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1 Safety and Compliance Notices

**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.

1 Laser Safety

The following information is provided to comply with the rules imposed by international authorities and refers to the correct use of the TCNM-AD/EX family of scanners.

1 Standard Regulations

This scanner uses a low-power laser diode. Although staring directly at the laser beam momentarily causes no known biological damage, avoid staring at the beam as one would with any very strong light source, such as the sun. Avoid allowing the laser beam to hit the eye of an observer, even through reflective surfaces such as mirrors, etc.

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. The scanner is classified as a Class 2 laser product according to IEC 60825-1 regulations.

There is a safety device, which allows the laser to be switched on only if the motor is rotating above the threshold for its correct scanning speed.

The laser beam can be switched off through a software command (see also the GeniusPlus Help On Line).

**WARNING:**

*Use of controls or adjustments or performance of procedures other than those specified herein may result in exposure to hazardous visible laser light.*

The laser light is visible to the human eye and is emitted from the window on the front of the scanner. Warning labels indicating exposure to laser light and the device classification are applied onto the body of the scanner.

Disconnect the power supply when opening the device during maintenance or installation to avoid exposure to hazardous laser light.

The laser diode used in this device is classified as a class 3B laser product according to EN 60825-1 regulations and as a Class IIIb laser product according to CDRH regulations.

Any violation of the optic parts in particular can cause radiation up to the maximum level of the laser diode (35 mW at 630 to 680 nm).

1 FCC Compliance

Modifications or changes to this equipment without the expressed written approval of Banner Engineering Corp 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.

1 Power Supply
This product is intended to be installed by Qualified Personnel only.

This accessory device is intended to be supplied by a UL Listed or CSA Certified Power Unit with «Class 2» or LPS power source, which supplies power directly to the scanner via the 25-pin connector.

1 CE Compliance

WARNING:
This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

1 Handling
The TCNM-AD is designed to be used in an industrial environment and is built to withstand vibration and shock when correctly installed. However, it is also a precision product and it must be handled correctly before and during installation to avoid damage.

- Avoid that the scanners hit one another causing damage. They should be handled separately.
- Avoid that the scanners are dropped (exceeding shock limits).
- Do not fine tune the positioning by striking the scanner or bracket.
- Do not weld the scanner into position; this can cause electrostatic, heat, or output window damage.
- Do not spray paint near the scanner; this can cause output window damage.
2 Installation

2.1 Package Contents

Verify that the barcode reader and all the parts supplied with the equipment are present and intact when opening the packaging; the list of parts includes:

- Barcode reader with cable
- Quick Start Guide
- Barcode Test Chart
- GeniusPlus CD-ROM
- Replicate serial number labels
- Mounting kit: bracket, screws

**NOTE:** The replicate serial number labels are for external reference and can be applied to the reading station and/or to the TCNM-ACM-OM110 accessory when used.

2.1.1 General View

1 = Laser Beam Output Window
2 = POWER ON LED
3 = Warning and Device Class Labels
4 = Accessory Mounting Holes
5 = Mounting Holes
6 = LEDs
7 = Push Button

2.2 Mechanical Installation

The barcode scanner can be installed to operate in different positions. The four screw holes (M4 x 5) on the body of the reader are for mechanical fixture. The diagrams below give the overall dimensions of the scanner and mounting bracket and may be used for installation.
2.2.1 Mounting Barcode Scanner

Use the barcode scanner mounting bracket to obtain the most suitable position for the reader as shown.
2.2.2 Mounting the Deflection Mirror (Option)

The TCNM-ACM-102R accessory is a 102° deflection mirror that can be mounted to a barcode scanner. Install the deflection mirror as follows:

1. Make sure the device is not powered
2. Remove the 0° scanning window from the scanner by unscrewing the two cover screws

CAUTION: Avoid any contact with the deflection mirror, mirrored rotor, the lenses or other optical components; otherwise the performance of the reader will be reduced.

3. Clean the mirror surface and reading window with a clean soft cloth and alcohol before closing the scanner.
4. Mount the TCNM-ACM-102R 102° scanning window so the opening face is at 90° with respect to the scanner body.
5. Tighten the two cover screws.

![Figure 5. Mounting TCNM-ACM-102R Deflection Mirror](image)

The reading position with respect to the scanner is shown below.

![Figure 6. TCNM-ACM-102R Laser Beam Output Position](image)

### 2.2.3 Positioning

The barcode scanner is able to decode moving barcode labels at a variety of angles, however, significant angular distortion may degrade reading performance. When mounting the barcode scanner take into consideration these three ideal label position angles: **Skew 10° to 30°**, **Tilt 0°**, and **Pitch 0°**.
The Skew angle is represented by the value $S$ shown. Position the reader to assure at least 10° for the Skew angle. This avoids the direct reflection of the laser light emitted by the barcode scanner. For the raster version, this angle refers to the most inclined or external raster line, so that all other raster lines assure more than 10° Skew.

The Tilt angle is represented by the value $T$ shown. Position the reader to minimize the Tilt angle.

By using the Reconstruction Reading Mode software parameter, the tilt angle is less critical and can be decoded even if the scan line doesn't cross the entire code.

The Pitch angle is represented by the value $P$. Position the reader to minimize the Pitch angle.
3 Introduction

3.1 Product Description

The barcode laser scanner satisfies the most advanced needs of a wide range of users. It has been developed focusing on the realistic requirements of its target market. The outstanding result is an extremely compact, cost-effective, and easy-to-use industrial scanner.

The barcode scanner uses a solid-state laser diode as a light source; the light emitted has a wavelength between 630 and 680 nm. Refer to Safety and Compliance Notices on page 4 for information on laser safety.

The enclosure is rated IP65, making the scanner suitable for industrial environments where high protection against harsh external conditions is required.

3.1.1 Indicators

The five LEDs on the side of the scanner indicate the following:

<table>
<thead>
<tr>
<th>Table 1: Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Label</td>
</tr>
<tr>
<td>READY</td>
</tr>
<tr>
<td>GOOD</td>
</tr>
<tr>
<td>TRIGGER</td>
</tr>
<tr>
<td>COM</td>
</tr>
<tr>
<td>STATUS</td>
</tr>
</tbody>
</table>

During the reader startup (reset or restart phase), all the LEDs blink for one second.

On the back of the reader near the cable, the "POWER ON" LED indicates the laser scanner is correctly powered.

3.2 Model Description

The barcode scanners are available in versions that differ in regard to the following parameters:

- Resolution
- Performance
- Linear or raster reading

3.2 TCNM-AD Models

<table>
<thead>
<tr>
<th>TCNM-AD-</th>
<th>X</th>
<th>2</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical Resolution</td>
<td>Communication Interface</td>
<td>Option Version</td>
<td>Performance</td>
<td></td>
</tr>
<tr>
<td>1 = Standard resolution</td>
<td>2</td>
<td>0 = Linear</td>
<td>0 = Standard</td>
<td></td>
</tr>
<tr>
<td>2 = High resolution</td>
<td>1 = Raster</td>
<td>4 = High Performance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following tables display each version’s reading performance:

---

3 In On-Line mode the TRIGGER LED corresponds to the active reading phase signaled by the Presence Sensor. In Automatic and Continuous modes the TRIGGER LED is always on, indicating the reader is ready to read a code.
<table>
<thead>
<tr>
<th>Version</th>
<th>Max Code Resolution (mm (mils))</th>
<th>Max Code Resolution (scans/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12X0</td>
<td>0.20 (8)</td>
<td>500 to 800</td>
</tr>
<tr>
<td>12X4</td>
<td>0.15 (6)</td>
<td>800 to 1000</td>
</tr>
<tr>
<td>22X0</td>
<td>0.15 (6)</td>
<td>500 to 800</td>
</tr>
<tr>
<td>22X4</td>
<td>0.12 (5)</td>
<td>800 to 1000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Version</th>
<th>Reading Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>12X0</td>
<td>40 mm (1.6 in) - 300 mm (11.8 in) on 0.50 mm (20 mils) codes</td>
</tr>
<tr>
<td>12X4</td>
<td>50 mm (1.8 in) - 310 mm (11.8 in) on 0.50 mm (20 mils) codes</td>
</tr>
<tr>
<td>22X0</td>
<td>30 mm (1.2 in) - 90 mm (3.5 in) on 0.30 mm (12 mils) codes</td>
</tr>
<tr>
<td>22X4</td>
<td>45 mm (1.8) – 100 mm (3.9 in) on 0.20 mm (8 mils) codes</td>
</tr>
</tbody>
</table>

