**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.




**Class 2 Lasers**

Class 2 lasers are lasers that emit visible radiation in the wavelength range from 400 nm to 700 nm, where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

**Class 2 Laser Safety Notes**

Low-power lasers are, by definition, incapable of causing eye injury within the duration of a blink (aversion response) of 0.25 seconds. They also must emit only visible wavelengths (400 to 700 nm). Therefore, an ocular hazard may exist only if individuals overcome their natural aversion to bright light and stare directly into the laser beam.

**Laser wavelength:** 630-680 nm **Output:** 1 mW **Pulse Duration:** variable

## Installation Instructions

### Mount the Reader

**Note:** Mount the device at a 10° to 15° angle from the target to avoid direct reflections.

1. Rotate the connector block to the desired angle.

*Figure 4. Connector Block*



2. If a bracket is needed, mount the device onto the bracket.
3. Select a reading distance.

   The ABR 7000 manual adjustable focus models and Liquid Lens Autofocus models are both factory focused to a precise reading distance.
   - If this distance is compatible with your application, or if you have a Liquid Lens Autofocus model, you can use the Smart Teach Interface to install the reader.
   - If this distance is not compatible with your application and you have a manual focus model, use the software setup procedure described in the Instruction Manual.

   The following table shows the Horizontal Field of View size for these factory focused reading distances:

| Lens | Resolution | Factory Focused Reading Distance | Horizontal Field of View |
|---|---|---|---|
| 6 mm | 1.3 MP | 85 mm (3.3 in) | 121 mm (4.8 in) |
| 9 mm | | 180 mm (7.1 in) | 145 mm (5.7 in) |
| 9 mm Liquid Lens Autofocus | | 135 mm (5.3 in) [3] | 109 mm (4.3 in) |
| 12 mm | | 250 mm (9.8 in) | 145 mm (5.7 in) |
| 16 mm | | 320 mm (12.6 in) | 132 mm (5.2 in) |
| 9 mm Liquid Lens Autofocus | 2 MP | 100 mm (3.9 in) [3] | 95 mm (3.7 in) |
| 16 mm Liquid Lens Autofocus | | 240 mm (9.4 in) [3] | 112 mm (4.4 in) |

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

## Connect the Cables

*Table 2: Power and I/O Pinouts for MQDC2S-17xx*

| Pin | Wire Color | Description | |
|---|---|---|---|
| 1 | Brown | Power Supply Input Voltage + (V dc) | |
| 2 | Blue | Power Supply Input Voltage - (GND) | |
| 3 | White | Input Signal 2 B (polarity insensitive) | |
| 4 [4] | Green | Transmit Data of Auxiliary RS232 | |
| 5 | Pink | External Trigger/Input 1 B (polarity insensitive) | |
| 6 | Yellow | External Trigger/Input 1 A (polarity insensitive) | |
| 7 | Black | ID-NET network + | |
| 8 [4] | Gray | Output 2<br>NPN or PNP short circuit protected and software programmable | |
| 9 [4] | Red | Output 1<br>NPN or PNP short circuit protected and software programmable | |
| 13 | White/Green | Input Signal 2 A (polarity insensitive) | |
| 14 [4] | Brown/Green | Receive Data of Auxiliary RS232 | |
| 15 | White/Yellow | ID-NET network - | |
| 16 [4] | Yellow/Brown | Output 3<br>NPN or PNP short circuit protected and software programmable | |
| Connector Case | n/a | Cable shield connected to chassis and 17-pin connector shell | |
| | | **RS232 Main Serial Interface** | **RS422 FD Main Serial Interface** |
| 10 [4] | Violet | - | RX- [5] |
| 11 [4] | Gray/Pink | RX | RX+ [5] |
| 12 [4] | Red/Blue | - | TX- |
| 17 [4] | White/Gray | TX | TX+ |

If using a TCNM-ACBB1 connection box, connect the reader using cable MQDEC-1703SS-DB25 and refer to the Instruction Manual for writing details.

