MICROSCAN®

MS-1 Scan Engine Integration Manual

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About the MS-1 Scan Engine

The key features of the MS-1 Scan Engine are:

- Ultra-compact size
- CCD image sensor
- LED illumination
- No moving parts
- Low power draw (voltage: 5V; current: 120 mA)
- ESP and K command support
- Up to 220 scans per second
- 1.0 to 13" (25 to 330 mm) read range
- High Density and Low Density options

About This Manual

This manual provides complete information on setting up, integrating, and configuring the MS-1 Scan Engine. The sections are presented in the order in which the MS-1 might be set up and made ready for operation.

Highlighting

Serial commands, highlighted command fields, and default command settings are highlighted in **rust bold**. Cross-references and web links are highlighted in **blue bold**. References to **ESP,** its toolbar headings (**Communications**, **Read Cycle**, **Symbologies**, etc.), menu topics, and other points of emphasis, are highlighted in **Bold Initial Caps**.

Host Communications

There are two ways to configure and test the MS-1 Scan Engine:

- Microscan's Windows-based **ESP** (Easy Setup Program) Software, which offers point-and-click ease of use and visual responses to user adjustments.
- Serial commands, such as **<K200,0>**, that can be sent from **ESP**'s **Terminal** or another terminal program.

1 Quick Start

Contents

This chapter is designed to get your MS-1 Scan Engine up and running quickly. Following these steps will allow you to get a sense of the MS-1's capabilities and to test symbol decode performance.

Detailed setup information for installing the MS-1 into your application can be found in the subsequent sections.

Step 1 — Check Hardware

> **Caution:** Be sure that all cables are connected **BEFORE** applying power to the system. Always power down **BEFORE** disconnecting any cables.

MS-1 Demo Kit Contents

Item	Description
1	MS-1 Scan Engine, HD, RS-232
	MS-1 Scan Engine, LD, RS-232
2	Demo Board
3	Two M1.6 x .35 Screws
4	Ribbon Cable (Scan engine to demo board)
5	RS-232 Cable (RJ45 to D-sub)
6	Power Supply
7	IC-3USB Converter (optional)*

*Note: The MS-1 demo board can be connected to a host computer's USB port by using an IC-3USB Converter (98-000051-01). Power is supplied by the USB connection to the host.

Step 2 — Connect the System

> **Caution:** Be sure that all cables are connected **BEFORE** applying power to the system. Always power down **BEFORE** disconnecting any cables.

The MS-1 Scan Engine can be connected directly to a host computer using a demo board.

1. Attach the MS-1 to the demo board, label side down, as shown below.
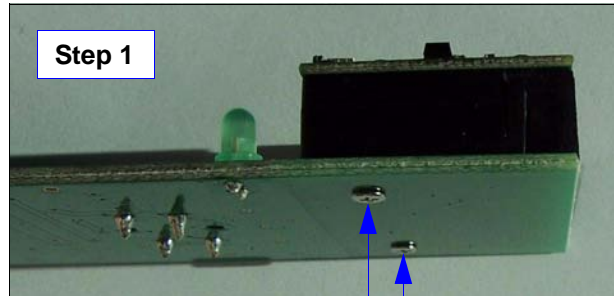
Screw holes for mounting the MS-1 are located on the base of the unit and on the demo board. Use the M1.6 x .35 screws provided.

2. Once the MS-1 is affixed to the demo board, push the ends of the ribbon cable into the connectors on the MS-1 and the demo board, as shown below.
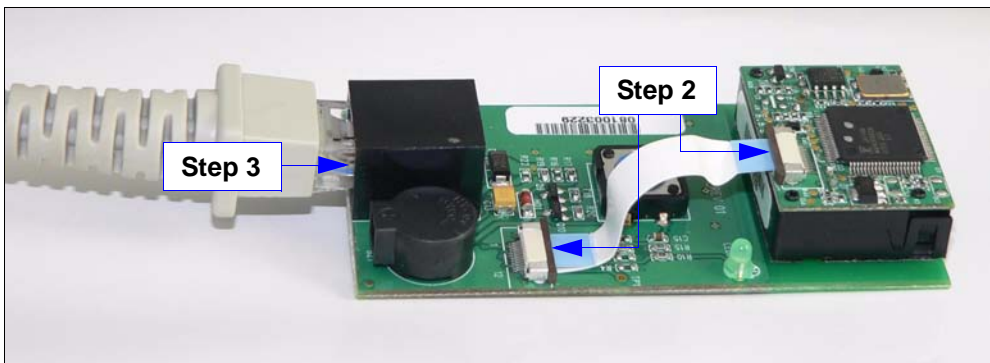
3. Plug the RJ45 end of the RS-232 cable into the connector on the demo board, as shown above.
4. Plug the D-sub end of the RS-232 cable into the 9-pin serial port on the host computer.
   Note: Use an IC-3USB Converter (98-000051-01) to connect to the host computer by USB. No additional power supply will be needed, as power is supplied by the host computer.
5. Attach the power supply to the RS-232 cable.
6. Plug in the power supply.

Step 3 — Install ESP

Easy Setup Program (ESP) is Microscan's proprietary setup and testing application. The purpose of **ESP** is to provide a quick and easy way to set up and configure Microscan products.

When the MS-1 is connected to a host computer (Windows Vista, XP, or 2000), **ESP** can be used to configure scan engine settings and to set up communications between the scan engine and host.

If installing from the Microscan Tools CD:

1. Insert the Microscan Tools CD in your computer's CD drive.
2. Select **ESP Software** from the navigation bar at the left of the screen.
3. Click on **ESP Software** under the **Current Version** heading.
4. Click the **Run** button and follow the prompts in the **ESP** Setup Wizard.
   Note: During installation, you may see an Internet Explorer Security Warning that states: "The publisher could not be verified." If you see this warning, click **Run** to continue installation.

If downloading from the web:

1. Go to the Download Center at **www.microscan.com**.
2. Create a new member account or, if you are already a member, enter your user name and password.
3. Navigate to the "Microscan Software" section of the Download Center (near the top of the page).
4. Click on the link showing the latest version of **ESP**. Extract the **ESP** installation files to a location of your choice on the host computer. *Note where your **ESP.exe** file is stored on your hard drive.*
5. At the end of the installation process, the following icon will appear on your desktop:

6. Click the **ESP** icon to start the program.

System Requirements for ESP

- 166 MHz Pentium processor (recommended)
- Windows Vista, XP, or 2000 operating system
- Internet Explorer 5.0 or higher
- 64 MB minimum RAM
- 40 MB minimum disk space
- 800 x 600 pixel minimum 256 color display

Step 4 — Select Model

When you start **ESP**, the following menu will appear:

1. Click the button showing the MS-1 Scan Engine.
2. Click **OK**.

   Note: You can also double-click the MS-1 Scan Engine button to make your selection.
3. Click **Yes** when this dialog appears:
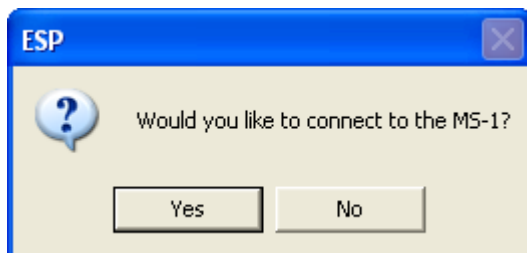
Note: If you need to select another model later, click the **Switch Model** button near the top of the screen or use **Model > New Model** in the menu toolbar.

Step 5 — Autoconnect

• Click **Start** when the **Autoconnect** dialog appears.
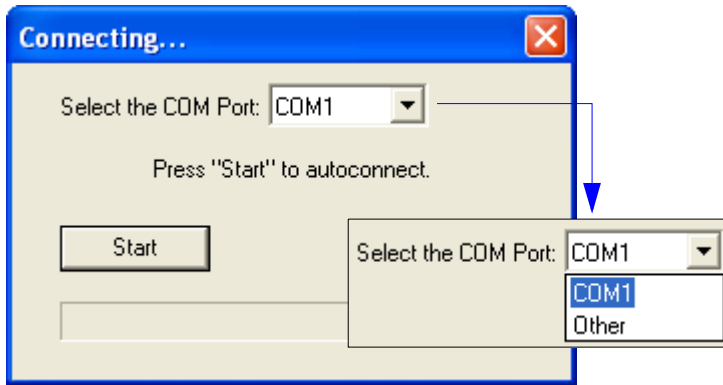
• If your communications port is not the default **COM1**, use the dropdown menu to change your port.

• Once you have chosen the correct port, click **Start** to connect.
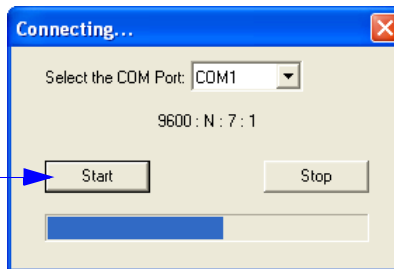
When you are connected, you will see the green connection indicator in the status bar at the bottom right of your screen:
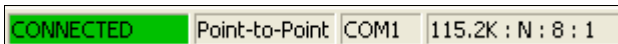
• If the connection attempt fails, click the **Autoconnect** button, select a different communications port, and try again.

Note: If your RS-232 host settings cannot be changed to match the MS-1's settings, select **Connect** from the **Connect** dropdown menu on ESP's menu toolbar. When the **Connection Settings** dialog appears, check the **Force Connect** box and click the **Connect** button.
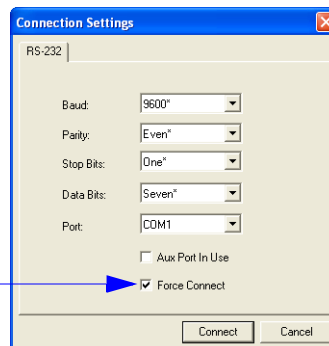
Step 6 — Position the MS-1 Scan Engine

- Set up a symbol at the distance you will be using in your application. Refer to the **Read Ranges** for your MS-1 model (High Density or Low Density) to determine the optimal distance.
  Note: If you are using an Interleaved 2 of 5 symbol, verify that the number or characters being scanned matches the symbol length enabled for I 2/5 (default is **10** and **6**).
- Avoid bright light or infrared light from other sources, including other readers.
- Pitch the MS-1 or symbol at a minimum of **±15°** to avoid specular reflection (the return of direct, non-diffused light).
- Avoid excessive skew or pitch. Maximum skew is **±30°**; maximum pitch is **±30°**.
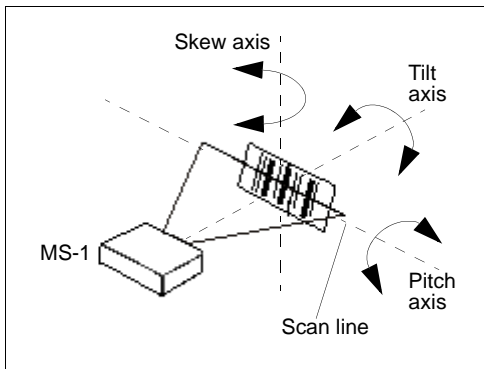
MS-1 and Symbol Orientation

Note: Code 39 is the default symbology enabled. If you are uncertain of your symbology, perform the following steps:

1. Enable all symbologies using **ESP**.
2. Enable **Symbology Identifier** at the bottom of ESP's **Symbologies** tree control.
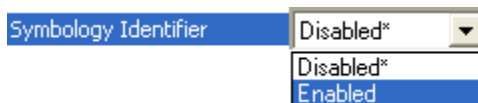
3. Decode the symbol and compare the symbology identifier character to the list on page **7-20** to determine your symbology.
4. Disable all other symbologies.

Step 7 — Configure the MS-1 Scan Engine

To make setup changes, click the **App Mode** button.

The following modes are accessible by clicking the buttons in the first row of **App Mode** icons:

- Click the **Autoconnect** button to establish communications between **ESP** and the MS-1.
- Click the **Send/Recv** button to send or receive commands.
- Click the **Terminal** button to display decoded symbol data, and to send serial commands to the MS-1 using text or macros.
- Click the **Utilities** button to test Read Rate, request or clear Counters, enable or disable the MS-1 or send output pulses in Device Control, determine the Differences from Default in the current settings, add or remove master symbol data in Master Database, and verify or update the MS-1's firmware.

Click the **Configuration** button to display the second row of **ESP** icons.
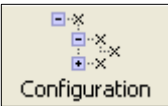
From here you can make changes in the tree controls that can be accessed by clicking the buttons on the second row of icons in the **ESP** window.
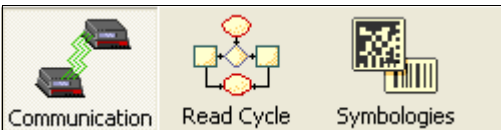
For further details, see **Microscan ESP Help** in the dropdown Help menu.
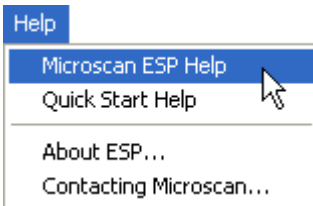
Step 8 — Save Configuration in ESP

To make changes to a configuration setting:

1. **Left-click** on the **+** to expand the desired tree.
2. **Double-click** on the desired parameter and click once in the selection box to view options.

3. Place your cursor in the selection box, scroll down to the setting you want to change, and **click** once on the setting.

Parameters	ESP Values
⊟ Communications	
⊟ Host Port Connections	
Baud Rate	
Parity	
Stop Bits	
Data Bits	
Host Protocol	Point-to-Point
⊟ Preamble	Disabled
Preamble Characters	CR
⊟ Postamble	Enabled˟ ▼
Postamble Characters	Disabled / Enabled˟

4. **Left-click** again on the open screen to complete your selection.

5. **Right-click** on the open screen and select **Save to Reader** to implement the command in the MS-1.

Saving Options

• **Send, No Save**. Changes will be lost when power is re-applied to the MS-1.

• **Send and Save**. This activates all changes in current memory *and* saves to the MS-1 for power-on.

Save Configuration in ESP

■ 2 Setup and Operation

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Electrical Interface
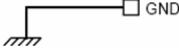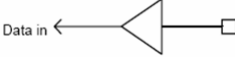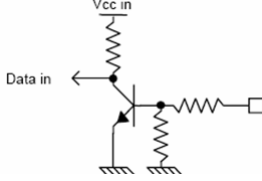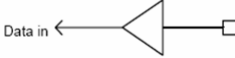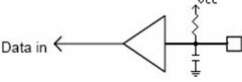
Ribbon Cable Pinout

Pin	Host RS-232	In/Out
1	+5V Power (VCC)	In
2	TTL_RxD	In
3	Trigger Input	In
4	Power Enable	In
5	TTL_TxD	Out
6	TTL_RTS	Out
7	GND	
8	Firmware Upgrade 1	In
9	LED/Beeper Output	Out
10	TTL_CTS	In
11	Firmware Upgrade 2	In
12	RESET	In

Contact Assignments (Host Side of Ribbon Cable)

Pin	Name	I/O	Description	Electrical Equivalence
1	**VCC**	In	Scan engine power supply. **Important:** Must be connected to a 5V power supply.	
2	**TTL_RxD**	In	Serial input (reception from host system). Requires TTL input levels. (Active High)	
3	**Trigger Input**	In	LOW = Illumination enabled, Scan engine reads, decodes, and sends information to the host. HIGH = Illumination off, Scan engine stops attempting to decode.	
4	**Power Enable**	In	Enables power to be supplied to the scan engine. LOW = Scan engine on. High = Scan enging off except during data transmission and when writing setup parameters to non-volatile memory.	
5	**TTL_TxD**	Out	Serial output (transmission to host system) 0 = LOW 1 = HIGH Sends TTL output levels. (Active High)	
6	**TTL_RTS**	Out	Serial Output (When active, the scan engine requests data to be sent to the host system). Sends TTL output levels. (Active High)	

Contact Assignments (cont.)

7	GND		Power and Signal Ground	
8	Firmware Upgrade 1	In	When this signal is active (during a reset condition or during power-on) the scan engine will enter a firmware download mode. Pin 11 must also be active. (Active Low)	
9	LED/Beeper Output	Out	This signal is an oscillating output. When the scan engine decodes, this signal will oscillate at 2.5 KHz, 55% duty, for 74 ms. Can also be used to drive an LED directly (15 mA max). Use a transistor, FET, or buffer when connecting to a beeper. (Active High)	
10	TTL_CTS	In	Serial input (When active, the host system is ready to accept data from the scan engine). Requires TTL input levels. (Active High)	
11	Firmware Upgrade 2	In	When this signal is active (during a reset condition or during power-on) the scan engine will enter a firmware download mode. Pin 8 must also be active. (Active Low)	
12	RESET	In	When this signal is active, the scan engine's processor is forced into a reset condition. The processor's clock continues to run, but all processing is stopped until the signal is no longer active. (Active Low)	

Configuration

The MS-1 Scan Engine can be configured using ESP (the preferred method), or serial K commands. Refer to the following chapters in this manual for specific information about configuring the MS-1:

Quick Start helps you get the MS-1 Scan Engine up and running quickly, to allow you to get a sense of the MS-1's capabilities and to test symbol decode performance.

Using ESP helps you understand the basic structure and elements of ESP, which is the configuration software that you will use to set up the MS-1 for operation.

Communications explains how to set up communications between the MS-1 and a host.

Read Cycle explains the spatial and timing parameters associated with your application.

Symbologies describes the various symbol types that can be decoded by the MS-1 Scan Engine.

Terminal describes the Terminal window and Macro functions in ESP, which can be used to configure and test the MS-1.

Utilities explains the operational commands that can also be sent to the MS-1 from Terminal.