### 3.2 TCNM-EX Models

<table>
<thead>
<tr>
<th>TCNM-EX-</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Range</td>
<td>Communication Interface</td>
<td>Option Version</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 = Short</td>
<td>1 = Medium</td>
<td>2</td>
<td>0 = Linear</td>
<td>1 = Raster</td>
</tr>
<tr>
<td>1 = Medium</td>
<td>2 = Long</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following tables display each version’s reading performance:

<table>
<thead>
<tr>
<th>Version</th>
<th>Max Code Resolution (mm (mils))</th>
<th>Max Code Resolution (scans/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>02X0</td>
<td>0.20 (8)</td>
<td>600 to 1000</td>
</tr>
<tr>
<td>12X0</td>
<td>0.25 (10)</td>
<td>600 to 1000</td>
</tr>
<tr>
<td>22X0</td>
<td>0.35 (14)</td>
<td>600 to 1000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Version</th>
<th>Reading Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>02X0</td>
<td>75 mm (3 in) - 340 mm (13.4 in) on 0.35 mm (14 mils) codes</td>
</tr>
<tr>
<td>12X0</td>
<td>100 mm (3.9 in) - 440 mm (17.3 in) on 0.50 mm (20 mils) codes</td>
</tr>
<tr>
<td>22X0</td>
<td>190 mm (7.5 in) - 600 mm (23.6 in) on 0.50 mm (20 mils) codes</td>
</tr>
</tbody>
</table>

See reading diagrams for further details.
4 Default Settings

1. On-line operating mode (1 input, active closed)
2. Code Label Settings #1 = Read Code 39, variable length, up to 60 characters (Match string rule)
3. Code Label Settings #2 = Read I 2 of 5 of 8 characters (Match string rule)
4. Code Label Settings #3 = Read Code 128, variable length, up to 60 characters (Match string rule)
5. Code Label Settings #4 through #10 = disabled
6. Output 1 (normally open) No Read, Partial Read, 50 msec duration
7. Output 2 (normally open) Complete Read, Partial Read, 50 msec duration
8. RS-232 serial port: 9600 baud, 8 data bits, None parity, 1 Stop bit, Flow Control none
9. Standard Code Resolution, Standard Reading Conditions, default scans per sec (800 for EX, 500 for AD)

Default Operation:

1. Takes a trigger input
2. Reads the codes above
3. Outputs the data via RS-232 if code type and length meet the above requirements
5 Rapid Configuration

5.1 STEP 1 – Connect the System

NOTE: This section illustrates a standalone application. For a pass-through installation, refer to the appropriate section. For complete scanner configuration using the GeniusPlus configuration program, refer to the Context-Sensitive Help On-Line.

To connect the system in a standalone configuration, you need the hardware indicated below. In this layout, the data is transmitted to the Host on the main serial interface.

- In Local Echo communication mode, data is transmitted on the RS-232 auxiliary interface independently from the main interface selection.
- When On Line Operating mode is used, the scanner is activated by an External Trigger (photoelectric sensor) when the object enters its reading zone.

![Figure 8. Barcode scanner in a standalone layout](image)

5.1.1 TCNM-ACBB1 Pinout

The table below gives the pinout of the TCNM-ACBB1 terminal block connectors. Use this pinout when the barcode scanner is connected using the TCNM-ACBB1:

<table>
<thead>
<tr>
<th>TCNM-ACBB1 Terminal Block Connectors</th>
<th>Input Power</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vdc</td>
<td>Power Supply Input Voltage +</td>
<td>+V</td>
</tr>
<tr>
<td>GND</td>
<td>Power Supply Input Voltage –</td>
<td>–V</td>
</tr>
<tr>
<td>Earth</td>
<td>Protection Earth Ground</td>
<td>O1+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>O1–</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td></td>
<td>O2+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>O2-</td>
</tr>
<tr>
<td>+V</td>
<td>Power Source – External Trigger</td>
<td>TX</td>
</tr>
<tr>
<td>I1A</td>
<td>External Trigger A (polarity insensitive)</td>
<td>RX</td>
</tr>
<tr>
<td>I1B</td>
<td>External Trigger B (polarity insensitive)</td>
<td>SGND</td>
</tr>
</tbody>
</table>
### TCNM-ACBB1 Terminal Block Connectors

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>I2A</td>
<td>Input 2 A (polarity insensitive)</td>
<td>ID-NET™</td>
</tr>
<tr>
<td>I2B</td>
<td>Input 2 B (polarity insensitive)</td>
<td>REF Network Reference</td>
</tr>
<tr>
<td>–V</td>
<td>Power Reference – Inputs</td>
<td>ID+ ID-NET™ network +</td>
</tr>
<tr>
<td>Shield</td>
<td>Network Cable Shield</td>
<td>ID– ID-NET™ network –</td>
</tr>
</tbody>
</table>

**Main Interface**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>TX+</td>
</tr>
<tr>
<td>RTS</td>
<td>TX–</td>
</tr>
<tr>
<td>RX</td>
<td>RX+</td>
</tr>
<tr>
<td>CTS</td>
<td>RX–</td>
</tr>
<tr>
<td>SGND</td>
<td>SGND</td>
</tr>
</tbody>
</table>

**CAUTION:** Do not connect GND, SGND, and REF to different (external) ground references. GND, SGND, and REF are internally connected through filtering circuitry that can be permanently damaged if subjected to voltage drops over 0.8 Vdc.

### 5.1.2 25-pin Connector Pinout

The table below gives the pinout of the 25-pin male D-sub connector for connection to the power supply and input/output signals. Use this pinout when the barcode scanner is connected using the 25-pin connector:

![Figure 9. 25-pin male D-sub connector](image)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>13, 9</td>
<td>Vdc</td>
<td>Power supply input voltage +</td>
</tr>
<tr>
<td>25, 7</td>
<td>GND</td>
<td>Power supply input voltage –</td>
</tr>
<tr>
<td>1</td>
<td>CHASSIS</td>
<td>Cable shield connected to chassis</td>
</tr>
<tr>
<td>18</td>
<td>I1A</td>
<td>External Trigger A (polarity insensitive)</td>
</tr>
<tr>
<td>19</td>
<td>I1B</td>
<td>External Trigger B (polarity insensitive)</td>
</tr>
<tr>
<td>6</td>
<td>I2A</td>
<td>Input 2 A (polarity insensitive)</td>
</tr>
<tr>
<td>10</td>
<td>I2B</td>
<td>Input 2 B (polarity insensitive)</td>
</tr>
<tr>
<td>8</td>
<td>O1+</td>
<td>Output 1 +</td>
</tr>
<tr>
<td>22</td>
<td>O1–</td>
<td>Output 1 –</td>
</tr>
</tbody>
</table>

* Do not leave floating, see connection details.
### 25-pin D-sub male connector pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>O2+</td>
<td>Output 2 +</td>
</tr>
<tr>
<td>12</td>
<td>O2–</td>
<td>Output 2 –</td>
</tr>
<tr>
<td>20</td>
<td>RX</td>
<td>Auxiliary RS232 RX</td>
</tr>
<tr>
<td>21</td>
<td>TX</td>
<td>Auxiliary RS232 TX</td>
</tr>
<tr>
<td>23</td>
<td>ID+</td>
<td>ID-NET™ network +</td>
</tr>
<tr>
<td>24</td>
<td>ID–</td>
<td>ID-NET™ network –</td>
</tr>
<tr>
<td>14, 15, 16, 17</td>
<td>NC</td>
<td>Not Connected</td>
</tr>
</tbody>
</table>

### 25-pin D-sub male connector pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>RS232</th>
<th>RS485 Full-Duplex</th>
<th>RS485 Half-Duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>INTERFACE</td>
<td>TX</td>
<td>TX+</td>
<td>RTX+</td>
</tr>
<tr>
<td>3</td>
<td>(SW SELECTABLE)</td>
<td>RX</td>
<td>RX+</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>TX–</td>
<td>RTX–</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>RX–</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### 5.2 STEP 2 – Mounting and Positioning the System

1. To mount the barcode scanner, use the mounting bracket to obtain the most suitable position for the reader as shown in the figures below.

