Microscan X-Mode Technology

Technical Note

Application environments present many data capture challenges, some of which are direct part mark symbols, damaged symbols, partially covered symbols, poorly printed symbols, and variation of label placement. Symbol quality, location, and orientation cannot always be controlled. Symbols can be torn, partially obscured, overprinted, or underprinted due to variations in print mechanisms. For industrial tracking and traceability to be reliable, symbols must be decoded regardless of printing or marking method, damage, label tilt, or any other factors.

Examples of obscured and poorly-printed linear barcodes.

Examples of over-printed, underprinted, and damaged 2D Data Matrix symbols.

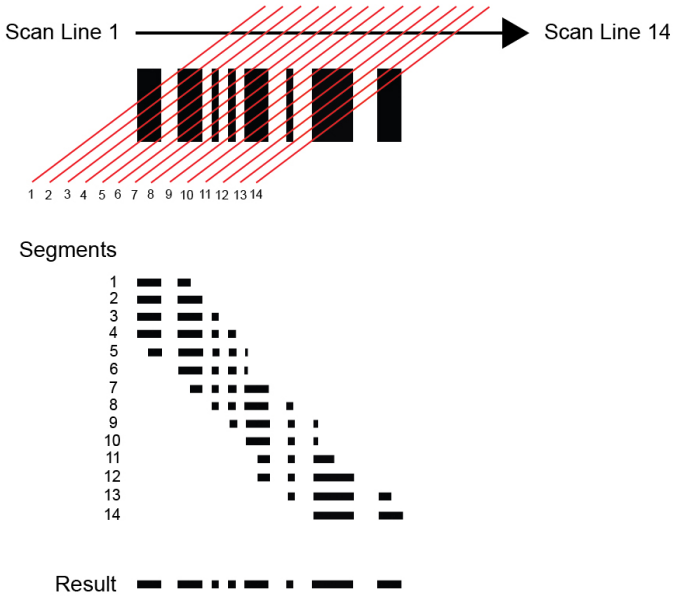
Microscan X-Mode technology provides industry-leading decode performance on both directly-marked and printed symbols. X-Mode decoding algorithms are available on several Microscan platforms from laser barcode scanners to 2D barcode imagers to machine vision cameras and software. X-Mode allows devices to be deployed easily in a wide variety of applications with minimum configuration required to read a range of codes regardless of marking method, damage, orientation, or code type.

Decodes Common Symbologies

The most widely-used symbologies are enabled by default in X-Mode (Data Matrix, QR Code, PDF417, UPC/EAN, Code 39, Interleaved 2 of 5, Code 128, Codabar, Code 93). Other symbologies can be configured on the device as required by the application.

Symbol Reconstruction

X-Mode symbol reconstruction uses an algorithm that pieces together discontinuous symbol data from multiple scan lines. The algorithm combines several incomplete segments of a rotated or damaged symbol into the equivalent of a complete scan line. The data from the scan line is then output from a device to a host system.

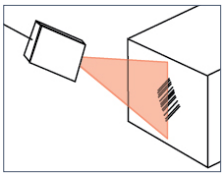


Damaged Symbols

Symbol damage may be the result of problems with the printing or marking method, or a product of environmental factors further down the line as parts move through the manufacturing process. Symbol damage can take many forms, including overprinting and underprinting, torn labels, eroded ink from friction or moisture, or unintended markings that partially obscure a symbol. The X-Mode symbol reconstruction algorithm is able to identify multiple undamaged areas of a symbol and piece them together to create the equivalent of a complete scan. The complete data string from that scan line is then sent to the host device.

This Code 39 symbol was successfully decoded using a Microscan reader with X-Mode, despite the tilted and partially-obscured elements (bars). The symbol reconstruction algorithm enabled the scanner to “work around” the tilted and blocked elements by combining multiple decoded segments into a complete symbol.

Rotated Symbols



In some applications, operators may have little or no control over label placement, which can lead to unexpected symbol orientations. X-Mode symbol reconstruction allows a device to decode tilted symbols that would otherwise be unreadable.

Reliable Direct Part Mark Decoding

The X-Mode algorithm identifies symbols within a device's field of view and uses sophisticated image processing to decode valid symbols. In each of the examples below, X-Mode locates a symbol, analyzes the image gradient to detect areas with changes in reflectivity, grid-maps the image, and ultimately produces an ideal, reliably decodable symbol.

Dot Peen on Curved Surface

Comparison of direct part mark and symbol after processing

Laser Etch

Comparison of direct part mark and symbol after processing

Laser Etch

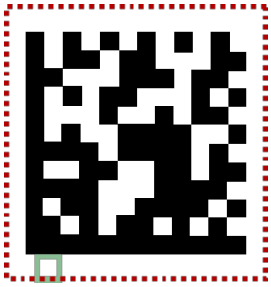
Comparison of direct part mark and symbol after processing

Ink Jet

Comparison of direct part mark and symbol after processing

Narrow Quiet Zone

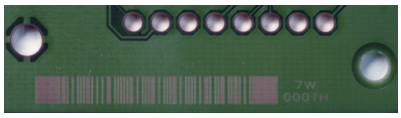
The quiet zone is the area surrounding the symbol that must be kept free of text, marks, or other obstacles. The quiet zone is typically the width of one element on each side of the symbol. X-Mode has a Narrow Quiet Zone feature that allows for less space around the symbol. Although larger quiet zones around symbols are preferable, the physical attributes of applications do not always allow for large quiet zones. X-Mode's **Narrow Quiet Zone Enabled** default setting addresses the issue of reduced quiet zones.