Configuration

3 Installation

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Mounting the MS-1 Scan Engine

Mechanical Dimensions
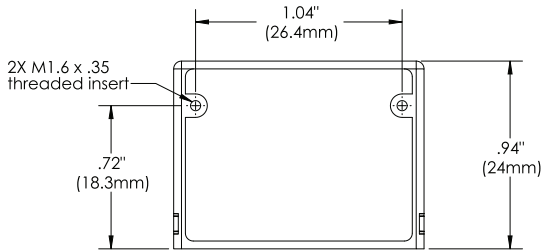
Base
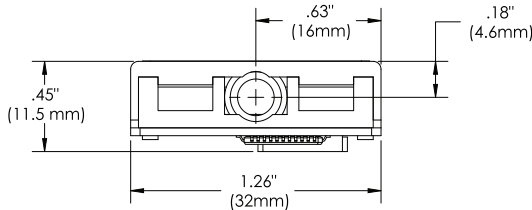
Front

Mounting Screws
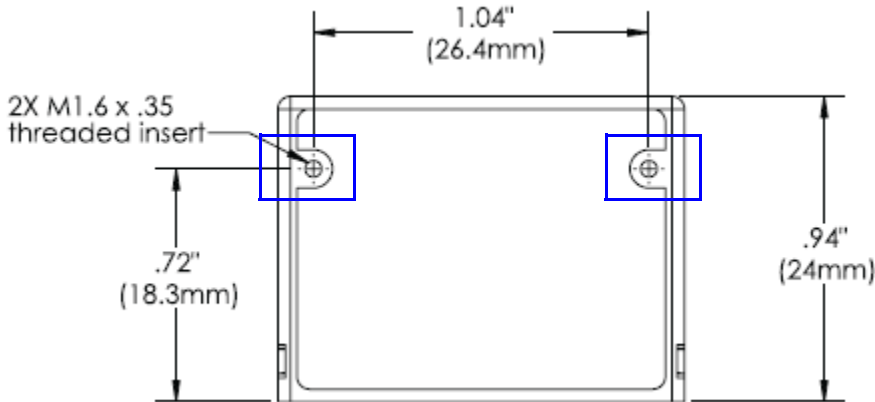
Calculating Aperture Size

Minimum Aperture Width

La = 2 * [(Da + 7.9) * TAN((49 / 2) + 4.2) + 12 / (COS(49 / 2 + 4.2))]
= 2 *[(Da + 7.9) * 0.55 + 13.68] mm

Aperture Width Graph
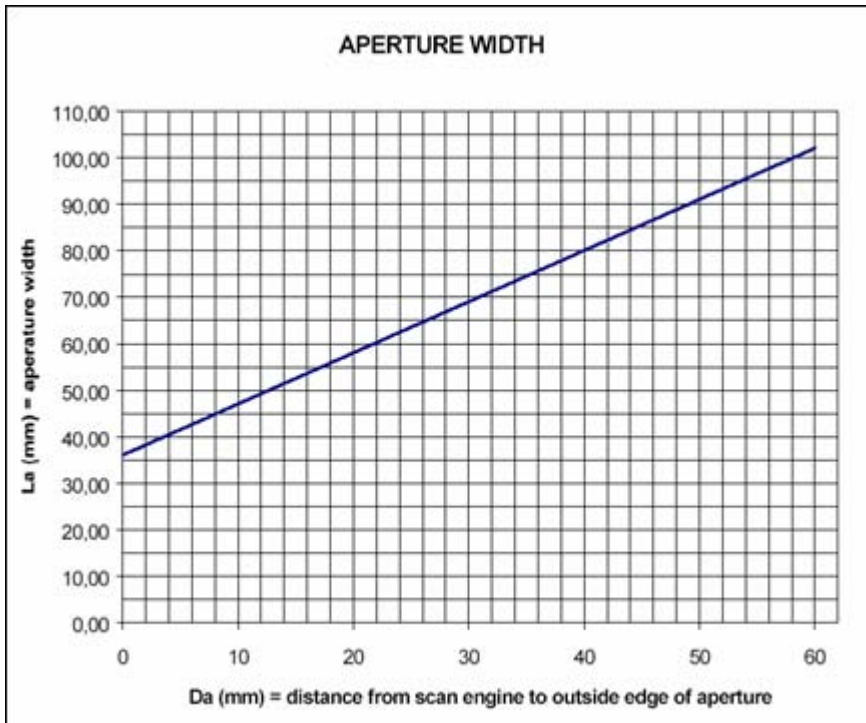
Minimum Aperture Height

Ha = 2 * [Da * TAN((2.5 / 2) + 2.5) + (4.5 / 2)]

= 2 * (Da * 0.066 + 2.25) mm

Aperture Height Graph
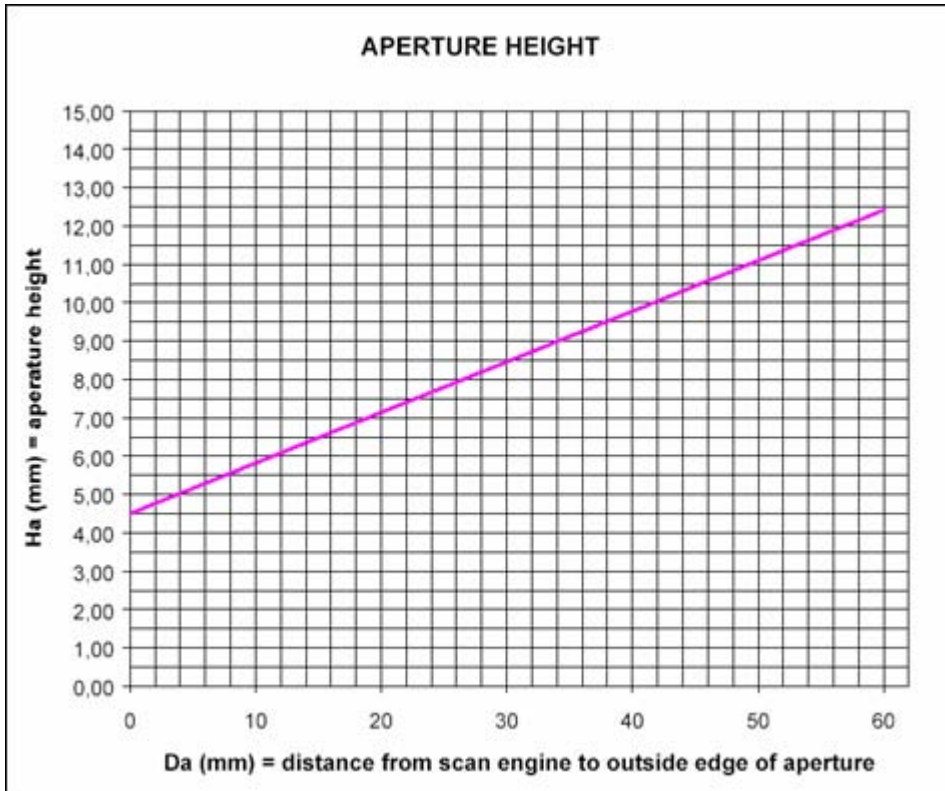
Calculating Window Tilt Angle and Localization

Minimum Window Tilt Angle
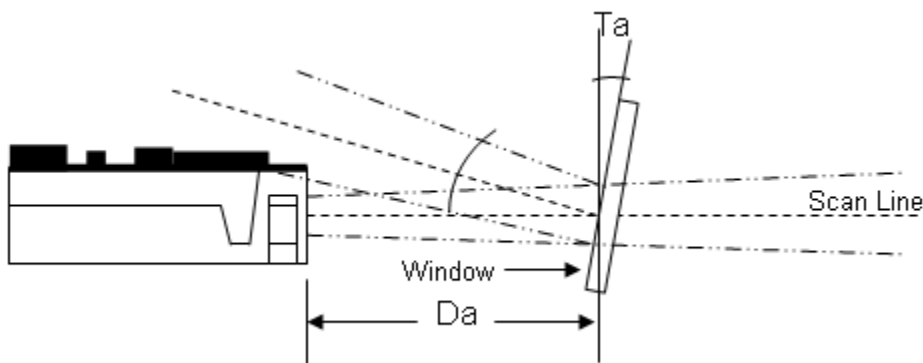
Ta° = TAN^{-1}(Da / 4) (from perpendicular to scan line)

Window Tilt Angle Graph
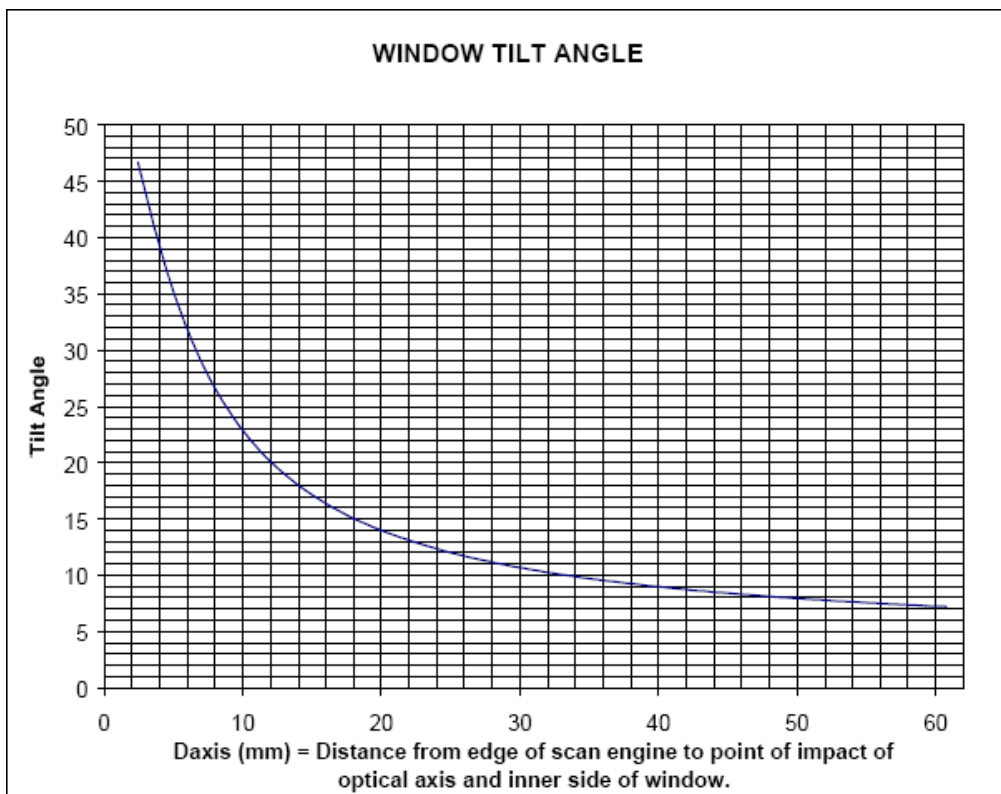
External Window Tilt Angle and Placement

Use the following guidelines if a window will be placed between the front of the MS-1 and the opening of a case or other enclosure.

Window Opening

Make the clear opening of the window large enough that the entire aperture width and height passes through the window. It is recommended that you add an extra 5% tolerance to the calculated height and width. Not allowing the full window opening can result in potential internal reflections and can degrade the decodable depth of field range performance.

Window Tilt Angle
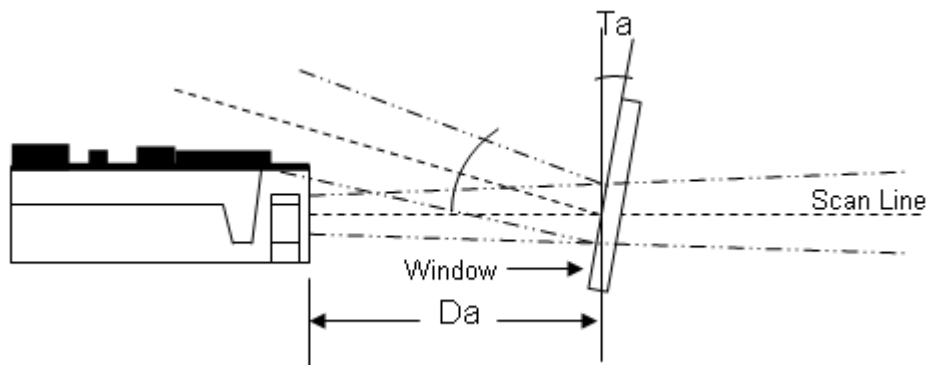
Calculate the tilt angle for the window based on the distance from the engine's aperture exit point and the (zero degree) horizontal point of the window (inside edge), which is distance **Da**. Further tilting of the window is acceptable and decreases the possibility of specular reflection from that window, which can degrade the scan engine's performance to the point that it may not decode at all.

Window Materials

Adding a window can reduce the working range of the scan engine because there is a signal loss when passing through window material. Choose a window material to minimize loss but also to provide the best protection vs. cost for your application.

The following window materials are recommended:

Acrylic: Acrylic is relatively low-cost and has good optical clarity. It is also resistant to accidental impact. It is sensitive to some chemicals, ultraviolet light, and severe mechanical stress. Acrylic is produced by extrusion, cell casting, or injection molding. Acrylic is suitable for ultrasonic welding.

CR-39: CR-39 has a hard surface and does not usually require coating treatment unless it will be used in extraordinarily harsh environments. It is fairly resistant to accidental impact. CR-39 is a thermal-setting plastic produced by cell casting. CR-39 is not suitable for ultrasonic welding.

No matter what window material you choose, do not tint the window. Because the MS-1 is a CCD scan engine, an anti-reflective coating is not necessary.

Window Materials Vendors

AR Coating Companies

- JDS Uniphase — **http://www.jdsu.com/products/custom-optics.html**
- Dontech, Inc. — **http://www.dontech.com/**
- TSP, Inc. — **http://www.tspinc.com/**

Window Fabrication Companies

- Nelson Nameplate — **http://www.nelsonusa.com/**
- Cadillac Plastic — **http://www.cadillacplastic.com/**
- Reading Plastic Fabricators — **http://www.readingplastic.com/**
- G-S Supplies — **http://www.gssupplies.com/**
- Laurel Industries — **http://www.laurelindustries.com/**

Location and Reading Position
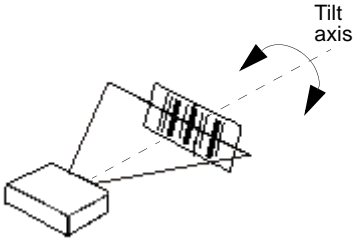
Tilt

Tilt interferes with successful decodes if all the bars in the symbol are not inside the scan width, or if the tilt is greater than 25 degrees.

Skew
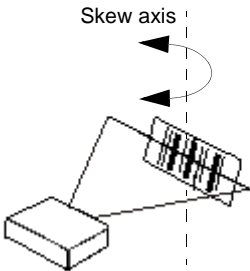
Skew reduces bar width, and affects high-density symbols more than low or medium density symbols. Decoding may be possible with a skew angle of up to 65 degrees.

Pitch
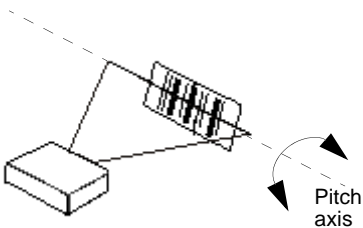
Pitch reduces bar height. Decoding may be possible with a pitch angle of up to 75 degrees. Reducing pitch increases decoding efficiency. A low pitch angle (2–3 degrees minimum) is helpful because it prevents specular reflection.

Ribbon Cable

Connecting the Ribbon Cable

1. Open the ribbon cable connector clip. Use a small screwdriver or other pointed object to extend the clip so that the end of the ribbon cable can be inserted.

2. Remove the ribbon cable carefully.

3. Install a new ribbon cable as required. The ribbon cable connectors must be in direct contact with the scan engine connectors.

Ribbon Cable

4 Using ESP

Contents

This section is designed to help you understand the basic structure and elements of **ESP** (Easy Setup Program).

When you open **ESP**, unless otherwise specified in the **ESP Preferences** dialog accessible from the **Options** heading on the menu toolbar, you will enter **EZ Mode** for initial setup. From there, you can enter **Application Mode** (**App Mode**) and access three configuration menus (**Communications**, **Read Cycle**, and **Symbologies**), a **Terminal** interface, and a **Utilities** interface.

ESP can be used to configure the MS-1 Scan Engine in three main ways:

• **Tree Controls:** Each configuration menu contains a list of all option settings that pertain to that specific element of MS-1 operation. For example, the **Communications** menu shows a **Host Port Connections** option, and then a list of the sub-options **Baud Rate**, **Parity**, **Stop Bits**, and **Data Bits**. Each of these sub-options is configurable by using dropdown menus.

• **Graphic User Interfaces:** MS-1 settings can be configured using such point-and-click tools as radio buttons, zoom in/zoom out sliders, spin boxes, check boxes, and drag-and-drop functions.

• **Terminal: ESP**'s **Terminal** allows you to send serial configuration and utility commands directly to the MS-1 by typing them in the provided text field.

Information about using **ESP** in specific applications is provided in subsequent sections.

For **ESP** system requirements, see **System Requirements for ESP** in Chapter 1, **Quick Start**.

EZ Mode

EZ Mode offers instructions on positioning the MS-1 in relation to a test symbol, and also features an **Autodiscriminate** function that automatically enables all symbologies.
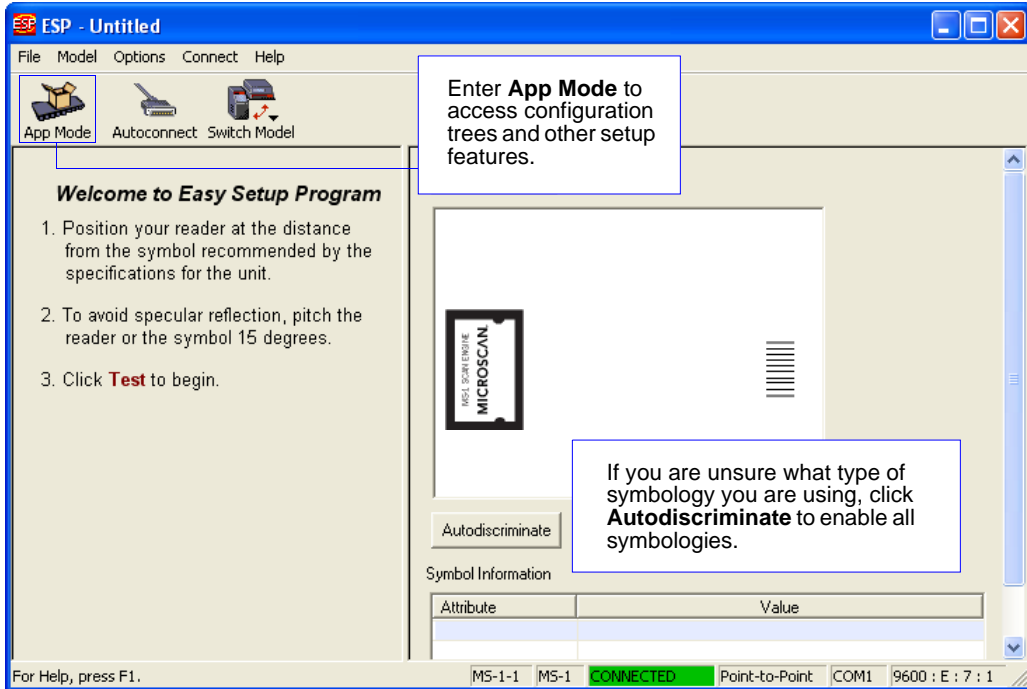
Application Mode

From **EZ Mode**, you can click on the **App Mode** button to access specific configuration menus, **Utilities** tools, **Camera** setup, **Output Format** options, and a **Terminal** window where serial commands can be entered.