![Figure 10. Positioning with mounting bracket](image-url)

---

3. Do not leave floating, see connection details.
2. When mounting the barcode scanner, take into consideration these three ideal label position angles: Skew 10° to 30°, Tilt 0° and Pitch 0°.

![Skew Angle Tilt Angle Pitch Angle](image)

Figure 11. Skew, Tilt, and Pitch Angles

3. Refer to the Reading Diagrams to determine the distance at which your scanner should be positioned.

5.3 STEP 3 – SMART-TEACH Configuration

SMART-TEACH is the intuitive Human Machine Interface designed to improve ease of installation and maintenance. Status and diagnostic information are presented using the five colored LEDs, and the single push button gives immediate access to the following functions:

- **AutoLearn**—to self-detect and auto-configure for reading unknown barcodes (by type and length)
- **AutoSetup**—to self-optimize and auto-configure reading performance in demanding applications
- **Test Mode** with bar-graph visualization—to check static reading performance

![LED Indicators](image)

**NOTE:** If using the TCNM-ACM-OM110 accessory, when entering the SMART-TEACH interface, the Oscillating Mirror remains in the default fixed position (~15°) to make barcode reading easier while performing the SMART-TEACH functions.

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>READY</td>
<td>Green</td>
<td>Indicates the device is ready to operate</td>
</tr>
<tr>
<td>GOOD</td>
<td>Green</td>
<td>Confirms successful reading</td>
</tr>
<tr>
<td>TRIGGER</td>
<td>Yellow</td>
<td>Indicates the status of the reading phase</td>
</tr>
<tr>
<td>COM</td>
<td>Yellow</td>
<td>Indicates active communication on main serial port</td>
</tr>
<tr>
<td>STATUS</td>
<td>Red</td>
<td>Indicates a NO READ result</td>
</tr>
</tbody>
</table>

During the reader startup (reset or restart phase), all the LEDs blink for one second.

On the back of the reader near the cable, the "POWER ON" LED indicates the laser scanner is correctly powered.
5.3.1 Auto Learn

If you are configuring your scanner using SMART-TEACH, you must start with the Auto Learn procedure.

1. Hold the SMART-TEACH push button pressed until the LEARN LED is on.
2. Release the button to enter the Auto Learn function. The reader begins to automatically detect and recognize barcodes (by type and length) that are presented to it. The laser turns on and the LEARN LED blinks to indicate the ongoing process.
3. Exit the process by pressing the SMART-TEACH push button once. The scanner restarts at the end of the process, and then the detected barcodes are automatically configured in the scanner memory.

**NOTE:** If the barcode cannot be read because of low contrast or excessive ambient light, you can perform the AutoSetup function to optimize the optical parameters. Then you can perform Auto Learn to recognize the barcode symbology.

**NOTE:** On exit from Auto Learn, the following parameters are forced: Code Combination = Single Label, Reading Mode = Linear. If necessary, these parameters can be changed through GeniusPlus.

5.3.2 Auto Setup (Optional)

At the end of the Auto Learn procedure, you may follow the Auto Setup procedure to set up the reading parameters.

1. Hold the SMART-TEACH push button pressed until the SETUP LED is on.
2. Release the button to enter the Auto Setup function.
3. Once entered, if a barcode label is positioned in front of the scanline, the scanner automatically performs the optimal setup of the reading parameters for that specific barcode.

1. Place the desired barcode on the scanline.
2. Enter the Auto Setup function (the laser turns on and the SETUP LED blinks to indicate the ongoing process).
3. Wait until the SETUP LED stays steady ON (indicating the reader has detected the barcode).

This procedure ends either when the barcode is successfully decoded or after a timeout of about 7 seconds. The scanner restarts at the end of the process, and then the optimized reading parameters for that barcode are automatically configured in scanner memory.

**NOTE:** If your application has been configured using SMART-TEACH, go to STEP 5.

---

*In case of Programming Barcodes, refer to the "Setup Procedure Using Programming Barcodes" document in the product CD.*
5.3.3 Reset Scanner to Factory Default (Optional)

To reset the scanner to the factory default values, hold down the SMART-TEACH push button while powering up the scanner. At the end of the procedure (about 5–6 seconds), the Configuration and Environmental parameters are reset, and all LEDs blink simultaneously three times.

5.4 STEP 4 – Installing GeniusPlus Configuration Program

GeniusPlus is a scanner configuration tool that provides several important advantages:

- Wizard approach for new users
- Multi-language version
- Defined configuration directly stored in the reader
- Communication protocol independent from the physical interface allowing to consider the reader as a remote object to be configured and monitored

To install GeniusPlus, insert the GeniusPlus CD-ROM, wait for the CD to autorun, and follow the installation procedure. The software is compatible with Windows 98, 2000/NT, XP, Vista, Windows 7, and Windows 8.

This configuration procedure assumes scanner connection to a TCNM-ACBB1. GeniusPlus, running on a laptop computer, is connected to the scanner auxiliary port through the TCNM-ACBB1 9-pin connector. To communicate with the scanner, GeniusPlus performs an auto baud rate detection starting from its default parameters, which are 115200, 8, N, 1. These parameters can also be set in the GeniusPlus Tools > Options > Communications window.

5.4.1 Wizard for Quick Reader Setup

After installing the GeniusPlus software program, the following window appears asking the user to choose the desired configuration level.

![Wizard Window](image.png)

The Wizard option is advised for rapid configuration or new users because it shows a step-by-step scanner configuration.
1. Click **Create New** to create a new configuration

![Configuration Wizard - Action Selection](image1.png)

a. Select a barcode and drag it into one of the slots at the bottom. Click **Next** to configure the selected barcode(s) on the following screen(s).

![Configuration Wizard - Code Selection](image2.png)

b. Select **Operating Mode** and click **Next**.

![Configuration Wizard - Operating Modes](image3.png)

**On Line** operating mode requires the reader to be connected to an External Trigger/Presence Sensor using I1A and I1B inputs.

**Automatic** operating mode does not require connection to an external Presence Sensor. When working in this mode, the reader is continuously scanning while the reading phase is activated each time a barcode enters the reader reading zone. The reader stops reading after an N number of scans without a code. Barcode characters are transmitted on the serial interface. In case of a failed reading phase, no message is sent to the host computer.

c. Configure one or both digital outputs by selecting the desired **Activation Event**, **Deactivation Event**, and specifying **Deactivation Timeout**. Click **Next**.

![Configuration Wizard - Digital Outputs](image4.png)
2. After defining the parameter values, the following window appears allowing you to complete the reader configuration as follows:
   - **Save** the configuration to disk
   - Switch to **Advanced Mode**
   - Send the configuration to the scanner

3. After sending the configuration to the scanner, click **Next**. You have completed the configuration process. Click **Finish**.

4. After clicking **Finish**, the **System Information** window displays.
5.5 STEP 5 – Test Mode

Use a code suitable to your application to test the system.

1. To enter Test Mode, hold down the SMART-TEACH push button until the TEST LED is on.
2. Once entered, the bar graph on the five LEDs is activated and if the scanner starts reading barcodes, the bar graph shows the Good Read Rate. In case of no-read condition, only the STATUS LED is on and blinking.

3. To exit Test Mode, press the SMART-TEACH push button once.

NOTE: By default, the barcode scanner automatically exits Test Mode after two minutes.
6 Advanced Scanner Configuration

The Advanced selection is available when starting the GeniusPlus application and is designed for expert users to complete a more detailed scanner configuration. By choosing this option it is possible to start a new scanner configuration or to open and modify an old one. Refer to *TCNM - AD/EX/SP Family Software Configuration Parameter Guide* for more information.

6.1 SMART-TEACH Human Machine Interface

SMART-TEACH is the intuitive Human Machine Interface designed with the precise goal of improving ease of installation and maintenance.