Use Cat 5e or superior M12 D-code cables, such as STP-M12D-4xx.

To meet EMC requirements:
- Connect the reader chassis to the plant earth ground by means of a flat copper braid shorter than 100 mm
- Connect pin "Earth" of the TCNM-ACBB1 connection box to a good earth ground

[3] See Simple Configuration on p. 4 to perform the autofocus to optimize the reader for other distances.
[4] Referenced to GND; any connected serial or I/O device must share a connection to GND. Outputs 1 and 2 become opto-isolated and polarity sensitive when connected through the TCNM-ACBB1 connection box. See the Instruction Manual for connection details.
[5] If using RS422, do not leave floating. See the Instruction Manual for connection details.

- For direct connections, connect the cable shield to the locking ring nut of the connector

## Simple Configuration

From the factory, all standard 1D and 2D ABR 7000 models are set up to read Data Matrix barcodes. To configure other codes, perform the simple configuration using the Smart Teach Interface. A simple configuration does not require Barcode Manager software.

## Smart Teach Interface

Smart Teach is designed to improve ease of installation and maintenance

Status information is clearly presented by means of the five colored LEDs. The single push button provides access to the following modes.

- **Test** includes bar graph visualization to check static reading performance
- **Aim/Autofocus** turns on the laser pointers to aid positioning and focusing
- **Setup** self-optimizes and auto-configures image brightness parameters
- **Learn** automatically detects and recognizes a single code which is presented to it. Successive Learns will substitute the current code. To configure multiple codes, use the Barcode Manager Auto-learn procedure

Quick access to the following modes is provided by using the push button:

1. Press the button. The **Status** LED gives visual feedback.
2. Hold the button until the specific mode LED is on (**Test**, **Aim/Autofocus**, **Setup**, or **Learn**).
3. Release the button to enter the specific mode.

After the button is pressed, the cycle of LED activation is as follows:




Release button to exit




Release button to enter **Test** mode




Release button to enter **Aim/Autofocus** mode




Release button to enter **Setup** mode




Release button to enter **Learn** mode




Release button to exit (cycle)

## Aim

The Aim function turns on the built-in laser pointer aiming system to aid reader positioning. Because the laser pointers are centered on the FOV, use them to position the imager on the code. The Aim LED blinks to indicate this state.

After a short delay, this function also performs the Autofocus procedure for Liquid Lens Autofocus models. See the Instruction manual for more details.

1. Select a single code for your application and place at the correct reading distance for your application.

   See the Global FOV Diagrams in the Instruction Manual for reference.
2. Enter **Aim** mode by pressing and holding the Smart Teach button until the Aim LED is on.

*Figure 5. Smart Teach Interface: Aim Mode*




3. Release the button to enter **Aim** mode.
   The laser pointers turn on.
4. Position the code at the center of the Field of View (equidistant from the laser pointers).

*Figure 6. Code Position*



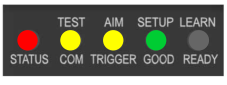
   For liquid lens autofocus models, the reader starts taking images and performs the autofocus distance calibration. Any enabled image lighting will flash until the autofocus is complete. Aim mode ends automatically. The focus distance is the only setting that can be changed during the Aim procedure. See the Instruction Manual for details on this procedure.
5. Once aligned, exit **Aim** mode by pressing the Smart Teach button once.
   After a short delay, **Aim** mode is cancelled and the laser pointers turn off.

## Setup

Once entered, the imager automatically performs the Image Acquisition parameter calibration for the specific code presented to it.

1. Enter **Setup** mode by pressing and holding the Smart Teach button until the **Setup** LED is on.

*Figure 7. Smart Teach Interface: Setup Mode*



2. Release the button to enter **Setup** mode.

   The **Setup** LED blinks until the procedure is completed. The **Setup** procedure ends when the Image Acquisition parameters are successfully saved in the reader memory, the **Setup** LED stops blinking, and the ABR emits three high pitched beeps.
3. If the calibration cannot be reached after a timeout of about 5 (five) seconds, ABR exits without saving the parameters to memory, the **Setup** LED stops blinking, and the ABR emits a long low pitched beep.