Note: The **App Mode** and **EZ Mode** buttons appear in the same position to allow easy switching between these primary modes.
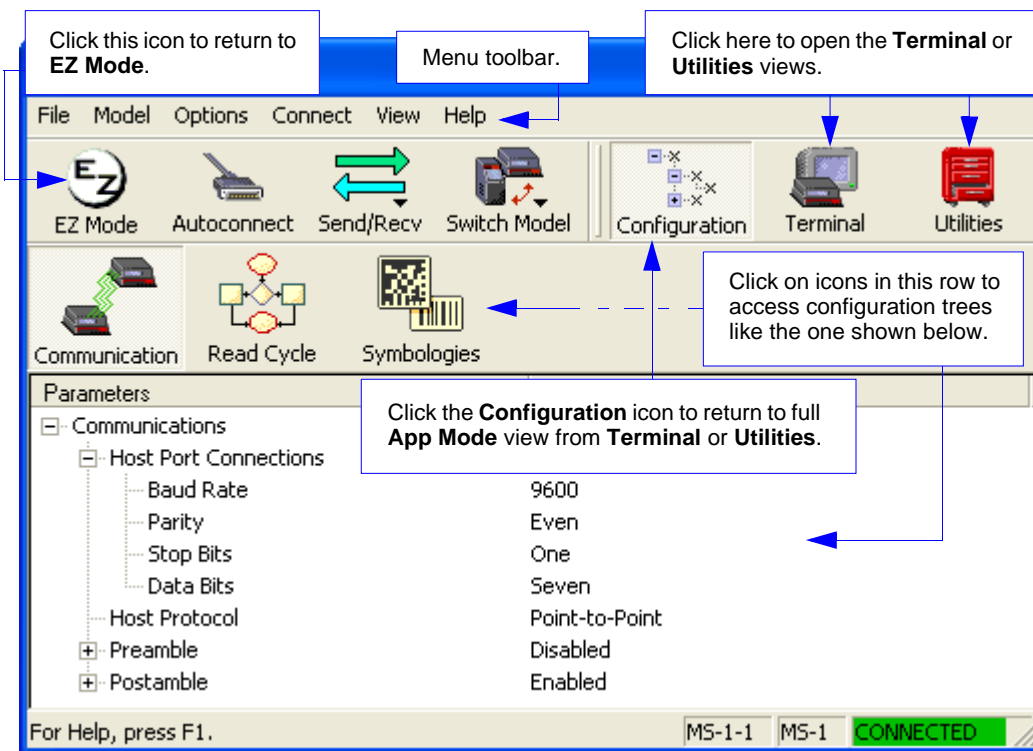
Note: See the corresponding sections of this manual for specific information on any of the views or modes mentioned above.

Menu Toolbar

File > New

Whenever **New** is selected, the default configuration of **ESP** is loaded.

Open/Save

When **Save** or **Save As** is selected, the **ESP** configuration is saved to the host computer's hard drive and available whenever the same file is selected under **Open**.

Important: When you save menu changes to your hard drive, these changes are not saved to the MS-1. The illustration below shows how settings can be saved and received between **ESP** and the MS-1, and **ESP** and the host hard drive.

(Save to Reader)

(Receive Reader Settings)
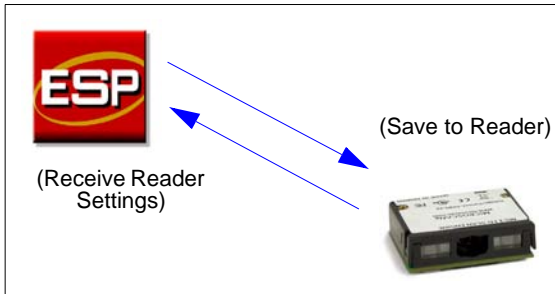
Import/Export

Import converts the ASCII settings from a text file to **ESP** configuration settings.
Export converts the active **ESP** configuration settings to an ASCII text file.

Model

In the **Model** menu you can select any of the models supported by **ESP**. When you choose a different model, the connection to your present model will be terminated.

Model		
MS-1 ▶	• MS-1-1	
New Model...		
Remove Model...		
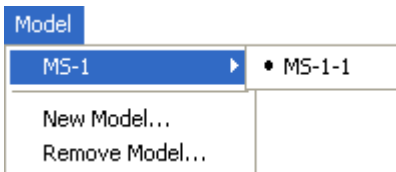
To connect to another model, select **New Model**, choose a new model from the **pop-up menu** that appears, and click **OK**.

Note: When you save an **ESP** file, you are saving the settings of all the models defined in that file.

Options

The **Options** menu allows you to save memos and set up **ESP Preferences**.

Note: Preferences will be saved and loaded into **ESP** whenever **ESP** is opened next, whether or not you save the **ESP** file.

Options
Preferences
Document Memo
Model Memo
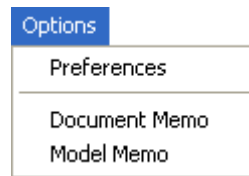
Preferences > General Tab
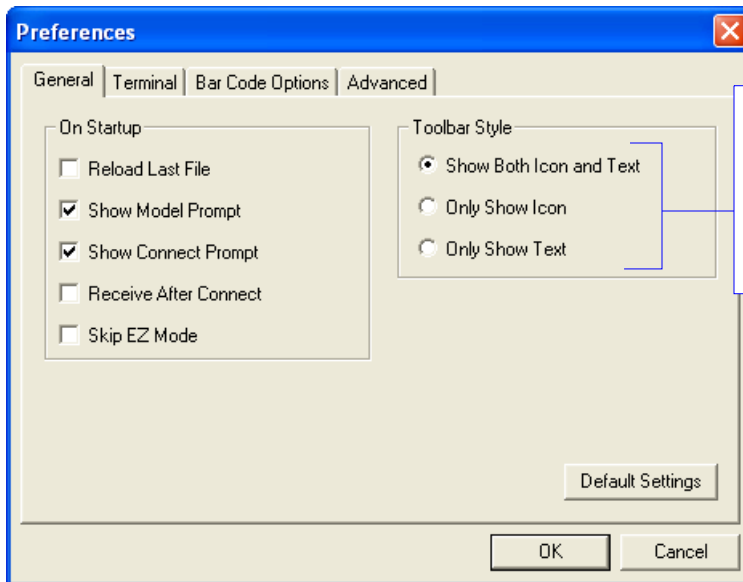
The **Toolbar Style** options allow you to determine how **ESP** will display the mode options in the two rows at the top of the screen.

Reload Last File
At startup, reloads the last file saved to the host computer's hard drive.

Show Model Prompt
At startup, shows the model menu displaying all supported readers.

Show Connect Prompt
At startup, displays the **Would you like to connect to the MS-1?** prompt.

Receive After Connect
At startup, loads the MS-1's settings into **ESP**. (This is not recommended if you want to preserve your **ESP** settings for future use.)

Skip EZ Mode
At startup, skips **EZ Mode** and opens directly in **App Mode**.

Preferences > Terminal Tab
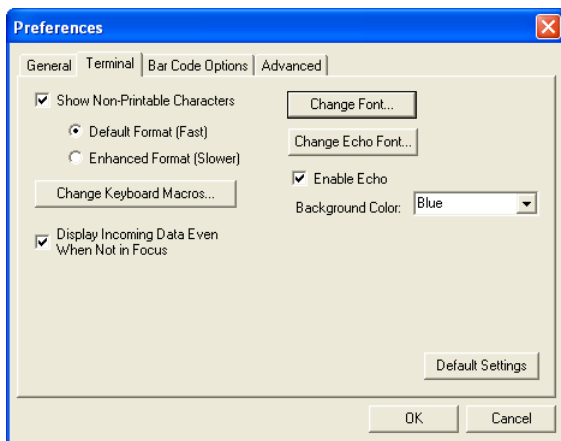
Show Non-Printable Characters

When **Show Non-Printable Characters** is enabled, characters such as "CRLF" will be displayed in the Terminal window. When **Enhanced Format** is checked, the characters are displayed with more detailed formatting.

Change Keyboard Macros

Clicking the **Change Keyboard Macros** button brings up the **Function Keys** dialog. In this dialog you can select the desired function key and then enter your macro keystrokes in the associated key map. For example, to make **Ctrl-F2** the keystroke to send a trigger character, select **F2**, then in the **Ctrl** row, enter **<trigger character>** and click **OK**. Then whenever the **Ctrl-F2** keystroke is pressed, the trigger character will start the read cycle.
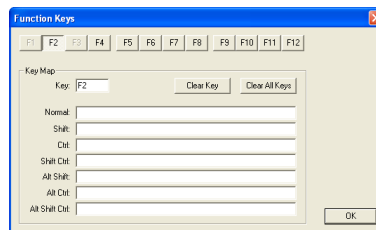
Note: The **F1** key is reserved for opening **ESP** Help and the **F3** key is reserved for the **Find Next** function.

Change Font

Allows you to modify the font used for decode data received from the MS-1 on the Terminal screen.

Change Echo Font

Allows you to modify the font used for command characters typed into the Terminal view.

Enable Echo

Allows you to enter command characters in Terminal.

Display Incoming Data Even When Not in Focus

When **Display Incoming Data Even When Not in Focus** is enabled, data from the MS-1 will continue to appear in the Terminal even when **ESP** is not the top window.

Preferences > Bar Code Options Tab
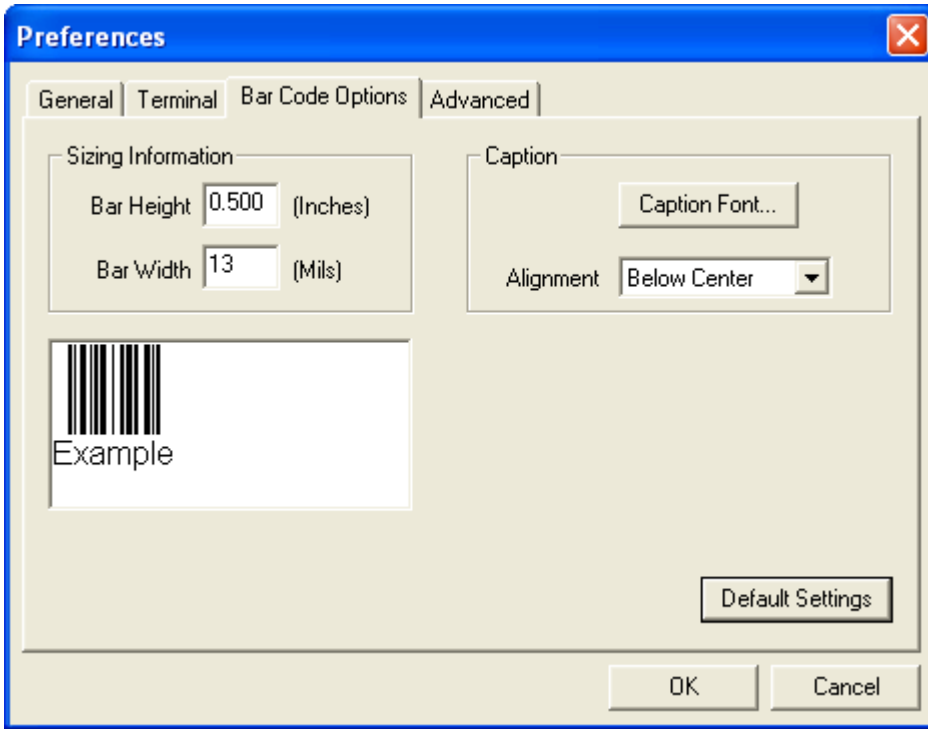
The **Bar Code Options** dialog allows you to set the size of user-created symbols.

Sizing Information

Sets the bar width or module width (in **mils**, or thousandths of an inch) of user-created symbols.

Example: A bar width of 14 is 0.014 inches.

Caption

Allows you to define and position a human-readable caption for the symbol you create.

Preferences > Advanced Tab
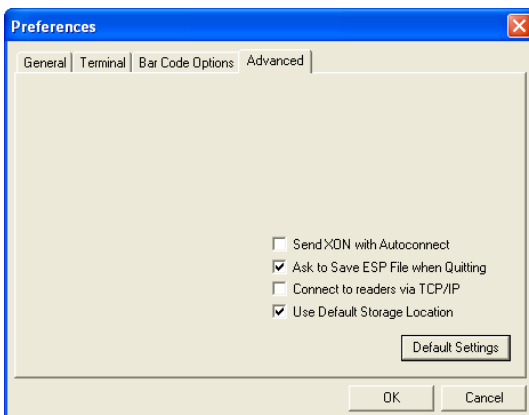
Send XON with Autoconnect

Sends an **XON** (**Begin Transmission**) command to the MS-1 before starting the **Autoconnect** routine.

Ask to Save ESP File when Quitting

When enabled, prompts the user to save a **.esp** file when ending a session.
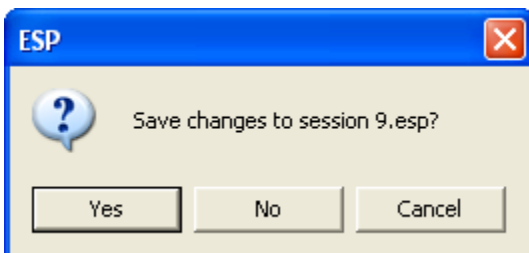
The **.esp** file will be saved in the location of your choice.
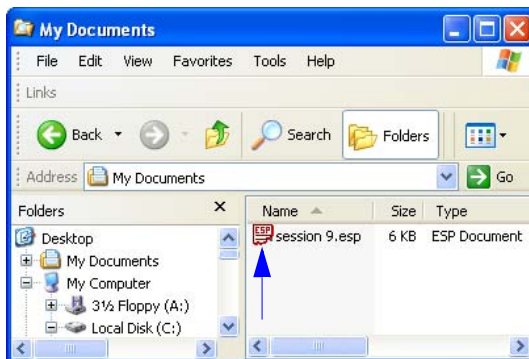
Preferences > Advanced Tab *(cont.)*

Connect to Reader via TCP/IP

When enabled, shows a **TCP/IP** option on the **Select Protocol** dialog.

Note: This option should only be selected if you intend to connect using an Ethernet adapter.
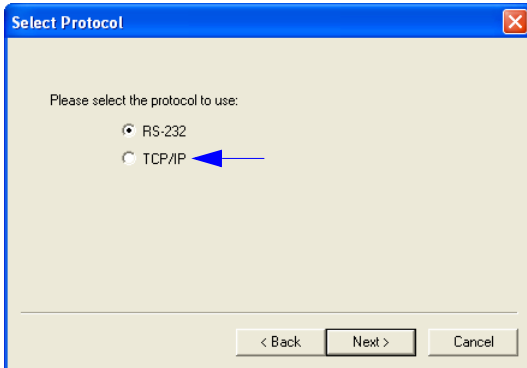
Use Default Storage Location

When enabled, automatically stores data in **ESP**'s Application Data folder.

Document Memo

The information you type in the **Document Memo** field will appear in a context-sensitive text box whenever your cursor hovers over the **Document Memo** item on the **Options** menu.
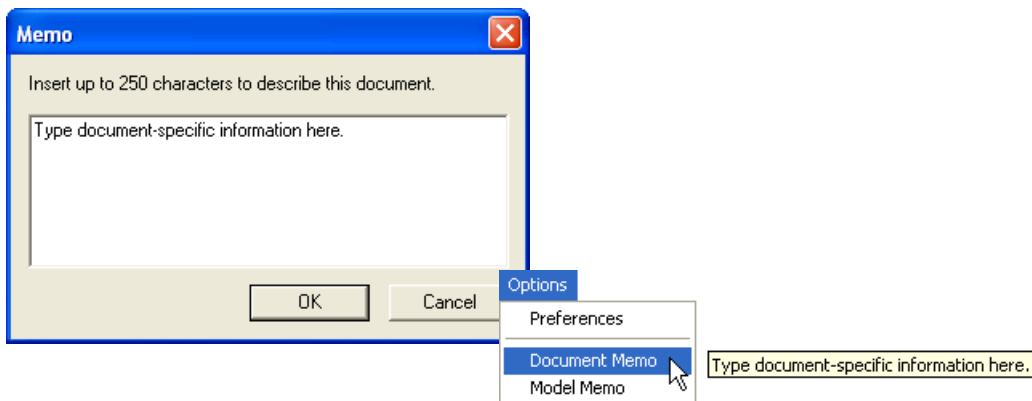
Model Memo

Similar to **Document Memo**, the information you type in the **Model Memo** field will appear in a context-sensitive text box whenever your cursor hovers over the **Model Memo** item on the **Options** menu. Memos created in **Model Memo** are specific to the model enabled when the message was created.
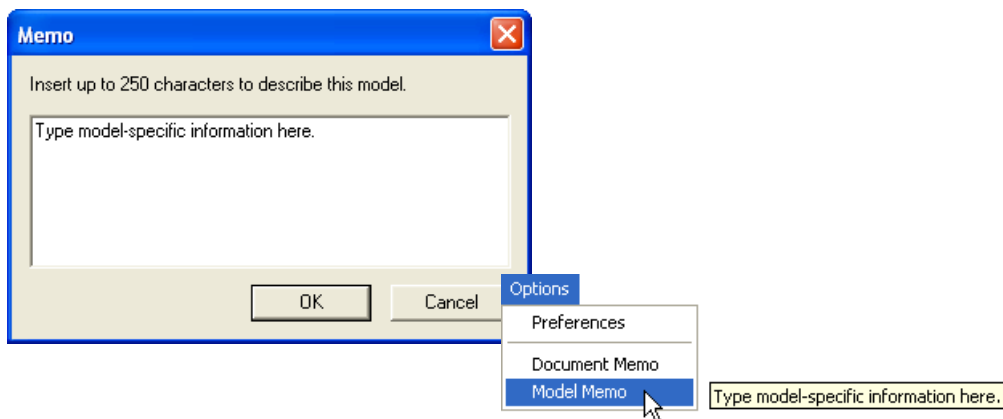
Note: Memos must be saved in a **.esp** file if you want them to available in your next session. If you do not save your current session, any memos that you have entered during the session will be discarded, and will be unavailable in your next session.