Status and diagnostic information are clearly presented by means of five colored LEDs, whereas the single multi-function key gives immediate access to relevant functions:

- **Autosetup**—to self-optimize reading performance in demanding application
- **Autolearn**—to self-detect unknown barcodes
- **Test Mode** with bar-graph visualization—to check static reading performance

The colors and meaning of the five LEDs when in the one of the operating modes (On Line, Automatic, or Continuous) are illustrated in *Indicators* on page 11.
NOTE: The SMART-TEACH functions do not work if the motor or laser are turned off, see Troubleshooting on page 50 for details.

6.1.1 Diagnostic Indication

The STATUS and READY LEDs blink simultaneously to signal the presence of a failure. Diagnostic message transmission on interfaces can be enabled to provide details about specific failure conditions.

At the same time, one or more LEDs light up according to the following scheme:

<table>
<thead>
<tr>
<th>LED</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>READY</td>
<td>Blink</td>
</tr>
<tr>
<td>GOOD</td>
<td>ON to indicate any failure different than motor or laser failures.</td>
</tr>
<tr>
<td>TRIGGER</td>
<td>ON to indicate a motor failure.</td>
</tr>
<tr>
<td>COM</td>
<td>ON to indicate a laser failure.</td>
</tr>
<tr>
<td>STATUS</td>
<td>Blink</td>
</tr>
</tbody>
</table>

6.1.2 SMART-TEACH Functions

Quick access to the following functions is provided by using the SMART-TEACH button:

1. Press the button (the STATUS LED will give a visual feedback)
2. Hold the button until the specific function LED is on (TEST, LEARN or SETUP)
3. Release the button to enter the specific function

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

Figure 12. Release button to Exit  Figure 13. Release button to enter Test mode  Figure 14. Release button to enter AutoLearn
6.1.2 Test Mode Function

In Test Mode, the bar graph on the five LEDs is activated and if the scanner starts reading barcodes, the bar graph shows the Good Read Rate. In case of no read condition, only the STATUS LED is on and blinks.

To exit the Test Mode, press the SMART-TEACH push button once.

6.1.2 AutoLearn Function

In AutoLearn, the reader starts to automatically detect and recognize barcodes (by type and length) that are presented to it. The laser turns on and the LEARN LED blinks to indicate the ongoing process.

The procedure is as follows:

1. Place the desired barcode on the scanline.
2. Wait until the LEARN LED stays steady on (indicating the reader has detected the barcode).
3. Repeat, if needed, the above two steps to program up to 10 different barcodes (the LEARN LED returns to the blinking state for the next code). If more than one barcode is detected in the scan line, the Multi Label mode is enabled.
4. Exit the process by pressing the SMART-TEACH push button once.

The scanner restarts at the end of the process, and the detected barcodes are automatically configured in scanner memory.

6.1.2 AutoSetup Function

In AutoSetup, if a barcode label is positioned in front of the scanline, the scanner automatically performs the optimal setup of the reading parameters for that specific barcode.

The procedure is as follows:

1. Place the desired barcode on the scanline.
2. Enter the AutoSetup function (the laser turns on and the SETUP LED blinks to indicate the ongoing process).
3. Wait until the SETUP LED stays steady on (indicating the reader has detected the barcode).

This procedure ends either when the barcode is successfully decoded or after a timeout of about 7 (seven) seconds.

The scanner restarts at the end of the process, and then the optimized reading parameters for that barcode are automatically configured in scanner memory.
**NOTE:**

The AutoSetup function does not modify the programmed barcode symbologies. If needed, the AutoLearn function can be performed after AutoSetup.

**6.1.2 Reset Scanner to Factory Default**

See *Reset Scanner to Factory Default (Optional)* on page 19.
## 7 TCNM-ACBB1 Electrical Connections

All laser barcode scanners are equipped with a cable terminated by a 25-pin male D-sub connector for connection to the power supply and input/output signals. We recommend making system connections through a TCNM-ACBB1 connection box because they offer the advantages of easy connection, device replacement, and filtered reference signals.

This table lists the pinout of the TCNM-ACBB1 terminal block connectors. Use this pinout when the barcode scanner is connected using the TCNM-ACBB1.

**Table 3: TCNM-ACBB1 Terminal Block Connectors**

<table>
<thead>
<tr>
<th>Input Power</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vdc</td>
<td>Power Supply Input Voltage +</td>
</tr>
<tr>
<td>GND</td>
<td>Power Supply Input Voltage –</td>
</tr>
<tr>
<td>Earth</td>
<td>Protection Earth Ground</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>+V</td>
<td>Power Source – External Trigger</td>
</tr>
<tr>
<td>I1A</td>
<td>External Trigger A (polarity insensitive)</td>
</tr>
<tr>
<td>I1B</td>
<td>External Trigger B (polarity insensitive)</td>
</tr>
<tr>
<td>–V</td>
<td>Power Reference – External Trigger</td>
</tr>
<tr>
<td>+V</td>
<td>Power Source – Inputs</td>
</tr>
<tr>
<td>I2A</td>
<td>Input 2 A (polarity insensitive)</td>
</tr>
<tr>
<td>I2B</td>
<td>Input 2 B (polarity insensitive)</td>
</tr>
<tr>
<td>–V</td>
<td>Power Reference – Inputs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>+V</td>
<td>Power Source - Outputs</td>
</tr>
<tr>
<td>–V</td>
<td>Power Reference - Outputs</td>
</tr>
<tr>
<td>O1+</td>
<td>Output 1 +</td>
</tr>
<tr>
<td>O1–</td>
<td>Output 1 –</td>
</tr>
<tr>
<td>O2+</td>
<td>Output 2 +</td>
</tr>
<tr>
<td>O2–</td>
<td>Output 2 –</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Auxiliary Interface</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>Auxiliary Interface TX</td>
</tr>
<tr>
<td>RX</td>
<td>Auxiliary Interface RX</td>
</tr>
<tr>
<td>SGND</td>
<td>Auxiliary Interface Reference</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID-NET™</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>Network Reference</td>
</tr>
<tr>
<td>ID+</td>
<td>ID-NET™ network +</td>
</tr>
<tr>
<td>ID–</td>
<td>ID-NET™ network –</td>
</tr>
<tr>
<td>Shield</td>
<td>Network Cable Shield</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main Interface</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RS232</td>
<td></td>
</tr>
<tr>
<td>TX</td>
<td></td>
</tr>
<tr>
<td>RX</td>
<td></td>
</tr>
<tr>
<td>RS485 Full-Duplex</td>
<td></td>
</tr>
<tr>
<td>TX+</td>
<td></td>
</tr>
<tr>
<td>RS485 Half-Duplex</td>
<td></td>
</tr>
<tr>
<td>RTX+</td>
<td></td>
</tr>
</tbody>
</table>
7.1 Power Supply

Supply 10 to 30V dc power to the scanner through the TCNM-ACBB1 spring clamp terminal pins as shown. Connect the device CHASSIS to earth ground (Earth) by setting the appropriate jumper in the TCNM-ACBB1 connection box. See the TCNM-ACBB1 Installation Manual for details.

7.2 Main Serial Interface

The signals relative to the following serial interface types are available on the TCNM-ACBB1 spring clamp terminal blocks.

If the interface type is not compatible with the current communication handshaking, then the system forces the handshake to none.

Set the main interface type and the relative parameters (baud rate, data bits, etc.) using the GeniusPlus utility program.

Details regarding the connections and use of the interfaces are given in the next sections.

7.2.1 RS232 Interface

The serial interface is used for point-to-point connections; it handles communication with the host computer and allows both transmission of code data and the programming of the scanner. This is the default setting.

The following pins are used for RS232 interface connection.

<table>
<thead>
<tr>
<th>TCNM-ACBB1</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>RX</td>
<td>Receive Data</td>
</tr>
<tr>
<td>RTS</td>
<td>Request To Send</td>
</tr>
</tbody>
</table>

Do not leave floating, see connection details.
It is always advisable to use shielded cables. The overall maximum cable length must be less than 15 m (49.2 ft).

The RTS and CTS signals control data transmission and synchronize the connected devices.

If the RTS/CTS handshaking protocol is enabled, the barcode scanner activates the RTS output to indicate a message is to be transmitted. The receiving unit activates the CTS input to enable the transmission.
7.2.2 RS485 Full-Duplex Interface

The RS485 full-duplex (5 wires + shield) interface is used for non-pollled communication protocols in point-to-point connections over longer distances (maximum of 1200 m / 3940 ft) than those acceptable for RS232 communications or in electrically noisy environments.