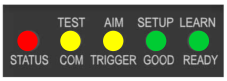
## Learn

Once entered, the imager starts a procedure to automatically detect and recognize a single code [7] which is presented to it. Successive Learns will substitute the current code. To configure multiple codes, use the Barcode Manager Auto-learn procedure.

Exit **Learn** mode at any time by pressing the Smart Teach button once. After a short delay the Learn procedure is cancelled.

1. Enter **Learn** mode by pressing and holding the Smart Teach button until the **Learn** LED is on.

*Figure 8. Smart Teach Interface: Learn Mode*




2. Release the button to enter **Learn** mode.

   The **Learn** LED blinks until the procedure is complete. The Learn procedure ends when the Image Processing and Decoding parameters **for a single code** are successfully saved in the reader memory, the Green Spot is activated, the **Learn** LED stops blinking, and the ABR emits 3 high pitched beeps.

# Advanced Configuration

Use the following procedures for a more advanced configuration of the ABR. Advanced configuration requires Barcode Manager software. For complete configuration instructions, refer to the Instruction Manual at www.bannerengineering.com. Search for p/n 207634 to view the Instruction Manual.

## Install Barcode Manager

Administrative rights are required to install the Barcode Manager software.

**Important:** Install Barcode Manager on a Windows® 7, 8, or 10 [8] computer. Barcode Manager does not currently support Windows Embedded (often used in industrial PCs and/or PLCs).

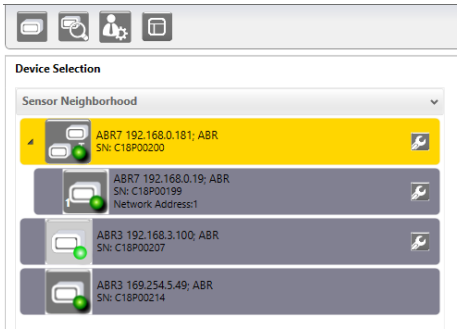
1. Download the latest version of Barcode Manager from www.bannerengineering.com.
2. Navigate to and open the downloaded file.
3. Run the downloaded file to access the installation screen.
4. Follow the onscreen installation procedure.
   After the installation is complete, the Barcode Manager entry is created under **Start** > **Programs** > **Banner Engineering**. A desktop icon is also created.

## Ethernet Device Discovery

The following configuration procedure assumes that a laptop computer running Barcode Manager is connected to a factory default reader through the Ethernet port.

The Barcode Manager user interface opens and displays a list of all the devices belonging to the Local Area Network (LAN).

*Figure 9. Device Discovery*




The Barcode Manager discovery feature also shows devices not belonging to the LAN and displays them in light gray (see Figure 9 on p. 5).

The following is an example configuration for Windows® operating system version 7, 8, or 10.

1. Confirm the network connections. Changing the Local Area Connection (LAN) properties of the programming computer to be compatible with the ABR device on the network may be required for connection.
   a) Click the **Start** button, then on the **Start** menu, click **Control Panel** or search for **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.

[7] The Learn procedure does not recognize the following symbologies: Postal Codes, Pharmacode, and MSI. Configure through Barcode Manager for these codes.
[8] Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.

d) In the connection properties, click **Internet Protocol Version 4 (TCP/IPv4)**, and then click **Properties**.
e) In the **Internet Protocol (TCP/IPv4) Properties**, select **Use the following IP address**.
f) Make sure that the IP address is 192.168.3.1, and the subnet mask is 255.255.255.0.
The IP address must be compatible with the default device address 192.168.3.100.

2. As an alternate method, change the IP address of the device.
3. In Barcode Manager, click **Find Devices**.
The device displays in **Sensor Neighborhood** with a dark gray icon, meaning it is now part of the LAN and can be configured. The new IP address also displays.
4. Double-click or drag the **device** icon into the **Selected Device Information Area**.
Details about the device display in this area.