Autoconnect

- If your RS-232 connection attempt fails, you can use **Autoconnect** to establish a connection between the MS-1 and the host.
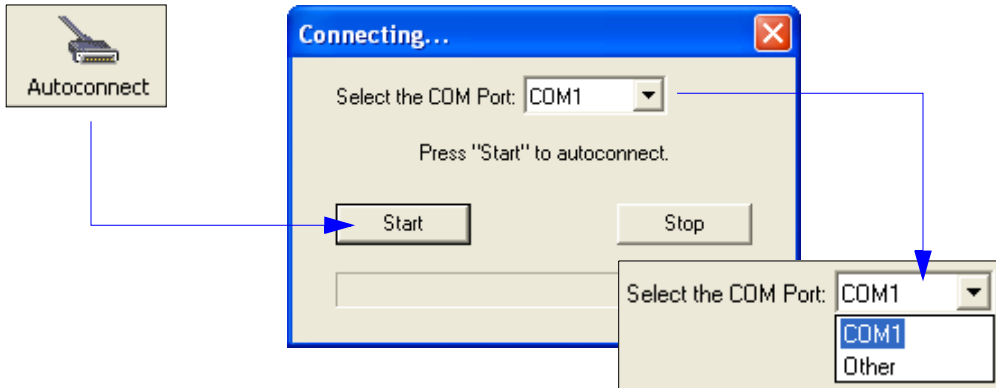
- If your communications port is not the default **COM1**, use the dropdown menu to change your port.

- Once you have chosen the correct port, click **Start** to connect.
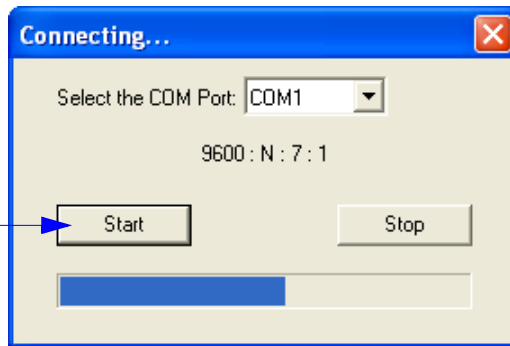
When you are connected, you will see the green connection indicator in the status bar at the bottom right of your screen:
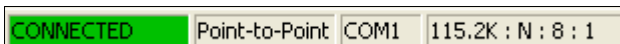
Autoconnect (cont.)

If your RS-232 host settings cannot be changed to match the MS-1's settings:

- Click **Connect** on **ESP**'s menu toolbar, and then select **Connect** on the dropdown menu.
- When the **Connection Settings** dialog appears, check the **Force Connect** box and click **Connect**.

Connection Settings

RS-232

Baud:	9600*
Parity:	Even*
Stop Bits:	One*
Data Bits:	Seven*
Port:	COM1

☐ Aux Port In Use

☑ Force Connect

Connect   Cancel
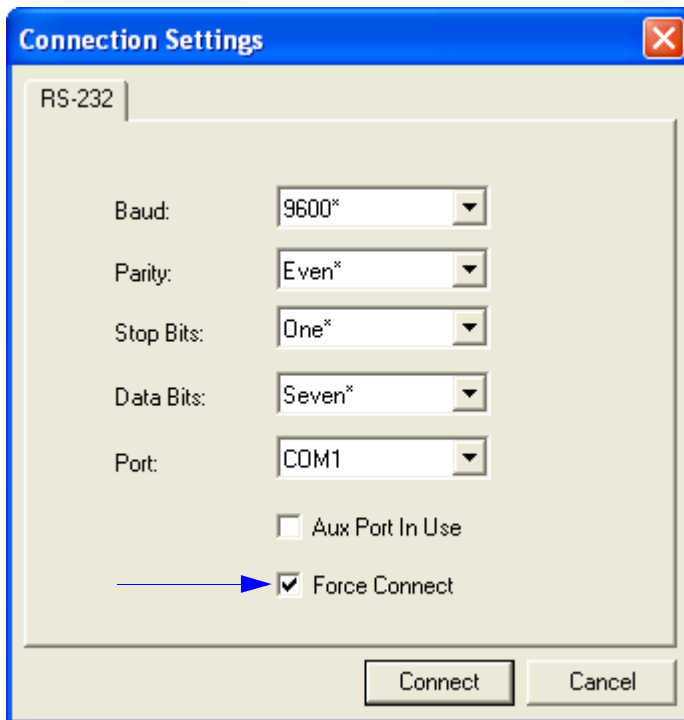
View

View

The **View** menu allows you to move quickly between interfaces without using the icon buttons on the **App Mode** toolbar.
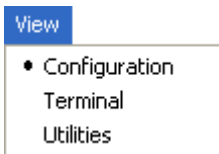
Notice that each menu item corresponds with the icon buttons at the top of the ESP window.

Navigating in ESP

To change MS-1 settings, or to access the **Terminal** or **Utilities** views, click the **App Mode** button.

To return to EZ Mode, click the **EZ Mode** button.

To make changes to configuration settings in the tree controls:

1. **Left-click** on the **+** to expand menu items.
2. **Double-click** the desired parameter and **single-click** in the selection box to view options.
3. Place your cursor in the selection box, scroll down to the setting you want to change, and **single-click** the setting.

Parameters	ESP Values
⊟ Read Cycle	
Number of Symbols	Single
Time Between Identical Decodes	0
Trigger Mode	Continuous Read
⊟ Serial Trigger	
Character (Delimited)	
Start Character (Non-Delimited)	
Stop Character (Non-Delimited)	
No Decode Timeout	2
Decodes Before Output	0
⊟ Noread Message	Enabled*
Message	Disabled / Enabled*
⊟ Reader Setup	
Shutter Speed	0
Minimum Speed	70
Maximum Speed	0

The **X** indicates that the setting is the **default**.

4. **Left-click** again on the open screen to complete the selection.
5. **Right-click** on the open screen and select **Save to Reader** to implement the command in the MS-1. You can send the command without saving it, or you can send and save the command simultaneously.

- Receive Reader Settings
- Save to Reader ▶
  - Send, No Save
  - Send and Save
- Default Current Menu Settings
- Default all ESP Settings
- Advanced Options ▶
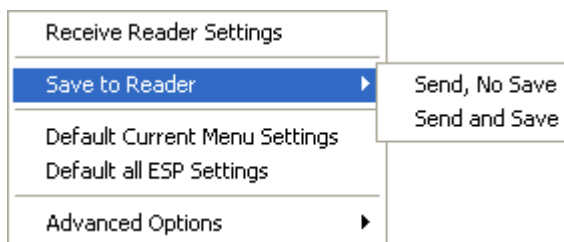
Send/Receive Options

To access **Receive**, **Save**, and **Default** options, click the **Send/Recv** button. You can also access these options by right-clicking in any of the configuration views.

Receiving

From the **Send/Recv** menu, select **Receive Reader Settings**.

Caution: Do not select this option if you do not want to upload the MS-1's settings. For example, if your **ESP** file has a number of custom settings that you want to maintain and download into the MS-1, these settings would be lost by choosing **Yes**.

This is useful if you want to receive (upload) the MS-1's settings and save them as a file for future use. For example, if your MS-1 has settings that you do not want to change, choosing **Yes** would allow you to load those settings to **ESP** and save them in an **ESP** file for later retrieval.

Receiving the MS-1's settings will also assure that you will not be subsequently saving any unwanted changes that you or someone else has made previously in **ESP**.

Saving

Send, No Save (<A>)

Saves **ESP** settings to current memory.

Send and Save (<Z>)

Activates all changes in current memory *and* saves to the MS-1 for power-on.

Defaulting

When you select **Default Current Menu Settings** or **Default all ESP Settings**, you are only defaulting the **ESP** settings.

Advanced Options

Send Current View

This is the same as **Save to Reader** > **Send No Save** except that only the commands in the current tree control are sent.

Receive Reader Settings	
Save to Reader	▶
Default Current Menu Settings	
Default all Settings	
Advanced Options	▶

Send Current View
Send Current Command
Add Exception
Remove Exception
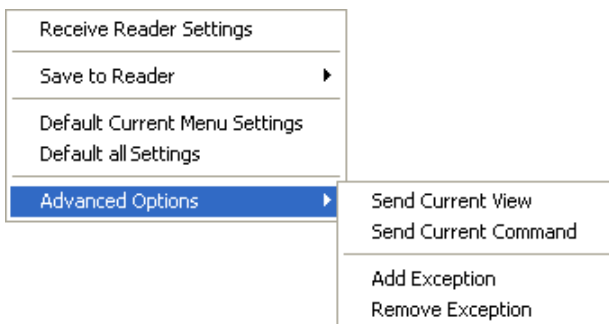
Send Current Command

Saves only the command that is currently selected in the tree control.

Add/Remove Exception

After you perform a **Receive Reader Settings** command[1] and you click on the **Advanced Options > Add Exception** option, you may see a list of serial commands. These are commands that may be in your MS-1's firmware but are not included in (or are different from) your current version of **ESP**. When exceptions are present, the **Exceptions** button will appear to the right of the other mode buttons (**Communication**, **Read Cycle**, **Symbologies**). When no exceptions are present, the button will disappear.

You can edit exception commands by double-clicking on them and changing them as needed.

It is important to note that these commands will be saved to your MS-1 whenever you send a **Save to Reader** command, or an **<A>** or **<Z>** command.

Also, if there is a corresponding **ESP** menu item, the **ESP Value** column for that item will be blank following a **Receive Reader Settings** command.

---

1. From the **Send/Recv** button, or by right-clicking in any blank section of a tree control.

■■■■ *5 Communications*

Contents

This section explains how to set up communications between the MS-1 and a host.

With Microscan's **ESP** (Easy Setup Program), configuration changes can be made in the **ESP** tree controls and then sent and saved to the MS-1. The user can also send serial commands to the MS-1 via **ESP**'s **Terminal**.

Communications by ESP

App Mode

Click this button to bring up the **App Mode** view.

Communication

Click this button to bring up the **Communication** tree control.

Parameters	ESP Values
⊟ Communications	
⊟ Host Port Connections	
— Baud Rate	
— Parity	
— Stop Bits	
— Data Bits	
Host Protocol	Point-to-Point* ▼
⊟ Preamble	Point-to-Point*
— Preamble Characters	Point-to-Point with RTS/CTS
⊞ Postamble	

To open nested options, **single-click** the **+**.

To change a setting, **double-click** the setting and use your cursor to scroll through the options.

Communications Serial Commands

Host Port Connections	<**K100,***baud rate,parity,stop bits,data bits*>
Host Port Protocol	<**K140,***protocol*>
Preamble	<**K141,***status,preamble character(s)*>
Postamble	<**K142,***status,postamble character(s)*>

Host Port Connections

The following settings define the basic transmission speeds and digital standards that ensure common formatting.

Baud Rate, Host Port

Usage:	Can be used to transfer data faster or to match host port settings.
Definition:	The rate at which the MS-1 and host transfer data back and forth.
Serial Cmd:	<**K100,*baud rate*,**parity,stop bits,data bits>
Default:	**9600**

Options:

1 = 1200	2 = 2400	3 = 4800
4 = 9600	5 = 19.2K	6 = 38.4K

Parity, Host Port

Usage:	Only changed if necessary to match host setting.
Definition:	An error detection routine in which one data bit per character is set to 1 or 0 so that the total number of bits in the data field is either even or odd.
Serial Cmd:	<**K100,**baud rate,***parity*,**stop bits,data bits>
Default:	**Even**

Options: 0 = None   **1 = Even**   2 = Odd

Stop Bits, Host Port

Usage:	Only changed if necessary to match host setting.
Definition:	One or two bits added to the end of each character to indicate the end of the character.
Serial Cmd:	<**K100,**baud rate,parity,***stop bits*,**data bits>
Default:	**One**

Options: **0 = One**   1 = Two

Data Bits, Host Port

Usage:	Only changed if necessary to match host setting.
Definition:	One or two bits added to the end of each character to indicate the end of the character.
Serial Cmd:	<**K100,**baud rate,parity,stop bits,***data bits*>
Default:	**Seven**

Options: **0 = Seven**   1 = Eight

Host Port Protocol

Usage: In general, the point-to-point protocols will work well in most applications. They require no address and must use RS-232 or RS-422 communications standards.

Definition: Protocols define the sequence and format in which information is transferred between the MS-1 and the host.

Serial Cmd: <**K140,*protocol***>

Default: **Point-to-Point**

Options: **0 = Point-to-Point**

1 = Point-to-Point with RTS/CTS

Note: The preamble **<K141>** and postamble **<K142>** character strings can be used to frame the decoded data in both protocol modes.

Point-to-Point (Standard)

Usage: Used only with RS-232 or RS-422.

Definition: Standard **Point-to-Point** requires no address and sends the data to the host whenever it is available, without a request or handshake from the host.

Serial Cmd: <**K140,*0***>

Point-to-Point with RTS/CTS

Usage: An MS-1 initiates a data transfer with an RTS (request-to-send) transmission. The host, when ready, responds with a CTS (clear-to-send) and the data is transmitted. RTS and CTS signals are transmitted over two dedicated wires as defined in the RS-232 standard. Used only with RS-232.

Definition: **Point-to-Point with RTS/CTS** (request-to-send/clear-to-send) is a simple hardware handshake protocol that allows an MS-1 to initiate data transfers to the host.

Serial Cmd: <**K140,*1***>

Preamble

Preamble Status

Usage:	Useful for identifying and controlling incoming data. For example, defining the preamble as a carriage return and a line feed causes each decoded message to be displayed on its own line.
Definition:	Defines a one to four character data string that can be added to the beginning of the decoded data.
Serial Cmd:	<**K141,***status*,*preamble character(s)*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled (within any protocol)

Preamble Characters

Serial Cmd:	<**K141,**status,***preamble character(s)***>
Default:	**^M (carriage return)**
Options:	To enter control characters within a serial command, hold down the **Ctrl** key while typing the desired character.
	Example: **<K141,1,CTRL-m>** to enter the control character **^M**.

Postamble

Postamble Status

Usage: Useful for identifying and controlling incoming data. For example, defining the postamble as a carriage return and a line feed causes each decoded message to be displayed on its own line.

Definition: Allows the user to enable or disable up to four postamble characters that can be added to the end of the decoded data.

Serial Cmd: <**K142,status**,*postamble character(s)*>

Default: **Enabled**

Options: 0 = Disabled   **1 = Enabled (within any protocol)**

Postamble Characters

Serial Cmd: <**K142,**status,***postamble character(s)***>

Default: **^M^J (carriage return/line feed)**

Options: To enter control characters within a serial command, hold down the **Ctrl** key while typing the desired character.

     Example: **<K142,1,CTRL-m CTRL-j>** to enter **^M^J**.

Postamble

6 Read Cycle

Contents

After you've established communications you will need to address the spatial and timing parameters associated with your application. This section explains those parameters.

Read Cycle by ESP

App Mode

Click this button to bring up the **App Mode** view.
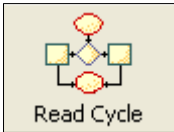
Read Cycle

Click this button to bring up the **Read Cycle** tree control.

Parameters	ESP Values
⊟ Read Cycle	
─── Number of Symbols	Single
─── Time Between Identical Decodes	0
─── Trigger Mode	Continuous Read
⊟ Serial Trigger	
─── Character (Delimited)	GS
─── Start Character (Non-Delimited)	0x00 NUL
─── Stop Character (Non-Delimited)	0x00 NUL
─── No Decode Timeout	2
─── Decodes Before Output	0
⊟ Noread Message	Enabled* ▼
─── Message	Disabled
	Enabled*
⊟ Reader Setup	
─── Shutter Speed	0
─── Minimum Speed	70
─── Maximum Speed	0

To open nested options, **single-click** the **+**.

To change a setting, **double-click** the setting and use your cursor to scroll through the options.

Read Cycle Serial Commands

Trigger Mode	<**K200,***trigger mode*>
Serial Trigger Character	<**K201,***serial trigger character*>
No Decode Timeout	<**K220,***0,seconds*>
Decodes Before Output	<**K221,***decodes before output*>
Number of Symbols	<**K222,***number of symbols*>
Start Trigger Character	<**K229,***start character*>
Stop Trigger Character	<**K230,***stop character*>
Time Between Identical Decodes	<**K503,***time between identical decodes*>
Reader Setup	<**K522,***shutter speed,minimum speed,maximum speed*>
No Read Message	<**K714,***status,No Read message*>

MS-1 Read Cycle Overview

The MS-1 outputs symbol data as soon as it is decoded. There is no "End of Read Cycle" option. **Multiple** symbol operations are emulated by controlling the read cycle duration and the time allowed between identical consecutive decodes.

The following conditions also apply:

1. In **Single** symbol mode, a read cycle ends only on a decode, falling trigger, or timeout.
2. In **Multiple** symbol mode, the read cycle begins on a triggered event, but starts over after any symbol has been decoded.
3. There is no "new trigger" feature.
4. There is no timeout for **External Level** mode.
5. There is no **Continuous Read 1 Output** setting in **Trigger Mode**, but this setting can be emulated by following the steps described in **Continuous Read 1 Output Emulation**.

Number of Symbols

Usage: Commonly used in shipping applications where an object contains individual symbols for part number, quantity, and other values.

Definition: This feature allows one trigger event to decode all symbols present.

Conditions: The following conditions apply:

- When **Number of Symbols** is set to **Single**, the read cycle ends when one symbol is decoded and output.
- When **Number of Symbols** is set to **Multiple**, all decoded symbol data (for both the same and different symbols) is output while the read cycle is active and/or no timeout has occurred.
- If set to **Multiple** and **Time Between Identical Decodes** is less than the decode time (typically about 4ms), the same symbol data can be output multiple times.

Number of Symbols

Definition: **Number of Symbols** is the number of different symbols that can be read in a single read cycle.

Serial Cmd: <**K222,***number of symbols*>

Default: **1**

Options: 0 = Multiple

1 = Single

Time Between Identical Decodes

Usage: Can be used to prevent repetition of data output. Also useful for emulating **Multiple** symbol operations. When used in conjunction with **Number of Symbols** set to **Multiple**, **Time Between Identical Decodes** can be set so that more than one symbol can be read within a read cycle.

Definition: Determines the length of time that the MS-1 will wait before it outputs the same symbol's data a second time.

Serial Cmd: <**K503,***time between identical decodes*>

Default: **0**

Options: 0 to 2550ms

Trigger Mode

Definition: The **Trigger** is the event that initiates a read cycle.

Serial Cmd: <**K200,***trigger mode*>

Default: **Continuous Read**

Options: **0 = Continuous Read**

               2 = External Level

               3 = External Edge

               4 = Serial Data

               5 = Serial Data and Edge

Continuous Read

Usage: **Continuous Read** is useful in testing symbol readability or MS-1 functions. It is not recommended for normal operations.

Definition: In **Continuous Read**, trigger input options are disabled and the MS-1 is always in the read cycle. If a single symbol stays within read range for multiple read cycles, its data will be transmitted repeatedly until it leaves the read range.

            The MS-1 sends replies to serial commands that require responses when symbol data is transmitted.

            Note: No Read options have no affect on **Continuous Read**.