The following pins are used for RS485 connection.

<table>
<thead>
<tr>
<th>TCNM-ACBB1</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX+</td>
<td>RS485 Transmit Data +</td>
</tr>
<tr>
<td>RX+</td>
<td>RS485 Receive Data +</td>
</tr>
<tr>
<td>TX–</td>
<td>RS485 Transmit Data –</td>
</tr>
<tr>
<td>RX–</td>
<td>RS485 Receive Data –</td>
</tr>
<tr>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
</tbody>
</table>

NOTE: For applications that do not use RX485 signals, do not leave these lines floating but connect them to SGND as shown below.
7.3 Auxiliary RS232 Interface

The auxiliary serial interface is used exclusively for RS232 point-to-point connections.

The parameters relative to the aux interface (baud rate, data bits, etc.) as well as particular communication modes such as LOCAL ECHO can be defined using the GeniusPlus utility program.

The 9-pin female Auxiliary Interface connector inside the TCNM-ACBB1 is the preferred connector for device configuration or communication monitoring.

![9-pin female connector](image)

**Figure 17. 9-pin female connector**

If permanent system wiring is required, the following pins are used to connect the RS232 auxiliary interface:

<table>
<thead>
<tr>
<th>TCNM-ACBB1</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX</td>
<td>Auxiliary Interface Receive Data</td>
</tr>
<tr>
<td>TX</td>
<td>Auxiliary Interface Transmit Data</td>
</tr>
<tr>
<td>SGND</td>
<td>Auxiliary Interface Reference</td>
</tr>
</tbody>
</table>

![RS232 Auxiliary Interface Connections](image)

**Figure 18. RS232 Auxiliary Interface Connections**

**NOTE:** Do not connect the auxiliary Interface to the TCNM-ACBB1 spring clamp connectors and the 9-pin connector simultaneously.
7.4 Inputs

There are two opto-coupled polarity insensitive inputs available on the scanner: Input 1 (External Trigger) and Input 2, a generic input. The electrical features of both inputs are:

- Maximum voltage: 30V dc
- Maximum current: 12 mA (scanner) + 12 mA (TCNM-ACBB1)

An anti-disturbance filter is implemented in software on both inputs so that the minimum pulse duration is approximately 5 milliseconds. This value can be increased through the software parameter Debounce Filter, see the software help file.

<table>
<thead>
<tr>
<th>TCNM-ACBB1</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>+V</td>
<td>Power Source - External Trigger</td>
</tr>
<tr>
<td>I1A</td>
<td>External Trigger A (polarity insensitive)</td>
</tr>
<tr>
<td>I1B</td>
<td>External Trigger B (polarity insensitive)</td>
</tr>
<tr>
<td>-V</td>
<td>Power Reference - External Trigger</td>
</tr>
</tbody>
</table>

The External Trigger input is used in the online operating Mode and tells the scanner to scan for a code. The active state of this input is selected in software.

The yellow Trigger LED is on when the active state of the External Trigger corresponds to ON.

This input is opto-coupled and can be driven by both an NPN and PNP type command. The connections are indicated in the following diagrams:

**Figure 19. PH-1 (PNP) External Trigger Using Barcode Scanner Power**

**Figure 20. NPN Photocell**

**Figure 20. NPN External Trigger Using Barcode Scanner Power**
External Trigger Input Connections Using External Power

**PNP Photocell**
- Input Signal
- Pulled down to External Input Device Reference

**NPN Photocell**
- Input Signal
- Pulled up to External Input Device Power

Figure 21. PNP External Trigger Using External Power

Figure 22. NPN External Trigger Using External Power

<table>
<thead>
<tr>
<th>TCNM-ACBB1</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>+V</td>
<td>Power Source - Inputs</td>
</tr>
<tr>
<td>12A</td>
<td>Input 2 A (polarity insensitive)</td>
</tr>
<tr>
<td>12B</td>
<td>Input 2 B (polarity insensitive)</td>
</tr>
<tr>
<td>-V</td>
<td>Power Reference - Inputs</td>
</tr>
</tbody>
</table>

Input 2 Connections Using Barcode Scanner Power

**Input Device**
- Power to Input Device
- Input Signal
- Input Device Reference

Figure 23. PNP Input 2 Using Barcode Scanner Power

Figure 24. NPN Input 2 Using Barcode Scanner Power
7.4.1 Code Verifier

If the barcode scanner is used as a Code Verifier, the verifier code can be configured in software through the GeniusPlus configuration program. However, it is also possible to use one of the inputs to trigger when the scanner should store a code read as the verifier code.

To read the verifier code:
1. Enable the Code Verifier parameter, and
2. Save the configuration parameters to allow correct Code Type reading to the scanner.

When the selected input is activated, the next read code is stored as the verifier code in the scanner’s non-volatile (Flash) memory. For more details see the Verifier Parameters in the TCNM-AD/EX/SP Family Software Configuration Parameter Guide help file.

7.5 Outputs

Two general purpose outputs are available.

<table>
<thead>
<tr>
<th>TCNM-ACBB1</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>+V</td>
<td>Power Source - Outputs</td>
</tr>
<tr>
<td>O1+</td>
<td>Output 1 +</td>
</tr>
<tr>
<td>O1–</td>
<td>Output 1 –</td>
</tr>
<tr>
<td>O2+</td>
<td>Output 2 +</td>
</tr>
<tr>
<td>O2–</td>
<td>Output 2 –</td>
</tr>
<tr>
<td>0–V</td>
<td>Power Reference Outputs</td>
</tr>
</tbody>
</table>

The meaning of Output 1 and Output 2 can be defined by the user (No Read, Right, Wrong, etc.). By default, Output 1 is associated with the No Read event, which activates when the code signaled by the external trigger is not decoded. Output 2 is associated with the Complete Read event, which activates when all the selected codes are correctly decoded.

The output signals are fully programmable being determined by the configuration of Activation/Deactivation events, Deactivation Timeout or a combination of the two.
$V_{CE \ max} = 30\text{V dc}$

40 mA continuous max.; 130 mA pulsed max.

### 7.6 User Interface - Host

The following table contains the pinout for standard RS232 PC Host interface. For other user interface types, please refer to their manual.
<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Pin</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Rx</td>
<td>3</td>
<td>Rx</td>
</tr>
<tr>
<td>3</td>
<td>Tx</td>
<td>2</td>
<td>Tx</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>7</td>
<td>GND</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>4</td>
<td>RTS</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>5</td>
<td>CTS</td>
</tr>
</tbody>
</table>
8 Typical Layouts

The following typical layouts refer to system hardware configurations. Dotted lines in the figures refer to optional hardware configurations within the particular layout. These layouts also require the correct setup of the software configuration parameters.

8.1 Point-to-Point

In a serial interface layout, data is transmitted to the Host on the main serial interface.

- In Local Echo communication mode, data is transmitted on the RS232 auxiliary interface independently from the main interface selection.
- When On Line Operating mode is used, the scanner is activated by an External Trigger (photoelectric sensor) when the object enters its reading zone.

Figure 31. Serial Interface Point-to-Point Layout
8.2 Pass-Through Mode

Pass-through mode allows two or more devices to be connected to a single external serial interface. Each barcode scanner transmits the messages received by the Auxiliary interface onto the Main interface. All messages are passed through this chain to the host.

When On Line Operating mode is used, the scanner is activated by an External Trigger (photoelectric sensor) when the object enters its reading zone.

Applications can be implemented to connect a device such as a hand-held reader to the Auxiliary port of the last scanner in the chain for manual code reading capability.