After device discovery, configure your device through Barcode Manager. Go to Automatic Setup on p. 6.

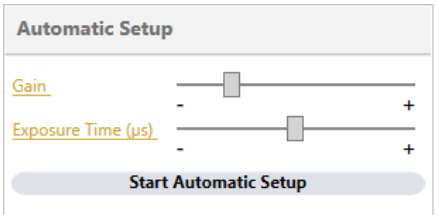
## Automatic Setup

To begin configuration, the reader must be correctly mounted at the correct reading distance for your application so that its Field of View covers the application reading area.

1. Click **Open Device Configuration**. The **Open Device Configuration** window opens showing the list of configurations (jobs) currently saved on the device. For new devices, the only saved configuration is the Default configuration.
2. Click **OK**. The device enters Live Image Capture mode and begins acquiring images.
3. Place the application code [9] in front of the reader at the correct application reading distance.
4. If needed, focus the reader on the code.
5. After the code is positioned, click **Pause** to stop image acquisition.

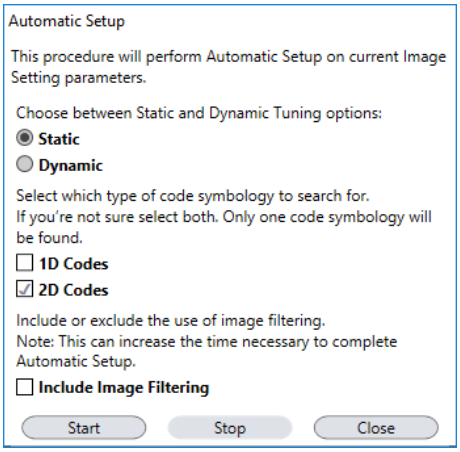
**Note:** If the image display area is too dark to see the images being captured, drag the Gain and Exposure Time sliders to the right to increase visibility. This will not affect Automatic Setup.

*Figure 10. Gain and Exposure Time*




6. Click **Start Automatic Setup**. The **Automatic Setup** window opens.

*Figure 11. Automatic Setup*




7. Select the correct reading conditions.
   - **Static** Tuning—No maximum limit on exposure time
   - **Dynamic** Tuning—Maximum allowable image exposure is automatically calculated using the parameters
   - **1D** code
   - **2D** code
   - **Include Image Filtering**—Select to find the best decoding condition.
8. Click **Start**.
   The reader begins acquiring images, adjusting the brightness and focus (for liquid lens autofocus models), and adjusting the decoding settings to find a barcode and optimize reading for the first code it finds. At the end of the procedure the Status: Completed message displays.
9. Close the **Automatic Setup** window.
   Your reader is now optimized for decoding. Continue setting up the reader for your application as desired. Typically, **Reading Phase** is configured next.

[9] Automatic Setup does not recognize the following symbologies: Postal Codes, Pharmacode, MSI, Standard 2 of 5, or Matrix 2 of 5, and Interleaved 2 of 5.

# Specifications

**Supply Voltage**
10 V dc to 30 V dc

**Consumption**
0.7 A (at 10 V dc) to 0.2 A (at 30 V dc) maximum

**Communication Interface**
Main RS232 or RS422 full duplex: 2400 bit/s to 115200 bit/s
Auxiliary - RS232: 2400 to 115200 bit/s
Ethernet [10]: 10/100 Mbit/s

**Inputs**
Input 1 (External Trigger) and Input 2 opto-isolated and polarity insensitive

**Outputs**
3 NPN/PNP/Push-Pull software selectable, reverse polarity and short circuit protected outputs available (2 Opto-isolated outputs instead if using TCNM-ACBB1)