Serial Cmd: <**K200,***0*>

External Level

Initiate Read Cycle:
Object #1, moving in front of the detector beam, causes a change in the trigger state, which initiates the read cycle.

End Read Cycle:
The same object, moving out of the detector beam, causes another change in the trigger state, which ends the read cycle.
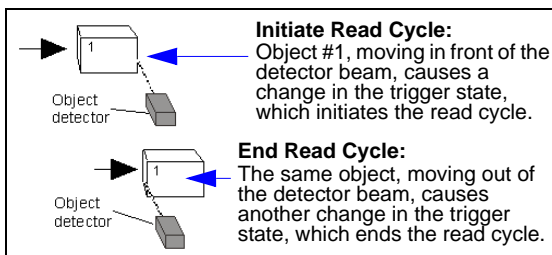
Usage: This mode is effective in an application where the speeds of the conveying apparatus are variable and the time the MS-1 spends reading each object is not predictable. It also allows the user to determine if a No Read has occurred.

Definition: **External Level** allows the read cycle (active state) to begin when a trigger (change of state) from an external sensing device is received. The read cycle persists until the object moves out of the sensor range and the active trigger state changes again.

Serial Cmd: <**K200,2**>

External Edge

Initiate Read Cycle:
Object # 1, moving in front of the detector beam, causes a change in the trigger state, which initiates the read cycle.

Initiate Second Read Cycle:
Object # 2, moving in front of the detector beam, causes another change in the trigger state. This signal initiates a new read cycle and ends the previous read cycle unless **Timeout** is enabled and a good read or timeout has not occured.

Usage: This mode is highly recommended in any application where conveying speed is constant, or if spacing, object size, or read cycle timeouts are consistent.

Definition: **External Edge**, as with Level, allows the read cycle (active state) to begin when a trigger (change of state) from an external sensing device is received. However, the passing of an object out of sensor range does not end the read cycle. The read cycle ends with a good read output, or, depending on the **End of Read Cycle** setting, a timeout or new trigger occurs.

Serial Cmd: <**K200,3**>

Serial Data

Usage: **Serial Data** is effective in a highly controlled environment where the host knows precisely when the object is in the field of view. It is also useful in determining if a No Read has occurred.

Definition: In **Serial Data**, the MS-1 accepts an ASCII character from the host or controlling device as a trigger to start a read cycle. A **Serial Data** trigger behaves the same as an **External Edge** trigger.
Serial commands are entered inside angle brackets, as shown here: **<t>**.

Serial Cmd: <**K200,4**>

Note: In **Serial Data**, sending a non-delimited start serial character will start a read cycle; however, a non-delimited stop serial character has no effect.

Serial Data and Edge

Usage: **Serial Data and Edge** is seldom used but can be useful in an application that primarily uses an external sensing device but occasionally needs to be triggered manually.
An auxiliary terminal can be connected to the auxiliary port so the user can send the serial trigger character through the MS-1 to the host.

Definition: In this mode the MS-1 accepts either a serial ASCII character or an external trigger pulse to start the read cycle.

Serial Cmd: <**K200,5**>

Note: In **Serial Data**, sending a non-delimited start serial character will start a read cycle; however, a non-delimited stop serial character has no effect.

Continuous Read 1 Output Emulation

Usage: **Continuous Read 1 Output** can be useful in applications where it is not feasible to use a trigger and all succeeding symbols contain different information. It is also effective in applications where the objects are presented by hand.

The MS-1 does not offer this feature, but it can be emulated by following the steps described below.

Definition: In **Continuous Read 1 Output Emulation**, the trigger must be active (grounded) for as long as the MS-1 needs to be scanning symbols. The MS-1 will only output symbol data once while that symbol remains in the MS-1's field of view. If the symbol is removed and then presented again, it must be removed from the field of view for the amount of time specified in the **Time Between Identical Decodes** value before the MS-1 will decode the symbol again. However, if a new symbol is presented, the MS-1 will decode it and output symbol data immediately.

Setting Up Continuous Read 1 Output Emulation

1. Set **Number of Symbols** to **Multiple**.

Number of Symbols	Multiple ▼
	Multiple
	Single*

Serial Cmd: <**K222,*0***>
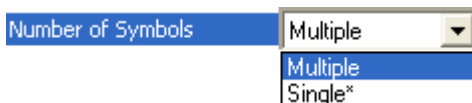
2. Set **Time Between Identical Decodes** to **500 (ms)**.

Time Between Identical Decodes	500 ⇕	(0 - 2550) ms

Serial Cmd: <**K503,*500***>

3. Set **Trigger Mode** to **External Level**.

Trigger Mode	Continuous Read* ▼
	Continuous Read*
	External Level
	External Edge
	Serial Data
	Serial Data and Edge

Serial Cmd: <**K200,*2***>
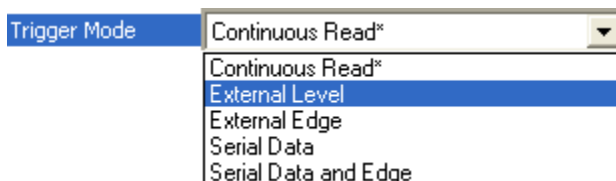
Important: Continuous Read 1 Output Emulation is not recommended for automated environments, because there is typically no reliable way to verify whether or not a symbol was missed.

Serial Trigger Character (Delimited)

Usage: Allows the user to define the trigger character and delimiters that start and stop the read cycle.

Definition: A serial trigger is considered an online host command and requires the same command format as all host commands. It must be entered within angle bracket delimiters **< >** or, in the case of non-delimited triggers, it must define individual start and stop characters.

Serial Cmd: <**K201,***serial trigger character*>

Default: **^] (<GS>)**

Options: Any single ASCII character, including control characters, except NUL (00 in hex), an existing host command character, or an on-line protocol character. Control characters entered on the command line are displayed in the menu as mnemonic characters.

                Note: Serial Data or **Serial Data and Edge** triggering mode must be enabled for **Serial Trigger Character** to take effect.

Start Trigger Character (Non-Delimited)

Usage: Useful in applications where different characters are required to start a read cycle.

Definition: A single ASCII host serial trigger character that starts the read cycle and is not enclosed by delimiters such as **<** and **>**.

Non-delimited **Start** characters can be defined and will function according to the trigger event.

When defining **Start** trigger characters, the following rules apply:

- In **External Edge** the MS-1 looks only for the **Start** trigger character and ignores any **Stop** trigger character that may be defined.
- In **External Level** the **Start** trigger character begins the read cycle and the **Stop** trigger character ends it. Note that even after a symbol has been decoded and the symbol data transmitted, the MS-1 remains in **External Level** trigger read cycle until a **Stop** character is received.
- In **Serial Data and Edge** trigger mode, either a **Start** trigger character or a hardware trigger can start an edge trigger read cycle.

Serial Cmd: <**K229,***start trigger character*>

Default: **NUL** (00 in hex) (disabled)

Options: Two hex digits representing any ASCII character except **XON** and **XOFF**.

Stop Trigger Character (Non-Delimited)

Usage: Useful in applications where different characters are required to end a read cycle.

Definition: A single ASCII host serial trigger character that ends the read cycle and is not enclosed by delimiters such as **<** and **>**.

Non-delimited **Stop** characters can be defined and will function according to the trigger event.

When defining **Stop** trigger characters, the following rules apply:

- In **External Edge** the MS-1 looks only for the **Start** trigger character and ignores any **Stop** trigger character that may be defined.

- In **External Level** the **Start** trigger character begins the read cycle and the **Stop** trigger character ends it. Note that even after a symbol has been decoded and the symbol data transmitted, the MS-1 remains in **External Level** trigger read cycle until a **Stop** character is received.

- In **Serial Data and Edge** trigger mode, either a **Start** trigger character or a hardware trigger can start an edge trigger read cycle.

Serial Cmd: <**K230,*stop trigger character***>

Default: **NUL** (00 in hex) (disabled)

Options: Two hex digits representing any ASCII character except **XON** and **XOFF**.

No Decode Timeout

Usage:　Useful in tightly-controlled applications that require a read cycle to end before the next object appears.

Definition:　The duration of the read cycle as measured from either the beginning of the read cycle or from the last decode.

Serial Cmd:　<**K220**,*0,seconds*>

Note: The first parameter is always a zero (0) and does not change.

Default:　**2**

Options:　**1 - 4095**

The MS-1 times out if no symbol is decoded during the **No Decode Timeout** period. If a symbol is decoded before the timeout expires, the timeout period starts again.

No Decode Timeout only applies to **Edge**, **Serial Data**, and **Serial Data and Edge** trigger modes.

In **Single** symbol mode (**<K222,1>**), **No Decode Timeout** is the maximum amount of time the MS-1 will attempt to decode after a trigger is activated.

In **Multiple** symbol mode (**<K222,0>**), **No Decode Timeout** is the time in which there are no decodes—not the time since the trigger was activated. That is, if the MS-1 continues to decode symbols presented to it, it will not exit the read cycle unless the time between decodes exceeds the time set in **No Decode Timeout**.

For **Level** trigger mode, the read cycle ends when the trigger falls, or when a symbol is decoded and output in **Single** symbol mode.

Decodes Before Output

Note: When setting up, determine if the MS-1's scan rate is capable of scanning your longest symbol the required number of times.

Usage:	Useful for increasing the reliability of decodes for symbologies that do not have internal error checking.
Definition:	The number of decodes required per symbol before its data is sent. Requires the MS-1 to decode a symbol successfully a designated number of times before data is output.
Serial Cmd:	<**K221,***decodes before output*>
Default:	**0**
Options:	0 to 10 (0 = "Auto-adaptive")

Note: If the MS-1 is in **Single** symbol mode and it doesn't achieve the number of required decodes during the read cycle, a **No Read** message will be output.

Note: Higher **Decodes Before Output** settings will decrease the throughput rate.

No Read Message

Note: A **No Read** message can only be transmitted when in **Single** symbol mode and no decodes occur.

Usage: Used in applications where the host needs serial verification that a symbol has not been read.

Definition: When enabled, and if no symbol has been decoded before timeout or the end of the read cycle, the No Read message will be transmitted to the host.

No Read Status

Serial Cmd: <**K714,***status*,No Read message>

Default: **Enabled**

Options: 0 = Disabled   **1 = Enabled**

No Read Message

Definition: Any combination of ASCII characters can be defined as the No Read message.

Serial Cmd: <**K714,***status*,**No Read message**>

Default: **No Read**

Options: 1 to 20 ASCII characters.

Note: A **No Read** message is not output when the MS-1 is disabled (when an **<I>** command has been sent).

Reader Setup

Reader Setup allows shutter speed to be controlled automatically, set to a specific value, or defined within a fixed range.

Shutter Speed

Usage:	Faster shutter speeds may be necessary in faster-moving applications. Slower shutter speeds are useful in slower, lower-contrast applications.
Definition:	**Shutter speed** is the amount of time that the sensor is exposed to light.
Serial Cmd:	<**K522,*shutter speed*,**minimum speed,maximum speed>
Default:	**0 (Automatic)**
Options:	70 to 65535

Minimum Speed

Usage:	Useful in applications with variable speeds, variable symbol sizes, and variable distances.
Definition:	The slowest shutter speed and longest exposure of the sensor to light.
Serial Cmd:	<**K522,**shutter speed,***minimum speed*,maximum speed>
Default:	**70**
Options:	70 to 65535

Maximum Speed

Usage:	Useful in applications with variable speeds, symbol sizes, and distances.
Definition:	The fastest shutter speed and shortest exposure of the sensor to light.
Serial Cmd:	<**K522,**shutter speed,minimum speed,***maximum speed*>
Default:	**65535**
Options:	70 to 65535

7 Symbologies

Contents

This section describes the various symbol types that can be decoded by the MS-1 Scan Engine.

See the following sites for additional symbology information:

http://www.aimglobal.org/standards/aimpubs.asp
http://barcodes.gs1us.org/dnn_bcec/Default.aspx?tabid=82

Symbologies by ESP

Click this button to bring up the **App Mode** view.

Click this button to bring up the **Symbologies** tree control.

To open nested options, **single-click** the **+**.

Parameters	ESP Values
⊟ Symbologies	
⊞ Code 39	
⊞ Code 128/EAN	
⊞ Interleaved 2 of 5	
⊞ Codabar	
⊞ UPC/EAN	
⊞ Code 93	
⊞ Industrial 2 of 5	
⊞ MSI Code	
⊞ Plessey Code	
DataBar Expanded	Disabled*
DataBar Limited	Disabled*
DataBar-14	Enabled
Symbology Identifier	

To change a setting, **double-click** the setting and use your cursor to scroll through the options.

Symbologies Serial Commands

Symbology Identifier	<**K450,***0,symbology identifier status*>
Code 39	<**K470,***status,check character status,check character output status, 0,0,minimum symbol length,full ASCII set*>
Codabar	<**K471,***status,0,start/stop match output status,0,symbol length status, symbol length,check character status,check character output status*>
Interleaved 2 of 5	<**K472,***status,check character status,check character output status, symbol length #1,symbol length #2*>
Code 128/EAN 128	<**K474,***status,0,minimum symbol length,1,1,0,application record separator character*>
Code 93	<**K475,***status,0,minimum symbol length*>
DataBar-14 (RSS-14)	<**K482,***status*>
DataBar Limited (RSS Limited)	<**K483,***status*>
DataBar Expanded (RSS Expanded)	<**K484,***status*>
MSI Code	<**K486,***status,check character mode,check character output status, 0,minimum symbol length*>
Plessey Code	<**K487,***status,check character output status,0,minimum symbol length*>
Industrial 2 of 5	<**K488,***status,check character status,check character output status, format,symbol length #1,symbol length #2*>
UPC/EAN	<**K489,***UPC-A status,UPC-E status,EAN-8 status,EAN-13 status, supplementals required,supplemental 2 status,supplemental 5 status, UPC-A as EAN-13,UPC-E as UPC-A,EAN-8 as EAN-13*>

Code 39

Usage:	**Code 39** is the most widely used non-retail 1D symbology.
Definition:	An alphanumeric symbology with unique start/stop code patterns, composed of 9 black and white elements per character, 3 of which are wide.
Serial Cmd:	<**K470,***status*,check character status,check character output status,0,0, minimum symbol length,full ASCII set>
Default:	**Enabled**
Options:	0 = Disabled **1 = Enabled**

Check Character Status (Code 39)

Definition:	When enabled, the MS-1 will verify a Modulus 10 check character in order to identify the decode as successful.
Serial Cmd:	<**K470,***status,**check character status**,check character output status, 0,0,minimum symbol length,full ASCII set>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Check Character Output Status (Code 39)

Usage:	**Check Character Output Status**, when added to the symbol, provides additional data security.
Definition:	When enabled, the check character is read and output along with the symbol data. When disabled, symbol data is output without the check character. **Note:** With **Check Character Output Status** and an **External** or **Serial** trigger option enabled, an invalid check character calculation will cause a No Read message to be transmitted at the end of the read cycle.
Serial Cmd:	<**K470,***status,check character status,**check character output status**, 0,0,minimum symbol length,full ASCII set>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Minimum Symbol Length (Code 39)

Usage: **Minimum Symbol Length** helps prevent truncations and increases data integrity by ensuring that only one symbol length will be accepted.

Definition: Specifies the exact number of characters that the MS-1 will recognize (this does not include start and stop characters and check characters). The MS-1 ignores any symbology that is less than the specified length.

Serial Cmd: <**K470,***status,check character status,check character output status,0,0,***minimum symbol length***,full ASCII set*>

Default: **0**

Options: 0 to 32

Full ASCII Set (Code 39)

Usage: Must be enabled when reading characters outside the standard character set (0-9, A-Z, etc.)

The user must know in advance whether or not to use the **Full ASCII Set** option. Since **Full ASCII Set** requires two code words to encode one character, it is less efficient.

Definition: Standard Code 39 encodes 43 characters; zero through nine, capital "A" through capital "Z", minus symbol, plus symbol, forward slash, space, decimal point, dollar sign, and percent symbol. When **Full ASCII Set** is enabled, the MS-1 can read the full ASCII character set, from 0 to 255.

Serial Cmd: <**K470,***status,check character status,check character output status,0,0,minimum symbol length,***full ASCII set**>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

Codabar

Usage:	Used in photo-finishing and library applications. Previously used in medical applications, but not typically used in newer medical applications.
Definition:	Codabar is a 16-bit character set (0 through 9, and the characters **$**, **:**, **/**, **.**, **+**, and **–**) with start/stop codes and at least two distinctly different bar widths.
Serial Cmd:	<**K471,***status*,0,*start/stop output status*,0,*symbol length status,symbol length,check character status,check character output*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Start/Stop Output Status (Codabar)

Definition:	When enabled, the start and stop characters *will* be present in the data output of the decoded symbol.
	When disabled, the start and stop characters will *not* be present in the data output of the decoded symbol.
	Note: Because the start and stop characters are included as part of the data, the characters must be included as part of the length in a fixed length mode of operation.
Serial Cmd:	<**K471,***status*,0,***start/stop output status***,0,*symbol length status,symbol length,check character status,check character output*>
Default:	**Enabled**
Options:	0 = Disabled **1 = Enabled**

Symbol Length Status (Codabar)

Definition:	When set to **Any/Minimum**, any symbol length is considered valid.
	When set to **Fixed**, the MS-1 will check the symbol length against the **Symbol Length Status** parameter.
Serial Cmd:	<**K471,***status*,0,*start/stop output status*,0,***symbol length status***,*symbol length,check character status,check character output*>
Default:	**Any/Minimum**
Options:	**0 = Any/Minimum** 1 = Fixed

Symbol Length (Codabar)

Definition: Specifies the number of characters that the MS-1 will recognize, including start and stop check characters. The

             Note: When setting **Symbol Length** to any value other than **0**, add **2** to account for reserved spaces. For example, if your symbol has **3** characters, set Symbol Length to **5**.

             Note: If Symbol Length is set to **0** and Symbol Length Status is set to **Any/Minimum**, all symbol lengths are decoded.

Serial Cmd: <**K471,***status,0,start/stop output status,0,symbol length status,**symbol length**,check character status,check character output*>

Default: **6**

Options: 0 to 32

Check Character Status (Codabar)

Definition: When disabled, the MS-1 will not perform any character checking calculations on decoded Codabar symbols.

             When set to **Modulus 16**, the MS-1 will perform a Modulus 16 check character calculation on the symbol. If the symbol does not pass this calculation, it will not be decoded.

Serial Cmd: <**K471,***status,0,start/stop output status,0,symbol length status,symbol length,**check character status**,check character output*>

Default: **Disabled**

Options: **0 = Disabled**

             1 = Enabled (Modulus 16)

Check Character Output (Codabar)

Definition: When this field is disabled and a check character calculation is enabled, the MS-1 will strip the verified check character from the symbol data output. This condition must be accounted for if a minimum length is also being used.