Figure 32. Pass-Through Layout
9 Reading Features

9.1 Advanced Code Reconstruction

The traditional way of barcode reading could be called “Linear Reading”. In this case, the laser beam crosses the barcode symbol from its beginning to its end as shown in the following figure:

![Linear Reading](image1.png)

**Figure 33. Linear Reading**

In Advanced Code Reconstruction (ACR) mode it is no longer necessary for the laser beam to cross the label from beginning to end. With just a set of partial scans on the label (obtained using the motion of the label itself), the scanner is able to “reconstruct” the barcode. A typical set of partial scans is shown in the figure below:

![Partial Scans](image2.png)

**Figure 34. Partial Scans**

None of the partial scans contains the whole label. The decoder aligns each partial scan correctly and combines them to obtain the entire code. The alignment is performed by calculating the time difference from one partial scan to another using a reference code element. ACR therefore has an intrinsic ability to increase the reading percentage of damaged codes as in the examples below:
Figure 35. ACR Readable Codes

ACR is disabled by default but can be enabled for the following code types:
- Code 25 Interleaved
- Code 39 Family
- Codabar
- GS1 DataBar
- Code 128/EAN128
- EAN/UPC (without Add-Ons)
- Code 93
- GS1 DataBar Expanded

9.1.1 Important Advanced Code Reconstruction Reading Conditions
- Do not use Advanced Code Reconstruction (ACR) for omni-directional reading stations
- Code concatenation and ACR are not compatible and therefore cannot be enabled simultaneously
- Stacked codes and ACR are not compatible
- Codes shorter than 4 digits, while readable linearly, cannot be reconstructed in ACR

**NOTE:** To maximize scanner performance in Advanced Code Reconstruction Reading applications:
- Enable only the code symbologies used in the application and disable any code symbologies not used in the application
- Reconstruct only one code label at a time
- Use conveyor speeds less than or equal to 1.0 m/s

9.1.2 Tilt Angle for Advanced Code Reconstruction
The most important parameter in Advanced Code Reconstruction is the value of the maximum tilt angle (α maximum) under which the code reconstruction process is still possible.
The decoder will be able to read the label with a tilt angle between $+\alpha_{\text{max}}$ and $-\alpha_{\text{max}}$ as shown in the following figure:

![Diagram showing reading zones with $\alpha_{\text{max}}$](image)

NOTE: Although tilt angles of 45° can be obtained, barcode scanners are not designed to create omnidirectional reading stations using two scanners in an X-pattern.

### 9.1.3 Advanced Code Reconstruction Reading Conditions

The following tables describe the minimum code height requirements (in mm) for standard ACR applications depending on the code symbology and the given reading conditions.

- ANSI Grade B minimum
- 800 scans/sec
- Three code symbologies enabled simultaneously
- Uniform background

#### Minimum Code Height for ACR-Lite Reading (mm)

**Table 4: 2/5 Interleaved (Ratio 2.5:1)**

<table>
<thead>
<tr>
<th>Code Resolution (mm)</th>
<th>Conveyor Speed (m/s)</th>
<th>45° max</th>
<th>30° max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.5</td>
<td>0.75</td>
</tr>
<tr>
<td>0.20</td>
<td>17</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>0.35</td>
<td>28</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>0.50</td>
<td>34</td>
<td>36</td>
<td>38</td>
</tr>
</tbody>
</table>

**Table 5: Code 39 (Ratio 2.5:1; Interdigit = Module Size)**

<table>
<thead>
<tr>
<th>Code Resolution (mm)</th>
<th>Conveyor Speed (m/s)</th>
<th>45° max</th>
<th>30° max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.5</td>
<td>0.75</td>
</tr>
<tr>
<td>0.20</td>
<td>16</td>
<td>19</td>
<td>22</td>
</tr>
<tr>
<td>0.35</td>
<td>26</td>
<td>28</td>
<td>30</td>
</tr>
</tbody>
</table>
### 9.2 Linear Code Reading

The number of scans performed on the code by the barcode scanner and therefore the decoding capability is influenced by the following parameters:

- Number of scans per second
- Code motion speed
- Label dimensions
- Scan direction with respect to code motion

At least five scans during the code passage should be allowed to ensure a successful read.

#### 9.2.1 Step-Ladder Mode

If scanning is perpendicular to the code motion direction, the number of effective scans performed by the reader is given by the following formula:

\[
SN = \left[ \frac{LH}{LS} \times SS \right] - 2
\]

where:

- \( SN \) = number of effective scans
- \( LH \) = label height (in mm)
- \( LS \) = label movement speed in (mm/s)
- \( SS \) = number of scans per second

---

**Table 6: Code 128 - EAN 128**

<table>
<thead>
<tr>
<th>Code Resolution (mm)</th>
<th>Conveyor Speed (m/s)</th>
<th>45° max</th>
<th>30° max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.5</td>
<td>0.75</td>
</tr>
<tr>
<td>0.50</td>
<td>31</td>
<td>33</td>
<td>35</td>
</tr>
<tr>
<td>0.35</td>
<td>22</td>
<td>25</td>
<td>28</td>
</tr>
<tr>
<td>0.20</td>
<td>12</td>
<td>15</td>
<td>18</td>
</tr>
</tbody>
</table>
9.2.2 Picket-Fence Mode

If scanning is parallel to the code motion, the number of effective scans is given by the following formula:

\[
SN = \left( \frac{(FW - LW)}{LS} \right) \times SS - 2
\]

where:
- \(SN\) = number of effective scans
- \(FW\) = reading field width (in mm)
- \(LW\) = label width (in mm)
- \(LS\) = label movement speed (in mm/s)
- \(SS\) = scans per second

For example:
TCNM-EX (800 scans/sec.) for a 25 mm high code moving at 1250 mm/s performs: \([(25 \div 1250) \times 800] - 2 = 14\)
effective scans

TCNM-AD (500 scans/sec.) for a 25 mm high code moving at 1000 mm/s performs: \([(25 \div 1000) \times 500] - 2 = 10\)
effective scans
For example:

TCNM-EX (800 scans per sec), for a 100 mm wide code moving in a point where the reading field is 200 mm wide at a 2000 mm/s speed, performs: $\frac{(200 - 100)}{2000} \times 800 - 2 = 38$ effective scans

TCNM-AD (500 scans per sec.), for a 60 mm wide code moving in a point where the reading field is 160 mm wide at a 1500 mm/s speed, performs: $\frac{(160 - 60)}{1500} \times 500 - 2 = 31$ effective scans

### 9.3 Performance

#### 9.3.1 Reading Performance (TCNM-EX Models)

<table>
<thead>
<tr>
<th>Version</th>
<th>Max Code Resolution (mm (mils))</th>
<th>Speed (scans/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>02X0</td>
<td>0.20 (8)</td>
<td>600 to 1000</td>
</tr>
<tr>
<td>12X0</td>
<td>0.25 (10)</td>
<td>600 to 1000</td>
</tr>
<tr>
<td>22X0</td>
<td>0.35 (14)</td>
<td>600 to 1000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Version</th>
<th>Reading Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>02X0</td>
<td>75 mm (3 in) - 340 mm (13.4 in) on 0.35 mm (14 mils) codes</td>
</tr>
<tr>
<td>12X0</td>
<td>100 mm (3.9 in) - 440 mm (17.3 in) on 0.50 mm (20 mils) codes</td>
</tr>
<tr>
<td>22X0</td>
<td>190 mm (7.5 in) - 600 mm (23.6 in) on 0.50 mm (20 mils) codes</td>
</tr>
</tbody>
</table>

Refer to the diagrams given in *Reading Diagrams* on page 45 for further details on the reading features. They are taken on various resolution sample codes at a 25 °C ambient temperature, depending on the conditions in the notes under the diagrams.

#### 9.3.2 Reading Performance (TCNM-AD Models)

<table>
<thead>
<tr>
<th>Version</th>
<th>Max Code Resolution (mm (mils))</th>
<th>Speed (scans/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12X0</td>
<td>0.20 (8)</td>
<td>500 to 800</td>
</tr>
<tr>
<td>12X4</td>
<td>0.15 (6)</td>
<td>800 to 1000</td>
</tr>
<tr>
<td>22X0</td>
<td>0.15 (6)</td>
<td>500 to 800</td>
</tr>
<tr>
<td>22X4</td>
<td>0.12 (5)</td>
<td>800 to 1000</td>
</tr>
</tbody>
</table>
### Version | Reading Distance
--- | ---
12X0 | 40 mm (1.6 in) - 300 mm (11.8 in) on 0.50 mm (20 mils) codes
12X4 | 50 mm (1.8 in) - 310 mm (11.8 in) on 0.50 mm (20 mils) codes
22X0 | 30 mm (1.2 in) - 90 mm (3.5 in) on 0.30 mm (12 mils) codes
22X4 | 30 mm (1.2 in) - 90 mm (3.5 in) on 0.30 mm (12 mils) codes

Refer to the diagrams given in Reading Diagrams on page 45 for further details on the reading features. They are taken on various resolution sample codes at a 25°C ambient temperature, depending on the conditions in the notes under the diagrams.