Low Aspect Ratio

Symbols with low aspect ratio (short or narrow codes) are often difficult for traditional barcode readers to decode, due in part to the fact that placement cannot always be controlled to ensure a device will be able to achieve a complete image or scan of an entire symbol.

The height of this barcode has been reduced to save space on the PCB surface, resulting in a low aspect ratio.



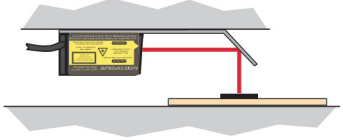
Using X-Mode symbol location and reconstruction technology, even incomplete or rotated codes can be decoded reliably so low aspect ratio is no longer a cause for concern.

Background Color Options

X-Mode's background color settings can be changed for light codes on dark backgrounds or dark codes on light backgrounds, allowing devices to better anticipate symbol elements and decode quickly.

Mirrored and Regular Image Decoding

Both regular images and mirrored images can be decoded by X-Mode in applications that require mirrors due to integration or positioning restrictions.



Software-Configurable Parameters

Microscan devices with X-Mode can be configured via graphical user interfaces and tree controls. Device settings and decode parameters on barcode readers or machine vision cameras are adjustable via software installed on a PC or through web-based user interfaces, allowing operators to make changes to device settings even after installation.

Symbol reconstruction parameters allow operators to determine the level of redundancy (the degree of redundancy check that will be used to qualify the reconstruction results) and effort (the amount of processing applied to the reconstruction process) that will be used by a device in attempting to decode a symbol.

Symbol Reconstruction Redundancy Parameter

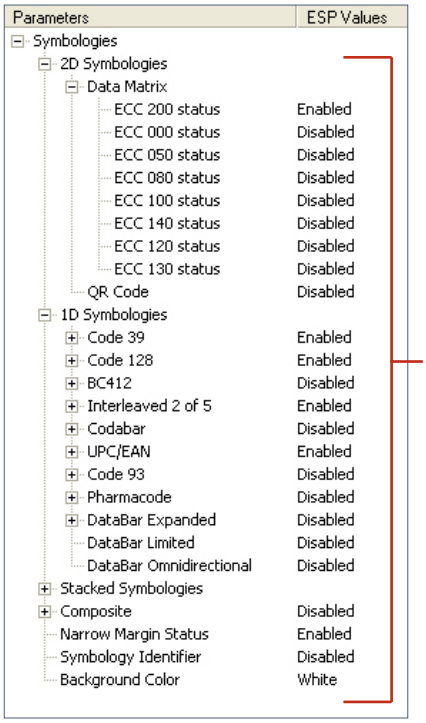
The purpose of redundancy checking is to ensure that the symbol has been decoded correctly and qualify the result of the symbol reconstruction process. Depending on the quality of symbols being used in an application, Microscan devices with X-Mode can be set to **Low**, **Medium**, or **High** redundancy. If the application uses high-quality symbols, the **Low** setting provides satisfactory redundancy checking. A higher level of redundancy ensures greater data integrity, but may also require a higher level of symbol reconstruction effort.

Symbol Reconstruction Effort Parameter

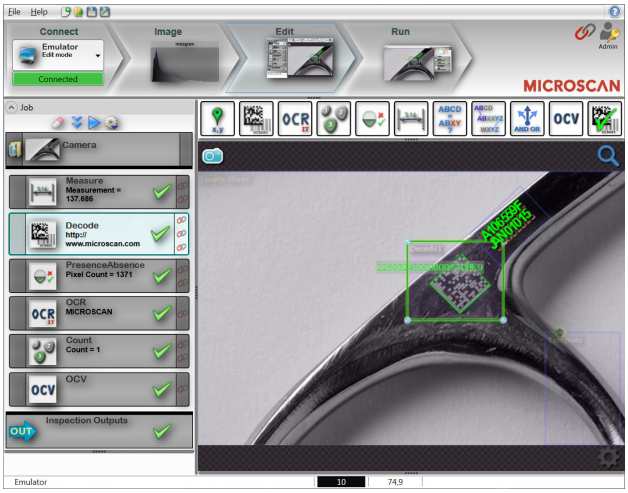
The purpose of the effort parameter is to determine the amount of time the system will spend identifying the symbol and the amount of processing that will be applied in reconstructing and decoding the symbol. Microscan X-Mode devices can be set to **Minimum**, **Moderate**, or **Maximum** effort. A low effort level can optimize decode speed, while a higher effort level may slow decode performance as the device runs through all options for reconstructing and decoding the symbol.

Aggressive Decode Performance Out of the Box

The capabilities of X-Mode are a substantial industrial automation advantage. X-Mode's default settings are designed to provide maximum decode performance with minimum configuration required out of the box.



Microscan's ESP® (Easy Setup Program) Software enables configuration of all Microscan barcode readers using simple tree controls.



Microscan's AutoVISION® Machine Vision Software decodes direct part marks using X-Mode algorithms on the connected camera.

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