             When enabled, the MS-1 will output the check character as part of the symbol data. This condition must be accounted for if a minimum length is also being used.

Serial Cmd: <**K471,***status,0,start/stop output status,0,symbol length status,symbol length,check character status,**check character output**>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

Interleaved 2 of 5

Usage:	**Interleaved 2 of 5** has been popular because it is the most dense symbology for printing numeric characters less than 10 characters in length; however, Microscan does not recommend this symbology for any new applications because of inherent problems such as truncation.
Definition:	A dense, continuous, self-checking, numeric symbology. Characters are paired together so that each character has five elements, two wide and three narrow, representing numbers 0 through 9, with the bars representing the first character and the interleaved spaces representing the second character. (A check character is highly recommended).
Serial Cmd:	<**K472,**_status_,*check character status,check character output status,symbol length #1,symbol length #2*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Check Character Status (Interleaved 2 of 5)

Usage:	This option is not typically used, but it can be enabled for additional security in applications where the host requires redundant check character verification.
Definition:	An error correcting routine in which the check character is added.
Serial Cmd:	<**K472,**_status,_**check character status**,*check character output status,symbol length #1,symbol length #2*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Check Character Output Status (Interleaved 2 of 5)

Definition:	When enabled, a check character is sent along with the symbol data for added data security.
Serial Cmd:	<**K472,**_status,check character status,_**check character output status**,*symbol length #1,symbol length #2*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Symbol Length #1 (Interleaved 2 of 5)

Usage:	Useful in applications where I 2/5 symbols of a specific length are required.
Definition:	The **Symbol Length # 1** field is one of two fields against which the decoded symbol is compared before accepting it as valid or rejecting it.
Serial Cmd:	<**K472,***status,check character status,check character output,***symbol length #1***,symbol length #2>*
Default:	**10**
Options:	0 to 32

Symbol Length #2 (Interleaved 2 of 5)

Usage:	Useful in applications where I 2/5 symbols of a specific length are required.
Definition:	The **Symbol Length # 2** field is one of two fields against which the decoded symbol is compared before accepting it as valid or rejecting it.
Serial Cmd:	<**K472,***status,check character status,check character output,symbol length #1,***symbol length #2***>*
Default:	**6**
Options:	0 to 32

Range Modes (Interleaved 2 of 5)

Variable Length

To set for any length, **Symbol Length # 1** and **Symbol Length # 2** must both equal zero.

Minimum Length

To set for minimum length, both **Symbol Length # 1** and **Symbol Length # 2** must be equal to each other and be any number other than zero.

Fixed Length

To set for a fixed length, **Symbol Length #1** and **Symbol Length #2** must not be equal to each other.

Code 128/EAN 128

Usage:	**Code 128** is a smaller symbology useful in applications with limited space and high-security requirements.
Definition:	A very dense alphanumeric symbology. It encodes all 128 ASCII characters, it is continuous, has variable length, and uses multiple element widths measured edge to edge.
Serial Cmd:	<**K474,***status*,0,*minimum symbol length*,1,1,0,*application record separator character*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Minimum Symbol Length (Code 128/EAN 128)

Usage:	**Minimum Symbol Length** helps prevent truncations and increases data integrity by ensuring that only one symbol length will be accepted.
Definition:	This specifies the exact number of characters that the MS-1 will recognize (this does not include start, stop, and check characters). The MS-1 ignores any symbol not having the specified length.
Serial Cmd:	<**K474,***status*,0,**minimum symbol length**,1,1,0,*application record separator character*>
Default:	**0**
Options:	0 to 32

Application Record Separator Character (Code 128/EAN 128)

Definition:	This is an ASCII character that serves as a separator in formatted output.
Serial Cmd:	<**K474,***status*,0,*minimum symbol length*,1,1,0,**application record separator character**>
Default:	**NUL**
Options:	Any ASCII character (7 bit)

Code 93

Usage:	Used in some clinical applications.
Definition:	Code 93 is a variable-length, continuous symbology employing four element widths. Each Code 93 character has nine modules that may be either black or white. Each character contains three bars and three spaces.
Serial Cmd:	<**K475,***status*,0,*minimum symbol length*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Minimum Symbol Length (Code 93)

Definition:	Specifies the minimum number of characters that the MS-1 will recognize, not including the start and stop check characters. The MS-1 ignores any symbol smaller than the specified length. **Note:** When setting **Minimum Symbol Length** to any value other than **0**, add **1** to account for a reserved space. For example, if your symbol has **3** characters, set Symbol Length to **4**.
Serial Cmd:	<**K475,***status*,0,***minimum symbol length***>
Default:	**10**
Options:	0 to 32

GS1 DataBar (RSS)

Note: GS1 DataBar symbologies were previously known as "Reduced Space Symbology", or "RSS".

DataBar-14 (RSS-14)

Note: DataBar-14 was previously known as "RSS-14".

Usage:	Used in the grocery, retail, and prescription drug industries where 14-digit EAN item identification may be needed.
Definition:	DataBar-14 is a minimum length symbology that encodes 14 digits, including a 1-digit indicator. DataBar-14 is 96 modules wide. It can be stacked in two rows, it can read omnidirectionally if printed in full height, or horizontally if height-truncated for small marking.
Serial Cmd:	<**K482,***status*>
Default:	**Disabled**
Options:	**0 = Disabled**
	1 = Enabled

DataBar Limited (RSS Limited)

Note: DataBar Limited was previously known as "RSS Limited".

Usage:	DataBar Limited is designed to be read by laser scanners and CCD readers. It is not recommended for omnidirectional slot scanners.
Definition:	Encodes a smaller 14-digit symbol (74 modules wide) that is not omnidirectional.
Serial Cmd:	<**K483,***status*>
Default:	**Disabled**
Options:	**0 = Disabled**
	1 = Enabled

DataBar Expanded (RSS Expanded)

Note: DataBar Expanded was previously known as "RSS Expanded".

Usage:	Used to encode primary and supplementary data in retail point-of-sale and other applications.
Definition:	DataBar Expanded is a variable length symbology that can encode supplementary information in addition to the 14-digit EAN item identification number and is capable of encoding up to 74 numeric or 41 alphabetic characters.
Serial Cmd:	<**K484,***status*>
Default:	**Disabled**
Options:	**0 = Disabled**
	1 = Enabled

MSI Code

Status (MSI Code)

Usage:	Used for inventory control and the identification of storage containers and locations in warehouse environments.
Definition:	**MSI Code** is a numeric, continuous symbology in which each character consists of four bits in a binary format.
Serial Cmd:	<**K486,***status*,*check character mode*,*check character output status, 0,minimum symbol length*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Check Character Mode (MSI Code)

Definition:	This field is set to perform a Modulus 10 calculation by default. It can also be set to perform a Double Modulus 10 calculation.
Serial Cmd:	<**K486,***status,***check character mode***,check character output status, 0,minimum symbol length*>
Default:	**Modulus 10**
Options:	**1 = Modulus 10** 2 = Double Modulus 10

Check Character Output Status (MSI Code)

Definition:	When this field is enabled, the MS-1 will output the check digit with symbol data. When disabled, the MS-1 will not output the check digit with symbol data.
Serial Cmd:	<**K486,***status,check character mode,***check character output status***, 0,minimum symbol length*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Minimum Symbol Length (MSI Code)

Definition:	This field specifies the minimum number of characters the MS-1 will recognize, including a check character.
Serial Cmd:	<**K486,***status,check character mode,check character output status, 0,***minimum symbol length***>
Default:	**6**
Options:	0 to 32

Plessey Code

Status (Plessey Code)

Usage:	Used primarily in library and retail applications.
Definition:	Plessey Code consists of pairs of wide and narrow bars representing binary data which, taken in units of 12, define hexadecimal characters.
Serial Cmd:	<**K487,***status,check character output status,0,minimum symbol length*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Check Character Output Status (Plessey Code)

Definition:	When this field is enabled, the check character will be output with symbol data. When disabled, the check character will not be output with symbol data.
Serial Cmd:	<**K487,***status,**check character output status**,0,minimum symbol length*>
Default:	**Disabled**
Options:	**0 = Disabled** 1 = Enabled

Minimum Symbol Length (Plessey Code)

Definition:	This field specifies the minimum number of characters the MS-1 will recognize, including a check character.
Serial Cmd:	<**K487,***status,check character output status,0,**minimum symbol length**>*
Default:	**0**
Options:	0 to 32

Industrial 2 of 5

Status (Industrial 2 of 5)

Usage: Used primarily in warehouse sortation, photo finishing, and the sequential numbering of airline tickets.

Definition: Microscan recommends that Industrial 2 of 5 always be used with fixed symbol length settings in any application. **Symbol Length # 1** and **Symbol Length # 2** can both be set to **0** to allow the MS-1 to decode Industrial 2 of 5 symbols of varying lengths.

Serial Cmd: <**K488,***status*,check character status,check character output status,format, symbol length #1,symbol length #2>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

Check Character Status (Industrial 2 of 5)

Definition: When this field is enabled, a check character is added.

Serial Cmd: <**K488,**status,*check character status*,check character output status,format, symbol length #1,symbol length #2>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

Check Character Output Status (Industrial 2 of 5)

Definition: When this field is enabled, the check character will be output with symbol data. When disabled, the check character will not be output with symbol data.

Serial Cmd: <**K488,**status,check character status,*check character output status*,format, symbol length #1,symbol length #2>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

Format (Industrial 2 of 5)

DefinitionL Defines the number of start and stop check characters.

Serial Cmd: <**K488,**status,check character status,check character output status,*format*, symbol length #1,symbol length #2>

Default   **3 start / 3 stop**

Options: 0 = 3 start / 3 stop   1 = 2 start / 2 stop

Symbol Length # 1 (Industrial 2 of 5)

Definition: This field specifies the number of characters that the MS-1 will recognize, including start and stop characters and check characters. The MS-1 ignores any symbol with fewer than the specified number of characters. Because Industrial 2 of 5 is a continuous symbology, it is prone to substitution errors. Therefore, a symbol length must be defined and a symbol must contain an even number of characters.

Serial Cmd: <**K488,***status,check character status,check character output status,format,* ***symbol length #1,****symbol length #2>*

Default: **10**

Options: 0 to 32

Symbol Length # 2 (Industrial 2 of 5)

Definition: This field specifies the number of characters that the MS-1 will recognize, including start and stop characters and check characters. The MS-1 ignores any symbol with fewer than the specified number of characters. Because Industrial 2 of 5 is a continuous symbology, it is prone to substitution errors. Therefore, a symbol length must be defined and a symbol must contain an even number of characters.

Serial Cmd: <**K488,***status,check character status,check character output status,format, symbol length #1,***symbol length #2***>*

Default: **6**

Options: 0 to 32

Range Modes (Industrial 2 of 5)

Variable Length

To set for any length, **Symbol Length # 1** and **Symbol Length # 2** must both equal zero.

Minimum Length

To set for minimum length, both **Symbol Length # 1** and **Symbol Length # 2** must be equal to each other and be any number other than zero.

Fixed Length

To set for a fixed length, **Symbol Length #1** and **Symbol Length #2** must not be equal to each other.

UPC/EAN

UPC-A Status (UPC/EAN)

Usage: Used primarily in point-of-sale applications in the retail industry.

Definition: **UPC** (Universal Product Code) is a minimum length, numeric, continuous symbology. UPC can have two- or five-digit supplemental bar code data following the normal code. The UPC Version A (UPC-A) symbol is used to encode a 12-digit number. The first digit is the number system character, the next five are the manufacturer number, the next five are the product number, and the last digit is the checksum character.

   EAN is the European version of the UPC symbology and is used in European market applications.

   When enabled, the MS-1 will read UPC-A symbols.

Serial Cmd: <**K489,***UPC-A status*,*UPC-E status,EAN-8 status,EAN-13 status,supplementals required,supplemental 2 status,supplemental 5 status,UPC-A as EAN-13, UPC-E as UPC-A,EAN-8 as EAN-13*>

Default: **Enabled**

Options: 0 = Disabled   **1 = Enabled**

UPC-E Status (UPC/EAN)

Definition: This field is enabled by default and will decode all UPC-E symbols.

Serial Cmd: <**K489,***UPC-A status,***UPC-E status***,EAN-8 status,EAN-13 status,supplementals required,supplemental 2 status,supplemental 5 status,UPC-A as EAN-13, UPC-E as UPC-A,EAN-8 as EAN-13*>

Default: **Enabled**

Options: 0 = Disabled   **1 = Enabled**

EAN-8 Status (UPC/EAN)

Definition: This field is enabled by default and will decode all EAN-8 symbols.

Serial Cmd: <**K489,***UPC-A status,UPC-E status,***EAN-8 status***,EAN-13 status,supplementals required,supplemental 2 status,supplemental 5 status,UPC-A as EAN-13, UPC-E as UPC-A,EAN-8 as EAN-13*>

Default: **Enabled**

Options: 0 = Disabled   **1 = Enabled**

EAN-13 Status (UPC/EAN)

Definition: This field is enabled by default and will decode all EAN-13 symbols.

Serial Cmd: <**K489,**UPC-A status,UPC-E status,EAN-8 status,**EAN-13 status**,supplementals required,supplemental 2 status,supplemental 5 status,UPC-A as EAN-13, UPC-E as UPC-A,EAN-8 as EAN-13>

Default: **Enabled**

Options: 0 = Disabled   **1 = Enabled**

Supplementals Required (UPC/EAN)

Definition: A supplemental is a 2 or 5-character symbol appended to the main symbol. When enabled, the MS-1 decodes supplemental symbol data that has been appended to the standard UPC or EAN symbol.

Serial Cmd: <**K489,**UPC-A status,UPC-E status,EAN-8 status,EAN-13 status,**supplementals required**,supplemental 2 status,supplemental 5 status,UPC-A as EAN-13, UPC-E as UPC-A,EAN-8 as EAN-13>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

Supplemental 2 Status (UPC/EAN)

Definition: A 2-character symbol appended to the main symbol.

Serial Cmd: <**K489,**UPC-A status,UPC-E status,EAN-8 status,EAN-13 status,supplementals required,**supplemental 2 status**,supplemental 5 status,UPC-A as EAN-13, UPC-E as UPC-A,EAN-8 as EAN-13>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

Supplemental 5 Status (UPC/EAN)

Definition: A 5-character symbol appended to the main symbol.

Serial Cmd: <**K489,**UPC-A status,UPC-E status,EAN-8 status,EAN-13 status,supplementals required,supplemental 2 status,**supplemental 5 status**,UPC-A as EAN-13, UPC-E as UPC-A,EAN-8 as EAN-13>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

UPC-A as EAN-13 (UPC/EAN)

Definition: When enabled, UPC-A will be transmitted as EAN-13.

Serial Cmd: <**K489,***UPC-A status,UPC-E status,EAN-8 status,EAN-13 status,supplementals required,supplemental 2 status,supplemental 5 status,***UPC-A as EAN-13***, UPC-E as UPC-A,EAN-8 as EAN-13*>

Default: **Enabled**

Options: **0 = Disabled**   1 = Enabled

UPC-E as UPC-A (UPC/EAN)

Definition: When enabled, UPC-E will be transmitted as UPC-A.

Serial Cmd: <**K489,***UPC-A status,UPC-E status,EAN-8 status,EAN-13 status,supplementals required,supplemental 2 status,supplemental 5 status,UPC-A as EAN-13,***UPC-E as UPC-A***,EAN-8 as EAN-13*>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

EAN-8 as EAN-13 (UPC/EAN)

Definition: When enabled, EAN-8 will be transmitted as EAN-13.

Serial Cmd: <**K489,***UPC-A status,UPC-E status,EAN-8 status,EAN-13 status,supplementals required,supplemental 2 status,supplemental 5 status,UPC-A as EAN-13, UPC-E as UPC-A,***EAN-8 as EAN-13***>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

Symbology Identifier

Definition: The **Symbology Identifier** is a standard prefix set of characters that identifies the symbol type.

When enabled, the MS-1 analyzes and identifies the symbology and adds a three-character identifying prefix to the data:

- **]** (closed bracket character) indicating the presence of a symbology identifier.
- A, C, E, F, G, I, e, P, M
  (A = Code 39; C = Code 128/EAN-128; E = UPC/EAN; F = Codabar; G = Code 93; I = Interleaved 2 of 5; e = GS1 DataBar (RSS); P = Plessey Code; M = MSI Code)
- Modifier

Serial Cmd: <**K450,0,***symbology identifier status*>

Default: **Disabled**

Options: **0 = Disabled**   1 = Enabled

Explanation of Modifiers for Code 39, Codabar, and I-2/5

- For Code 39, Codabar, and Interleaved 2 of 5, the modifier indicates **Check Character** and **Check Character Output** status.
- For Code 39 only, Full ASCII must be enabled to see modifiers **4**, **5**, and **7**.

Modifier	Check Character	Check Character Output	Full ASCII conversion performed (Code 39 only)
0	Disabled	N/A	No
1	Enabled	Enabled	No
3	Enabled	Disabled	No
4	Disabled	N/A	Yes
5	Enabled	Enabled	Yes
7	Enabled	Disabled	Yes

Example: **]A5** indicates a **Code 39** symbol with **Check Character** and **Check Character Output** enabled and Full ASCII conversion performed.

Explanation of Modifiers for Other Symbologies

- For Code 128/EAN-128, a **1** indicates EAN-128; otherwise the modifier is **0**.
- For all other symbologies, the modifier is **0**.

8 Terminal

Contents

This section describes the **Terminal** window and **Macro** functions in **ESP**.

Terminal Window

 Click this button to display the **Terminal** view.

The following view will appear:

Copy, **paste**, **save**

Type text here to find matching text in the **Terminal** window.

Type serial commands here, or directly in the terminal screen.

Clear screen

Terminal screen

Macros listed on this bar.

Click on desired Macro to run.