#### 9.3.3 Raster

Raster versions are available. The distance between the top and bottom scan lines is called capture and is measured from the laser beam output window. The reading characteristics for the raster versions for the TCNM-EX Barcode Scanner are given in the table below:

<table>
<thead>
<tr>
<th>Raster Capture</th>
<th>Reading Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300 mm (11.8 in)</td>
</tr>
<tr>
<td>18 mm (0.7 in)</td>
<td>35 mm (1.4 in)</td>
</tr>
</tbody>
</table>

The maximum capture of the TCNM-AD Barcode Scanner is 18 mm (0.7 in) at 300 mm (11.8 in).

#### 9.4 Reading Diagrams

### 9.4.1 Reading Diagrams (TCNM-EX Models)
### TCNM-EX-0200 (Short Reading Range)
- Optic Version = Linear
- Code = Interleaved 2/5 or Code 39
- PCS = 0.90
- Pitch angle = 0°
- Skew angle = 10°
- Tilt angle = 0°
- Code Resolution® = High
- Reading Conditions® = Standard
- Scan Speed® = 800 scans/sec

### TCNM-EX-1200 (Medium Reading Range)
- Optic Version = Linear
- Code = Interleaved 2/5 or Code 39
- PCS = 0.90
- Pitch angle = 0°
- Skew angle = 10°
- Tilt angle = 0°
- Code Resolution® = High for 0.25 mm (10 mils) codes;
  Standard for 0.35 mm, (14 mils) codes and greater
- Reading Conditions® = Standard
- Scan Speed® = 800 scans/sec

### TCNM-EX-2200 (Long Reading Range)

![Chart]

- Optic Version = Linear
- Code = Interleaved 2/5 or Code 39
- PCS = 0.90
- Pitch angle = 0°
- Skew angle = 10°
- Tilt angle = 0°
- Code Resolution® = High for 0.35 mm (14 mils) codes;
  Standard for 0.50 mm, (20 mils) codes and greater
- Reading Conditions® = Standard
- Scan Speed® = 800 scans/sec

---

**NOTE:** (0,0) is the center of the laser beam output window.

---

*Parameters selectable in GeniusPlus.*
### 9.4.2 Reading Diagrams (TCNM-AD Models)

<table>
<thead>
<tr>
<th>TCNM-AD-1200 (Standard Resolution)</th>
<th>TCNM-AD-2200 (High Resolution)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>TCNM-AD-1204 (Standard Resolution)</th>
<th>TCNM-AD-2204 (High Resolution)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
</tr>
<tr>
<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
</tr>
</tbody>
</table>

---

Note: (0,0) is the center of the laser beam output window.
### Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optic Version</td>
<td>Linear</td>
</tr>
<tr>
<td>Code</td>
<td>Interleaved 2/5 or Code 39</td>
</tr>
<tr>
<td>PCS</td>
<td>0.90</td>
</tr>
<tr>
<td>Pitch angle</td>
<td>0°</td>
</tr>
<tr>
<td>Skew angle</td>
<td>15°</td>
</tr>
<tr>
<td>Tilt angle</td>
<td>0°</td>
</tr>
<tr>
<td>Reading Conditions</td>
<td>Standard</td>
</tr>
<tr>
<td>Scan Speed</td>
<td>500 scans/sec</td>
</tr>
</tbody>
</table>

Parameter selectable in GeniusPlus.
10 Maintenance

Dust, dirt, and debris on the window may alter the reading performance. Clean the laser beam output window periodically for continued correct operation of the reader; clean frequently in particularly dirty environments.

**WARNING:** Clean the window of the laser barcode scanner when the scanner is turned off or, at least, when the laser beam is deactivated.

To clean:

- Use soft material and alcohol to clean the window.
- Avoid any abrasive substances.
11 Troubleshooting

11.1 General Guidelines

When wiring the device, pay careful attention to the signal name (acronym) on the TCNM-ACBB1 spring clamp connectors. If you are connecting directly to the scanner’s 25-pin connector, pay attention to the pin number of the signals.

If you need information about a certain reader parameter, refer to the GeniusPlus program help files. Either connect the device and select the parameter you are interested in by pressing the F1 key, or select Help > Parameters Help from the command menu.

If you are unable to fix the problem and need to contact Banner Engineering Corp, provide (if possible) the Device Configuration files (*.ddc). Connect through GeniusPlus and click the Save icon from the toolbar. Also note the device's model, serial number, and order number.

11.2 Troubleshooting Guide

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
</table>
| **Power On:** the “Power On”/“Ready” LED is not lit                      | • Is power connected?  
 • If using rail power, does the rail have power?  
 • If using TCNM-ACBB1, does it have power (check the switch and LED)?  
 • Measure voltage either at pin 13 and pin 25 (for 25-pin connector) or at spring clamp V dc and GND (for TCNM-ACBB1). |
| **On Line Mode:** TRIGGER LED is not lit (when external trigger activates) | • Is the sensor connected to I1A and I1B spring clamps (for TCNM-ACBB1) or to pins 18 and 19 (for 25-pin connector)?  
 • Is power supplied to the sensor?  
 • Are the sensor LEDs working correctly?  
 • Is the sensor/reflector system aligned? |
| **On Line Mode:** TRIGGER LED is correctly lit but nothing happens (no reading results) | • Is the software configuration consistent with the application condition (operating mode, etc.)?  
 • In the GeniusPlus program select the Operating Mode branch and check for related parameters. |
| **Serial On Line Mode:** the reader is not triggered (no reading results) | • In the GeniusPlus program select the Operating Mode branch and check if Serial On Line is selected in the On Line Options.  
 • Are the Start – Stop characters correctly assigned?  
 • Is the serial trigger source correctly connected and configured? |
| **On Line Mode and Serial On Line:** Reader doesn’t respond correctly to the expected external signals end | In the GeniusPlus program select the Operating Mode branch and check the Reading Phase Timeout parameter. |
| **SMART-TEACH** functions do not work. LEDs light up but do not allow access to the functions | The SMART-TEACH functions do not work if the scanner motor or laser are turned off. Check if the motor or laser are turned off through the following parameters:  
 • Beam Shutter = enabled  
 • Scan Speed = Motor Off  
 • Energy Saving > Serial Motor Off has been sent |
| **Reading:** Not possible to read the target barcode (always returns No Read) or the Auto Setup procedure Fails | Check the synchronization of reading pulse with object to read: Is the scan line correctly positioned?  
 Place the barcode in the center of the scan line and run Test mode (selectable by GeniusPlus as an Operating Mode). If you still have trouble, check the following:  
 • Is the reading distance within the allowed distance (see reading diagrams)?  
 • Is the Tilt angle too large?  
 • Is the Skew angle less than 10° (direct reflection)?  
 • Choose the Code Definition branch and enable different Code Symbologies (except Pharmacode). Length = Min and Max (variable).  
 • Is the barcode quality sufficient?  
 • If you had no success, perform the test using the BARCODE TEST CHART included with the product. |
<table>
<thead>
<tr>
<th><strong>Problem</strong></th>
<th><strong>Solution</strong></th>
</tr>
</thead>
</table>
| **Communication:** Device is not transmitting anything to the host        | • Is the serial cable connected?  
• Is the correct wiring respected?  
• Are serial host settings equivalent to the serial device setting?  
• If using TCNM-ACBB1, make sure that the RS485 termination switch is positioned to OFF. |
| **Communication:** Data transferred to the host are incorrect, corrupted, or incomplete | • In the GeniusPlus program select the Data Communication Settings/Data Format/Standard Parameters branch and check the Header, Separators, and Terminator values  
• Check the Code Field Length and Fill Character values.  
• Are the COM port parameters correctly assigned? |
| **Communication:** Always returns the Reader Failure Character (&lt;BEL&gt; ch as default) | Contact Banner Engineering Corp. Either a motor or laser failure has occurred. Note the exact model and serial number of the device.                                                                     |
| Where is the serial number located?                                       | The device’s serial number is on a label on the body of the reader. Serial numbers consist of 9 characters: one letter, 2 numbers, and another letter followed by 5 numbers.   |
12 Specifications