**Optical Features**
See the Instruction Manual for details
LED Safety: LED emission according to EN 62471

**Imager**
1.3 MP: 1280 × 1024 pixels, SXGA, 60 frames/second
2.0 MP: 1600 × 1200 pixels, 45 frames/second

**Construction**
Aluminum, plastic window

**Operating Conditions**
Operating Temperature [11]: 0 °C to +50 °C (+32 °F to +122 °F)
Liquid lens models Operating Temperature [11]: 0 °C to +45 °C (+32 °F to +113 °F)
Storage Temperature: –20 °C to +70 °C (–4 °F to +158 °F)
90% maximum relative humidity (non-condensing)

**Environmental Rating**
IEC IP67 [12]

**Parameter Storage**
Permanent memory (Flash)

**Other**
Smart Teach Button (configurable via Barcode Manager), Beeper

**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 (Amps) |
|---|---|
| 20 | 5.0 |
| 22 | 3.0 |
| 24 | 2.0 |
| 26 | 1.0 |
| 28 | 0.8 |
| 30 | 0.5 |

**Certifications**

**Barcode Types**

| 1-D and stacked | | 2-D | POSTAL |
|---|---|---|---|
| • PDF417 Standard and Micro PDF417<br>• Code 128 (GS1-128)<br>• Code 39 (Standard and Full ASCII)<br>• Code 32<br>• MSI<br>• Standard 2 of 5<br>• Matrix 2 of 5<br>• Plessey | • Interleaved 2 of 5<br>• Codabar<br>• Code 93<br>• Pharmacode<br>• EAN-8/13-UPC-A/E (including Addon 2 and Addon 5)<br>• GS1 DataBar Family<br>• Composite Symbologies | • Data Matrix ECC 200 (Standard, GS1 and Direct Marking)<br>• QR Code (Standard and Direct Marking)<br>• Micro QR Code<br>• MAXICODE<br>• Aztec Code<br>• Dotcode | • Australia Post<br>• Royal Mail 4 State Customer<br>• Kix Code<br>• Japan Post<br>• PLANET<br>• POSTNET<br>• POSTNET (+BB)<br>• Intelligent Mail<br>• Swedish Post |

## FCC Statement

Modifications or changes to this equipment without the expressed written approval of Banner Engineering could void the authority to use the equipment.

This device complies with PART 15 of the FCC Rules. 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 which may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. 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.

## PC Requirements—Barcode Manager

Administrative rights are required to install the Barcode Manager software.

**Operating System**
Microsoft® Windows® operating system version 7, 8, or 10 [13]
Barcode Manager does not currently support Windows Embedded (often used in industrial PCs and/or PLCs)

**System Type**
32-bit or 64-bit

**Hard Drive Space**
2 GB hard disk for 64-bit machines; 1 GB hard disk for 32-bit machines

**Memory (RAM)**
1 GB RAM

**Processor**
2.00 GHz or faster microprocessor

**Screen Resolution**
One 19-inch or larger monitor, optimized for 1280×1024 resolution

**Third-Party Software**
Web Browser: Google Chrome, Mozilla Firefox, Microsoft Internet Explorer, Opera, etc.

**Connection**
100 Base-T Ethernet

10 The Ethernet interface is compatible with the following application protocols: TCP/IP, EtherNet/IP™, MODBUS® TCP, SLMP, PROFINET®. (The ABR is PROFINET compatible but not PROFINET certified.)
11 High ambient temperature applications should use metal mounting bracket for heat dissipation.
12 IEC IP67 when correctly connected to IP67 cables with seals.
13 Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.

This product is covered by one or more of the following patents:

Design patents: EP002197715, JP1521956, JP1522252, USD765755, ZL201330393980.2

Utility patents: EP0996284B1, EP0999514B1, EP1014292B1, EP1128315B1, EP1396811B1, EP1413971B1, EP2517148B1, EP2649555B1, JP4435343B2, JP4571258B2, US6512218, US6616039, US6808114, US6997385, US7053954, US7387246, US8058600, US8368000, US8743263, US8888003, US8915443, US9268982, US9482793, ZL200880132595.9, ZL200980163411.X

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