Click on arrows to **Add Macro**, **Remove Macro**, or **Edit Macro**.
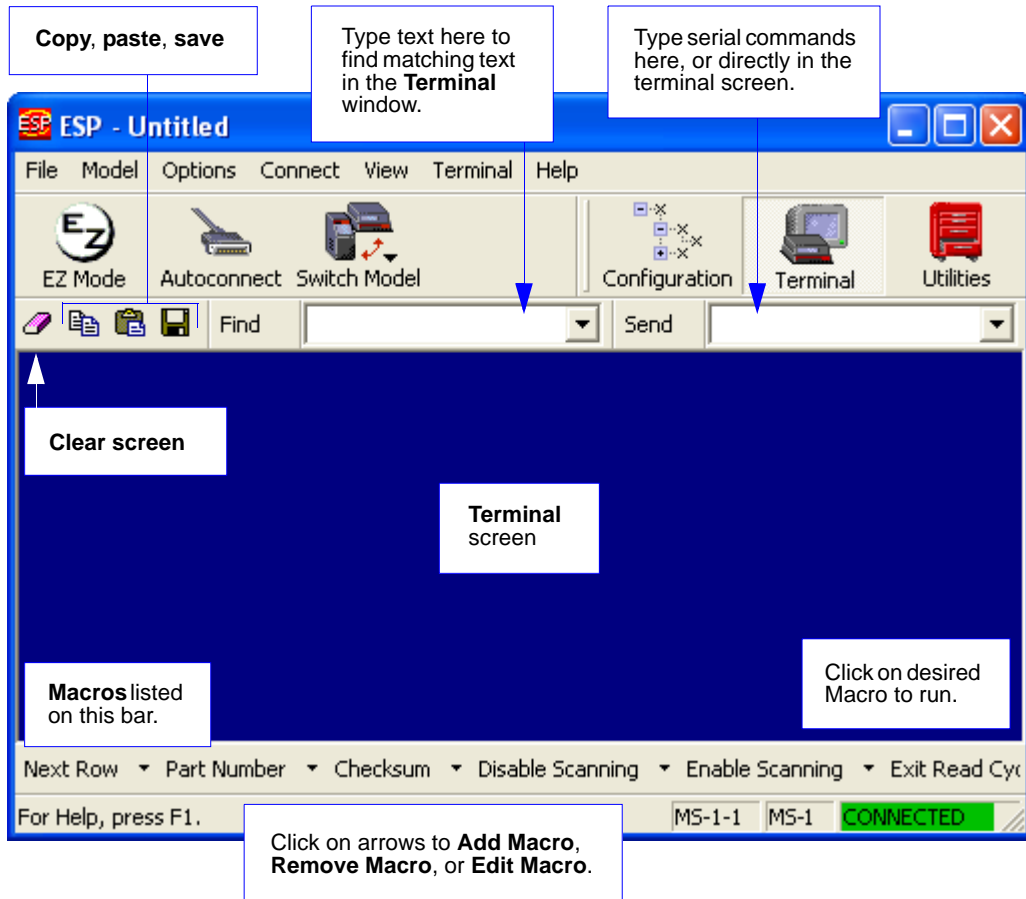
The **Terminal** allows you to send serial commands to the MS-1 by typing commands in the **Send** text field or directly in the Terminal screen, by copying and pasting, or by using Macros.

The Terminal screen also displays symbol data or information from the MS-1.

You can right-click on the screen to bring up a menu of several options for managing data in the Terminal view.

Find

The **Find** function allows you to enter text strings to be searched for in the Terminal window. For example, data from a series of symbols has been sent to the Terminal and you want to determine if a particular symbol whose data begins with "ABC" has been decoded.

1. Type "ABC" into the **Find** field.
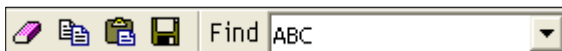
2. Press **Enter**.

   The first instance of "ABC" will be highlighted in the Terminal window.

3. Click the **Find** button to the left of the text field to locate additional instances of "ABC".

Send

The **Send** function allows you to enter serial commands and then send them to the MS-1.

1. Type the command into the **Send** box.
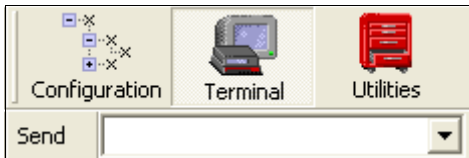
2. Press **Enter** to send the command to the MS-1.
3. Click the **Send** button to the left of the text field to send the command again.

Macros

Macros can be stored in a macro selection bar, edited in a separate window, and executed by clicking on the macro name.

Click on **Next Row** to see the next row of macros

Click on the first arrow here to see **Add Macro** or **Default Macros**.
When you default macros, the entire macros set is restored to their original macro commands.

Click on subsequent arrows to edit macros.
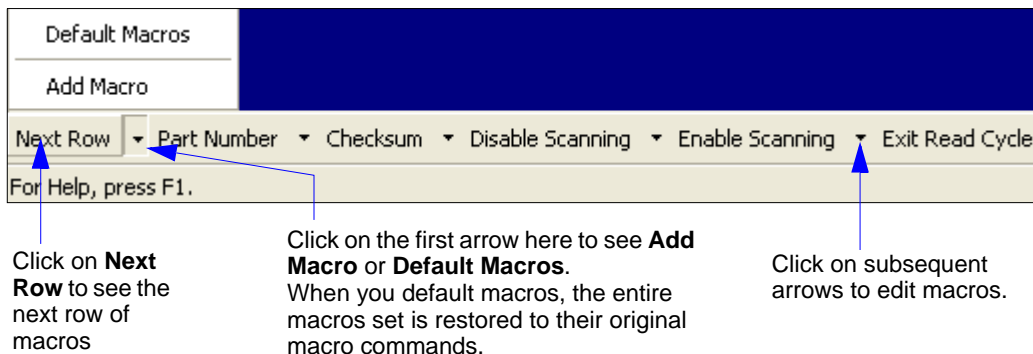
When you click on the macro name, the macro is executed in the Terminal window.

If the macro is a command, it is sent to the MS-1 at the same time that it is displayed.

Editing a Macro

When you click the arrow next to any macro and select **Edit Macro**, the following dialog appears:
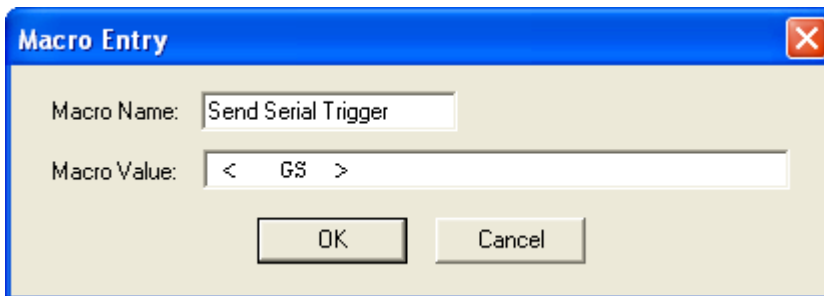
You can edit an existing **Macro Name** or **Macro Value** by typing a new name or value in the corresponding text field and clicking **OK**.

Terminal Window Menus

Right-click on the **Terminal** window to display the following menu:

- **Copy** selected text to clipboard.
- **Paste** from Terminal or other text.
- **Clear** all text in Terminal window.
- **Select All** text in the Terminal window.
- **Save...** brings up a **Save As** dialog.
- **Change Font...** of text in Terminal; brings up a **Font** dialog.
- **Change Echo Font...** to change typed text; brings up a **Font** dialog.
- **Enable Echo** enables Echo text (typed by user).
- **Change Background Color** of Terminal window.
- **Non-Printable Characters** allows you to hide non-printable characters, or to show them in **Standard** or **Enhanced** format.
- **Default Settings** returns all of the above settings to default.
- **Keyboard Macros** allows you to create new keyboard macro commands that can be sent from function keys (F2, F4, F5, etc.)

Terminal Dropdown Menu

The dropdown **Terminal** menu has **Capture Text**, **Save Current Text**, **Send File**, **Find Next**, and **Find Previous** functions, as well as the same functions defined above.
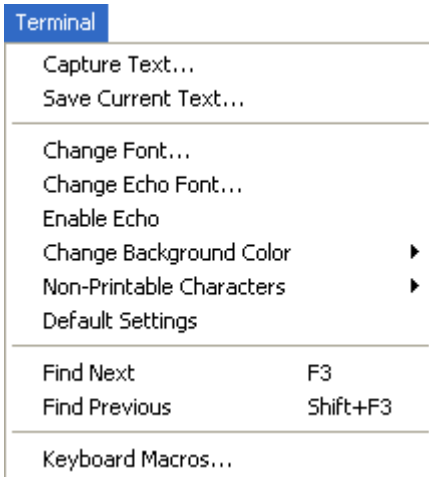
- **Capture Text...** lets you append data in real time to a text file of your choice. While in operation, the text file cannot be opened. You can select Pause to interrupt the capture flow or Stop to end the flow and open the file.
- **Save Current Text...** saves all text in the Terminal window to a text file.
- **Find Next** searches for a user-defined section of text in the Terminal.
- **Find Previous** operates in the same way as Find Next, but searches backward through Terminal text.

9 Utilities

Contents

Utility commands are generally commands that are performed during MS-1 operations to perform miscellaneous operations on MS-1 hardware. Serial utility commands are not prefaced with a "**K**" and a numeric value, nor do they require an initialization command (**<A>** and **<Z>**). They can be entered from **ESP**'s **Terminal** or **Utilities** views.

Serial Utility Commands

Note: For a list of all K commands, see **Serial Configuration Commands** on page A-6.

Type	Command	Name
Part Number	<**#**>	Display Firmware Part Number
Device Control	<**H**>	Enable Reader
	<**I**>	Disable Reader (Continuous, external trigger)
Default/Reset/Save	<**A**>	Reset (does not save for power-on)
	<**Z**>	Save Current Settings for Power-On
	<**Zrd**>	Recall Microscan Default Parameters and Save for Power-On
Reader Status Request	<**K?**>	Configuration Command Status
Trigger	<**char**>	Serial Trigger Character

Differences from Default

Clicking the **Differences from Default** button will cause **ESP** to check all stored configuration settings and compare them to default settings. All settings that are different than default will appear in the left column (shown below), and descriptions of those settings will appear in the right column.

Click this button for a list of **ESP** configuration settings that are different than default settings.

Differences from Default	
<K200,4>	Mode (Serial Data)
<K201h,52>	Character (Delimited) (R)
<K220,,1000>	Read Cycle Timeout (1000)
<K470,0>	Code 39 (Disabled)

Send configuration settings to the MS-1 without saving by clicking **Send to Reader**.

Save As...   Send and Save   Send to Reader

Click **Save As** to save the report as plain text or a tab-delimited text file.

Send configuration settings to the MS-1 and save in ESP by clicking **Send and Save**.

• To save the **Differences from Default** report, either as plain text or as a tab-delimited text file, click **Save As**.

• Click **Send and Save** to send the settings to the MS-1 and save them, or **Send to Reader** to send the settings without saving them.

Important: The use the **Differences from Default** feature, you must connect to the MS-1 and **Receive Reader Settings** via the **Send/Recv** button on the toolbar.

Send/Recv

Firmware

Firmware Update

Application code versions are specific to your MS-1. Consult with your sales representative before downloading application code. If needed, application code will be sent to you in the form of an ***.mhx** file.

Contact Microscan's help desk if you have difficulty downloading application code to the MS-1: **helpdesk@microscan.com**

Downloading Application Code to the MS-1 with a Demo Board

1. Connect to the MS-1 via **ESP**.

2. Verify your current firmware using **Firmware Verification** in **ESP Utilities**.

3. Set the demo board's mode switch (**S2**) to the **ON (Firmware Update)** position (up; toward the scan engine).

4. Connect the demo board interface cable by plugging the RJ45 connector into the demo board and plugging the RS-232 connector into the host computer. Plug the 5VDC power supply into the DC jack on the demo board interface cable.

5. Click the **Start** button in **ESP Utilities** to open the firmware update utility.
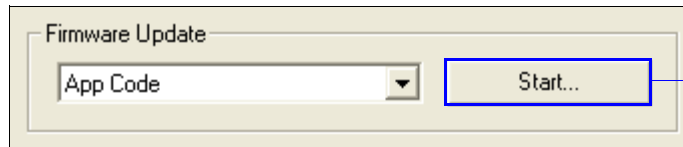
Click the **Start** button in **ESP Utilities** to open the firmware update utility.

6. Select **MS-1** from the **Target Device** dropdown menu.

7. Select **8MHz** from the **Crystal Frequency** dropdown menu.

8. Click **Open**, select the appropriate firmware file (a **.mhx** file) and click **OK**.
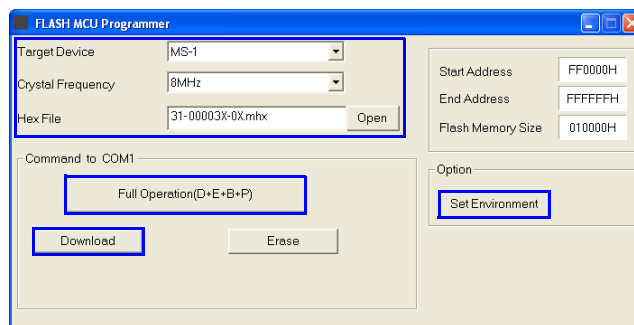
(Continued on next page)

9. Click the **Set Environment** button to bring up the COM Port menu.
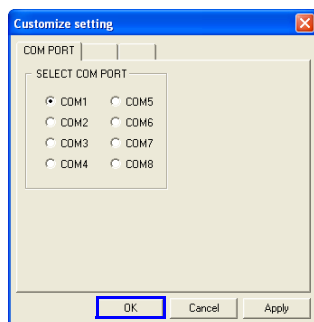
10. Select the appropriate COM Port and click **OK**.
11. Click the **Download** button. When the following dialog appears, cycle power to the reader (turn power off and then back on) and then click **OK** to continue.
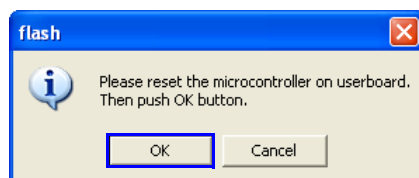
12. Click **OK** again once firmware is downloaded.
13. Click the **Erase** button to clear old firmware.
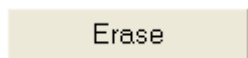
14. Click **OK** again when you see the dialog stating that old firmware has been erased.
15. Click the **Full Operation(D+E+B+P)** button. When the dialog shown in step 11 appears, cycle power to the reader (turn power off and then back on), and then click **OK** to complete the download process.
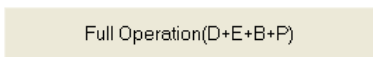
16. Click **OK** again when you see the dialog stating that the firmware download is complete.
17. Return the mode switch (**S2**) to the **Decoded Operation** position (down; away from scan engine).
18. Cycle power to the demo board (power-off and then power-on again) to begin MS-1 operation.
19. Verify installation of the new firmware using **Firmware Verification** in **ESP Utilities**.
20. If the firmware update procedure fails, check hardware and pinout connectivity, and repeat the procedure.

Caution: Do not interrupt power or disconnect the host cable while download is in progress. Be sure that each download is complete before moving on to the next.

Important: When updating firmware, be sure that the application code and boot code versions are mutually compatible.

Downloading Application Code to the MS-1 without a Demo Board
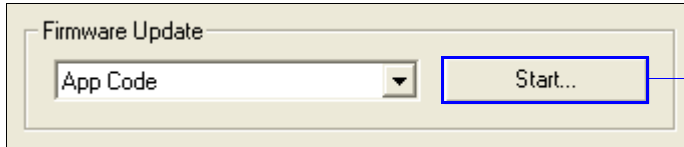
Click the **Start** button in **ESP Utilities** to open the firmware update utility.

Hardware Signal Settings		
Pin	**Decoded Operation**	**Firmware Update**
Pin 8	High	Low
Pin 11	High	Low
Pin 12	High	High

1. Connect to the MS-1 via **ESP**.
2. Verify your current firmware using **Firmware Verification** in **ESP Utilities**.
3. Set **Pin 8**, **Pin 11**, and **Pin 12** of the MS-1 to **Firmware Update** status (see **Hardware Signal Settings** table above).
4. Select **MS-1** from the **Target Device** dropdown menu.
5. Select **8MHz** from the **Crystal Frequency** dropdown menu.
6. Click **Open**, select the appropriate firmware file (a **.mhx** file) and click **OK**.
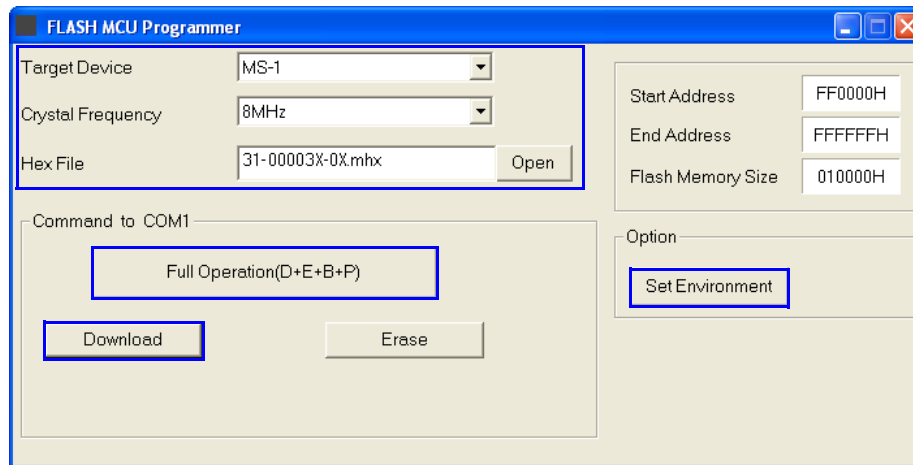
(Continued on next page)

7. Click the **Set Environment** button to bring up the COM Port menu.

8. Select the appropriate COM Port and click **OK**.
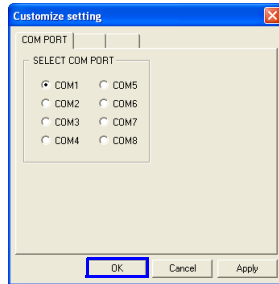
9. Click the **Download** button, pull **Pin 12** as a low trigger signal, and click **OK** to connect.
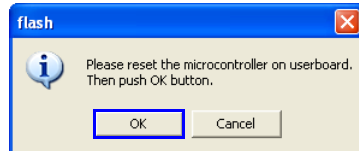
10. Click **OK** again once firmware is downloaded.

11. Click the **Erase** button to clear old firmware.
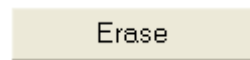
12. Click **OK** again when you see the dialog stating that old firmware has been erased.

13. Click **Full Operation(D+E+B+P)**. When the dialog shown in step 9 appears, supply a low trigger signal to **Pin 12** and then click **OK** to complete the download process.
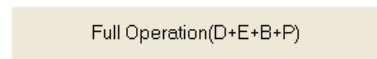
14. Click **OK** again when you see the dialog stating that the firmware download is complete.

15. Set **Pin 8**, **Pin 11**, and **Pin 12** of the MS-1 to **Decoded Operation** status (see **Hardware Signal Settings** table on the previous page) and supply a low trigger signal to **Pin 12**.