**Sensor**

**Input Power**
Supply Voltage: 10–30V dc  
Power consumption: Maximum 0.5 to 0.17 A; 5 W

**Serial Interfaces**
Main Serial Interface: Sw programmable: RS232; RS485 FD and HD  
Baud rate: 1200 to 115200  
Auxiliary: RS232  
Baud rate: 1200 to 115200  
ID-NET™: RS485 Half-duplex  
Baud rate: Up to 1 MBaud

**Inputs**
Input 1 (External Trigger), Input 2: Optocoupled, polarity insensitive  
Voltage: 10–30V dc  
Current Consumption: 12 mA maximum  
Minimum Pulse Duration: 5 ms

**Outputs**
Output 1, Output 2: Optocoupled  
$V_{CE}$: 30V dc maximum  
Collector Current: 40 mA continuous maximum; 130 mA pulsed maximum  
$V_{CE}$ saturation: 1V maximum at 10 mA  
Power Dissipation: 80 mW maximum at 45 °C (ambient temperature)

**Optical Features**
Light Source: Semiconductor laser diode  
Wave Length: 630 to 680 nm  
Safety Class: Class 2 - EN 60825-1; CDRH

**Reading Features**
Scan Rate (software): (600 to 1000 scans/sec)  
Aperture Angle: 50°  
Maximum Reading Distance and Resolution: see Reading Performance (TCNM-EX Models) on page 44 and Reading Performance (TCNM-AD Models) on page 44

**Operating Conditions**
Operating Temperature: 0 °C to +45 °C (+32 °F to +113 °F)  
Storage Temperature: −20 °C to +70 °C (−4 °F to +158 °F)  
Humidity: 90% (non-condensing)  
Vibration Resistance EN 60068-2-6: 14 mm at 2 to 10 Hz; 1.5 mm at 13 to 55 Hz; 2 g at 70 to 200 Hz; 2 hours on each axis  
Bump Resistance N 60068-2-29: 30g; 6 ms; 5000 shocks on each axis

**Environmental Rating**
IP65  
Protection Class – EN 60529

**Dimensions**
68 x 84 x 34 mm (2.7 x 3.3 x 1.3 in)

**Weight**
330 g (11.6 oz)

**LED Indicators**
Ready, Good, Trigger, Com, Status, Power On

**Multi-function Key**
SMART-TEACH button

---

**Software**

**Readable Codes**
- EAN/UPC (including Add-on 2 and Add-on 5)
- 2/5 Interleaved
- ABC Codabar
- Codabar
- Code 39 (Standard and Full ASCII)
- Code 93
- Code 128
- EAN 128
- GS1 DataBar
- GS1 DataBar Expanded
- GS1 DataBar Limited
- ISBT 128
- Pharmacode
- Plessey

**Code Selection**
Up to ten different symbologies during one reading phase

**Decoding Safety**
Can enable multiple good reads of same code

---

8 Further details given in the Reader Performance tables.  
9 If the reader is used in high temperature environments (over 40 °C), use of the Beam Shutter is advised (see the GeniusPlus configuration program) and/or a thermally conductive support (such as the metal bracket provided).
ACR Readable.
# 13 Accessories

<table>
<thead>
<tr>
<th>Mirrors</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCNM-ACM-102R</td>
<td>102° Reading Mirror</td>
<td>90823</td>
</tr>
<tr>
<td>TCNM-ACM-OM110</td>
<td>Oscillating Mirror</td>
<td>90825</td>
</tr>
<tr>
<td>TCNM-ACM-000A</td>
<td></td>
<td>90822</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connection Boxes</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCNM-ACBB1</td>
<td>Compact Connection Box</td>
<td>90828</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cables</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCNM-AD-CAB</td>
<td>25-pin Cable, Flying Leads</td>
<td>90856</td>
</tr>
</tbody>
</table>
14 Glossary

ACR (Advanced Code Reconstruction)
This powerful code reconstruction technology considerably increases the code reading capability in the case of damaged or very tilted barcodes.

Barcode
A pattern of variable-width bars and spaces that represents alphanumeric data in machine-readable form. The general format of a barcode symbol consists of a leading margin, start character, data or message character, check character (if any), stop character, and trailing margin. Within this framework, each recognizable symbology uses its own unique format.

Barcode Label
A label that carries a barcode and can be affixed to an article.

CDRH (Center for Devices and Radiological Health)
This organization (a service of the Food and Drug Administration) is responsible for the safety regulations governing acceptable limitations on electronic radiation from laser devices. Banner devices are in compliance with the CDRH regulations.

Decode
The process of translating a barcode into data characters using a specific set of rules for each symbology.

EAN
European Article Number System. The international standard barcode for retail food packages.

FLASH
An on-board non-volatile memory chip.

Half Duplex
Transmission in either direction, but not simultaneously.

A
Aperture
Term used on the required CDRH warning labels to describe the laser exit window.

B
Baud Rate
A unit used to measure communications speed or data transfer rate.

C
Code Positioning
Variation in code placement that affects the ability of a scanner to read a code. The terms Pitch, Skew, and Tilt deal with the angular variations of code positioning in the X, Y and Z axes. Variations in code placement affect the pulse width and therefore the decoding of the code. Pulse width is defined as a change from the leading edge of a bar or space to the trailing edge of a bar or space over time. Pulse width is also referred to as a transition. Tilt, pitch, and skew affect the pulse width of the code.

Decoder
As part of a barcode reading system, the electronic package that receives the signals from the scanner, performs the algorithm to interpret the signals into meaningful data, and provides the interface to other devices. The decoder is normally integrated into the scanner.

EAN
European Article Number System. The international standard barcode for retail food packages.

Full Duplex
Simultaneous, two-way, independent transmission in both directions.

Host
A computer that serves other terminals in a network, providing services such as network control, database access, special programs, supervisory programs, or programming languages.
Interface
A shared boundary defined by common physical interconnection characteristics, signal characteristics and meanings of interchanged signals.

LED (Light Emitting Diode)
A low power electronic device that can serve as a visible or near infrared light source when voltage is applied continuously or in pulses. It is commonly used as an indicator light and uses less power than an incandescent light bulb but more than a Liquid Crystal Display (LCD). LEDs have extremely long lifetimes when properly operated.

Multidrop Line
A single communications circuit that interconnects many stations, each of which contains terminal devices. See RS485.

Parameter
A value you specify to a program. Typically parameters are set to configure a device to have particular operating characteristics.

Picket-Fence Orientation
When the barcode’s bars are positioned vertically on the product, causing them to appear as a picket fence. The first bar will enter the scan window first.

Pitch
Rotation of a code pattern about the X-axis. The normal distance between center line or adjacent characters.

Raster
The process of projecting the laser beam at varied angles spaced evenly from each other. Typically, the mirrored rotor surfaces are angled to create multiple scan lines instead of a single beam.

Resolution
The narrowest element dimension, which can be distinguished by a particular reading device or printed with a particular device or method.
Scanner
A device that examines a printed pattern (barcode) and either passes the uninterpreted data to a decoder or decodes the data and passes it onto the Host system.

Serial Port
An I/O port used to connect a scanner to your computer, identifiable by a 9-pin or 25-pin connector.

Signal
An impulse or fluctuating electrical quantity (for example, a voltage or current) the variations of which represent changes in information.

Tilt
Rotation around the Z axis. Used to describe the position of the barcode with respect to the laser scan line.

UPC

Visible Laser Diode
A light source used in scanners to illuminate the barcode symbol. Generates visible red light at wavelengths between 630 and 680 nm.

Skew
Rotation about the Y-axis. Rotational deviation from correct horizontal and vertical orientation; may apply to single character, line or entire encoded item.

Step-Ladder Orientation
When the barcode's bars are positioned horizontally on the product, causing them to appear as a ladder. The ends of all bars will enter the scan window first.

Symbol
A combination of characters including start/stop and checksum characters, as required, that form a complete scannable barcode.

Trigger Signal
A signal, typically provided by a photoelectric sensor or proximity switch, which informs the scanner of the presence of an object within its reading zone.