16. Verify installation of the new firmware using **Firmware Verification** in **ESP Utilities**.

17. If the firmware update procedure fails, check hardware and pinout connectivity, and repeat the procedure.

Caution: Do not interrupt power or disconnect the host cable while download is in progress. Be sure that each download is complete before moving on to the next.
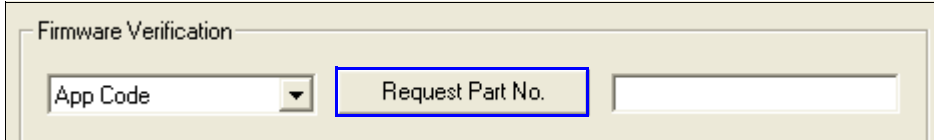
Important: When updating firmware, be sure that the application code and boot code versions are mutually compatible.

Firmware Verification

Request Part Number by ESP

ESP allows you to send a request to the MS-1 for the application code part number.

1. Click the **Firmware** tab.
2. From the dropdown menu to the left of the **Request Part No.** button, select **App Code**.
3. The application code part number will be displayed in the text field to the right of the **Request Part No.** button.

```
┌─ Firmware Verification ──────────────────────────────────────────┐
│                                                                  │
│   │App Code              ▼│   │  Request Part No.  │   │      │   │
│                                                                  │
└──────────────────────────────────────────────────────────────────┘
```

Device Control

Disable Reader

Usage: This feature is useful during extended periods when no symbols are being decoded, or when the MS-1 is being configured.

Definition: Sending **<I>** will turn the MS-1 off.

Serial Cmd: **<I>**

          Note: <I> only disables **Continuous Read** and the external trigger. Serial triggers will activate a read cycle.

Enable Reader

Definition: Sending **<H>** allows the MS-1 to trigger on any available trigger source.

Serial Cmd: **<H>**

Default/Reset/Save

Understanding and controlling your MS-1's active, saved, and default settings is critical to its successful operation.

	Function	*Serial Cmd*	*ESP (first, right-click in any menu tree)[a]*
Reset (not saved for power-on)	Reset	**\<A\>**	Save to Reader, Send No Save
Save for Power-on	Save Current Settings for Power-On	**\<Z\>**	Save to Reader, Send and Save
	Recall Microscan Default Parameters and Save for Power-On	**\<Zrd\>**	No

a. When you right-click in a menu tree and select **Default Current Menu Settings** or **Default All ESP Settings**, it is important to note that only **ESP** settings are defaulted. To save these defaults to the MS-1 itself, you need to follow up with a **Save to Reader, Send and Save** command.

Reset

Reset ("**A**" command) affects only current settings (active memory) and does not save for power-on.

Save for Power-On

Power-on parameters ("**Z**" commands) are saved, recalled, and loaded into current parameters when power is cycled to the MS-1.

Important: The following commands must be followed by a **\<Z\>** to be saved for power-on:

Host Protocol, **Baud Rate**, **Data Bits**, **Stop Bits**, **Parity**, **Trigger Characters** (**Delimited**, **Start**, **Stop**), **Preamble**, **Postamble**, and **No Read Message**.

All other parameters are saved for power-on without a **\<Z\>**. However, a **\<Zrd\>** affects all parameters.

Reader Status Request

<K?> Configuration Command Status

This is the fastest way to learn the MS-1's current configuration. Sending this request will return the current settings of all commands, starting with the lowest K command value and ending with the highest K command value.

Reader Status Request

Appendices

Contents

Appendix A — General Specifications

Mechanical
Height: 0.45" (11.5 mm)
Width: 1.26" (32 mm)
Length: 0.95" (24 mm)
Weight: .3 oz. (8.4 g)

Design
Sensor: CCD linear image sensor
Optics: 660 nm visible LED

Scanning Performance
Scan Rate: 220 scans/sec
Min. X Dimension: Down to 0.084 mm (3.3 mil) on Code 39
Depth of Field: 1.0 to 330 mm (13")
Symbol Width: Up to 178 mm (7") on 0.5 mm (20 mil) symbol

Communications
Interface: RS-232 TTL

Connector
Type: 12-Pin ZIF connector

Symbologies
UPC/EAN, Code 39, Code 128/EAN-128, Interleaved 2 of 5, Industrial 2 of 5, Codabar, Code 93, MSI Code, Plessey Code, GS1 DataBar (RSS)

MS-1 Scan Engine Dimensions

Environmental
Operating Tempurature: −20° to 50° C (−4° to 122° F)
Storage Tempurature: −30° to 60° C (−22° to 140° F)
Relative Humidity: 20% to 85% (non-condensing)
Ambient Light: Works in any lighting conditions, from 0 to 70,000 lux

CE Mark
Immunity Designed for: EN 55024:1998 ITE Immunity Standard
Radiated and Conducted Emissions Designed for:
EN 55022:1998 ITE Disturbances Class A

Electrical
Power: 5V +/− 5%, 300 mV p-p max. ripple, 120mA @ 5V (typ.)

Read Ranges

Low Density   **High Density**

Narrow-bar-width	Read Range	Scan Width
High Density		
.005" (.127 mm)	1.1 – 2.3" (28 – 58 mm)	2.0" (51 mm) at 1.9" (48 mm)
.010" (.254 mm)	1.0 – 3.5" (25 – 89 mm)	2.5" (64 mm) at 3.1" (79 mm)
.015" (.38 mm)	1.0 – 4.5" (25 – 114 mm)	3.0" (76 mm) at 3.5" (89 mm)
Low Density		
.005" (.127 mm)	1.6 – 3.5" (41 – 89 mm)	2.4" (61 mm) at 3" (76 mm)
.010" (.254 mm)	1.5 – 7.6" (35 – 193 mm)	4.2" (107 mm) at 6" (152 mm)
.020" (.508 mm)	1.5 – 13" (35 – 330 mm)	7.0" (178 mm) at 11" (279 mm)

Note: All values are based on a Grade B Code 39 symbol.

General Specifications

FIS Options

MS-1 Scan Engine	
CCD Scan Engines, 8-pack, Low Density, RS-232, 5VDC	FIS-0001-8001G
CCD Scan Engines, 8-pack, High Density, RS-232, 5VDC	FIS-0001-8002G

Safety Certifications

FCC, UL/cUL, CE, CB, RoHS/WEEE

ISO Certification

ISO 9001:2000 Certified Quality Management System
Issued by TUV USA Inc., Member of TUV NORD Group, Cert. No. 06-1080

Appendix B — Electrical Specifications

Power: 5V +/– 5%, 300 mV p-p max. ripple, 120mA @ 5V (typ.)

Host Connector / Pin Assignments

12-Pin ZIF Connector

Pin	Host RS-232	In/Out
1	+5V Power (VCC)	In
2	TTL_RxD	In
3	Trigger Input	In
4	Power Enable	In
5	TTL_TxD	Out
6	TTL_RTS	Out
7	GND	
8	Firmware Upgrade 1	In
9	LED/Beeper Output	Out
10	TTL_CTS	In
11	Firmware Upgrade 2	In
12	RESET	In

Appendix C — Serial Configuration Commands

Note: For a list of utility commands such as read rate requests, device control options, and reader status requests, see **Serial Utility Commands** on page 9-2.

Communications	
Host Port Connections	<**K100,***baud rate,parity,stop bits,data bits*>
Host Port Protocol	<**K140,***protocol*>
Preamble	<**K141,***status,preamble characters*>
Postamble	<**K142,***status,postamble characters*>

Read Cycle	
Trigger Mode	<**K200,***trigger mode*>
Serial Trigger Character	<**K201,***serial trigger character*>
No Decode Timeout	<**K220,***0,seconds*>
Decodes Before Output	<**K221,***decodes before output*>
Number of Symbols	<**K222,***number of symbols*>
Start Trigger Character	<**K229,***start character*>
Stop Trigger Character	<**K230,***stop character*>
Time Between Identical Decodes	<**K503,***time between identical decodes*>
Reader Setup	<**K522,***shutter speed,minimum speed,maximum speed*>
No Read Message	<**K714,***status,No Read message*>

Symbologies	
Symbology Identifier	<**K450,***0,symbology identifier status*>
Code 39	<**K470,***status,check character status,check character output status, 0,0,minimum symbol length,full ASCII set*>
Codabar	<**K471,***status,0,start/stop match output status,0,symbol length status, symbol length,check character status,check character output status*>
Interleaved 2 of 5	<**K472,***status,check character status,check character output status, symbol length #1,symbol length #2*>
Code 128/EAN 128	<**K474,***status,0,minimum symbol length,1,1,0,application record separator character*>
Code 93	<**K475,***status,0,minimum symbol length*>
DataBar-14 (RSS-14)	<**K482,***status*>
DataBar Limited (RSS Limited)	<**K483,***status*>
DataBar Expanded (RSS Expanded)	<**K484,***status*>
MSI Code	<**K486,***status,check character mode,check character output status, 0,minimum symbol length*>
Plessey Code	<**K487,***status,check character output status,0,minimum symbol length*>
Industrial 2 of 5	<**K488,***status,check character status,check character output status, format,symbol length #1,symbol length #2*>
UPC/EAN	<**K489,***UPC-A status,UPC-E status,EAN-8 status,EAN-13 status, supplementals required,supplemental 2 status,supplemental 5 status,UPC-A as EAN-13,UPC-E as UPC-A,EAN-8 as EAN-13*>

Serial Command Format

Serial commands are of two types: utility and configuration.

Rules that apply to both utility and configuration commands

• A less than **<** and greater than **>** character enclose the commands.

• Commands and data are "case sensitive." That is, characters must be entered as upper or lower case, as specified.

Serial Utility Commands

These are sent during operations and are not followed by **<A>** or **<Z>**.

Serial Configuration "K" Commands

These begin with a single "K" character followed by a 3-digit numeric character, data fields, and an initializing command, as follows:

<**K**numeric parameter,data,data,...etc.><initializing command>

An initializing command **<A>** or **<Z>** may follow the command. A **<Z>** initializes the MS-1's memory and saves for power-on; an **<A>** initializes the MS-1's memory but does not save for power-on.

For example, to enable **UPC** and save the change for power-on, send **<K473,*1*><Z>**.

To change **Baud Rate** and reset without saving changes for power-on, send **<K100,3><A>**.

Serial Configuration Command Conventions

• All data fields (except the last) must be followed by a comma (*without a space*).

• NUL cannot be used. The characters **<**, **>**, and **,** can be used, but only if entered as hex pairs.

• All fields preceding a modified field must be included.

• If there is no change in preceding fields, then commas alone can be entered in these fields. For example, if only the last field in the following command is changing, **<K100,*4,1,0,0*>** can be entered as **<K100,,,,*0*>**.

• All fields *following* a modified field can be omitted. For example, to change **Baud Rate** only, send **<K100,3>**.

Concatenating Configuration Commands

Commands can be concatenated (added together) in a single string or data block. For example, **<K145,*1*><K220,*1*><K450,*1*><A>** enables **LRC**, sets **End of Read Cycle** mode to **New Trigger**, enables **Narrow Margins**, and resets the data buffers (without saving the changes for power-on).

Serial Command Status Request

To ensure that any command was received and accepted, you can send the **Show Reader Status** command: **<?>**.

The status of a specific serial command can be requested by entering the command followed by a question mark. For example, send **<K142?>** to request the status of **Postamble**.

Entering Control Characters in Serial Commands

To enter control characters within a serial command, hold down the **Ctrl** key while typing the desired character.

Example: To enter a carriage return and line feed (**^M^J**), enter **<K141,1,CNTL-m CNTL-j>**

Appendix D — Communications Protocol

Communications Protocol Command Table

Protocol Command (Mnemonic displayed on menu)	Control Characters (Entered in menu or serial command)	Hex Value	Effect of Command
RES	^D	04	Reset
REQ	^E	05	Request
EOT	^D	04	Reset
STX	^B	02	Start of Text
ETX	^C	03	End of Text
ACK	^F	06	Acknowledge
NAK	^U	15	Negative Acknowledge
XON	^Q	11	Begin Transmission
XOFF	^S	13	Stop Transmission

Appendix E — ASCII Table

Dec	Hex	Mne	Ctrl	Dec	Hex	Ch	Dec	Hex	Ch	Dec	Hex	Ch
00	00	NUL	^@	32	20	SP	64	40	@	96	60	`
01	01	SOH	^A	33	21	!	65	41	A	97	61	a
02	02	STX	^B	34	22	"	66	42	B	98	62	b
03	03	ETX	^C	35	23	#	67	43	C	99	63	c
04	04	EOT	^D	36	24	$	68	44	D	100	64	d
05	05	ENQ	^E	37	25	%	69	45	E	101	65	e
06	06	ACK	^F	38	26	&	70	46	F	102	66	f
07	07	BEL	^G	39	27	'	71	47	G	103	67	g
08	08	BS	^H	40	28	(	72	48	H	104	68	h
09	09	HT	^I	41	29	)	73	49	I	105	69	i
10	0A	LF	^J	42	2A	*	74	4A	J	106	6A	j
11	0B	VT	^K	43	2B	+	75	4B	K	107	6B	k
12	0C	FF	^L	44	2C	,	76	4C	L	108	6C	l
13	0D	CR	^M	45	2D	-	77	4D	M	109	6D	m
14	0E	SO	^N	46	2E	.	78	4E	N	110	6E	n
15	0F	SI	^O	47	2F	/	79	4F	O	111	6F	o
16	10	DLE	^P	48	30	0	80	50	P	112	70	p
17	11	DC1	^Q	49	31	1	81	51	Q	113	71	q
18	12	DC2	^R	50	32	2	82	52	R	114	72	r
19	13	DC3	^S	51	33	3	83	53	S	115	73	s
20	14	DC4	^T	52	34	4	84	54	T	116	74	t
21	15	NAK	^U	53	35	5	85	55	U	117	75	u
22	16	SYN	^V	54	36	6	86	56	V	118	76	v
23	17	ETB	^W	55	37	7	87	57	W	119	77	w
24	18	CAN	^X	56	38	8	88	58	X	120	78	x
25	19	EM	^Y	57	39	9	89	59	Y	121	79	y
26	1A	SUB	^Z	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	^[	59	3B	;	91	5B	[	123	7B	{
28	1C	FS	^\	60	3C	<	92	5C	\	124	7C		
29	1D	GS	^]	61	3D	=	93	5D	]	125	7D	}
30	1E	RS	^^	62	3E	>	94	5E	^	126	7E	~
31	1F	US	^_	63	3F	?	95	5F	_	127	7F	D

Appendix F — Using an External Trigger

Two types of inputs are used on Microscan readers. 5 volt devices have NPN trigger inputs. 10-28 volt devices have optoisolated inputs and outputs.

5 Volt Devices

To trigger a 5 volt device, the input has to be pulled down to "signal ground" (NPN). This can be done by relays or by a transistor-sourced signal. If a 5 volt device is used in combination with an IC-332, it must be connected as a 10-28 volt device.
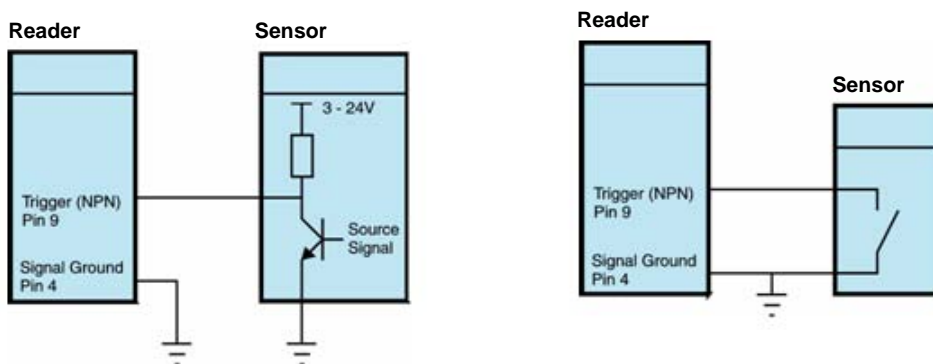
10-28 Volt Devices

To trigger a 10-28 volt device, a small amount of current needs to flow from "Trigger +" to "Trigger –". If a PNP source is used, "Trigger –" must be connected to "signal ground". If an NPN source is used, "Trigger +" must be connected to the supply voltage.
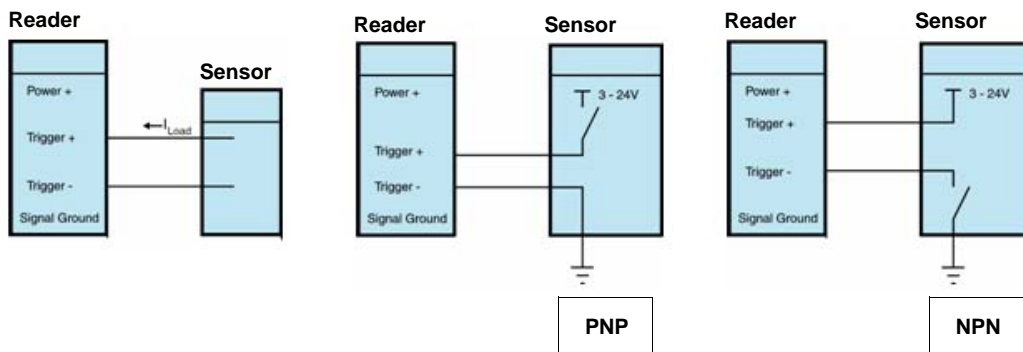
Appendix G — Glossary of Terms

Aberration — The failure of an optical lens to produce an exact point-to-point correspondence between the object and its resulting image. Various types are chromatic, spherical, coma, astigmatism and distortion.

Absorption — The loss of light of certain wavelengths as it passes through a material and is converted to heat or other forms of energy. (–)

Active Illumination — Lighting an area with a light source coordinated with the acquisition of an image. Strobed flash tubes and pulsed lasers are examples.

ADC — See **Analog-to-Digital Converter**.

A/D Converter — See **Analog-to-Digital Converter**.

AGC — See **Automatic Gain Control**.

Ambient Light — Light which is present in the environment of the front end of a reader and generated from outside sources. This light, unless used for actual illumination, will be treated as background noise by the reader.

Analog — A smooth, continuous voltage or current signal or function whose magnitude (value) is the information.

Analog-to-Digital Converter (A/D Converter or **ADC)** — A device that converts an analog voltage or current signal to a discrete series of digitally encoded numbers (signal) for computer processing.

Application-Specific Integrated Circuit (ASIC) — An integrated circuit that is customized for a particular kind of use, rather than general use. All vision system elements including firmware can be integrated into one ASIC.

Automatic Gain Control (AGC) — Adjustment to signal strength that seeks to maintain a constant level regardless of the distance between a reader and symbol.

Auxiliary Port — RS-232 connection to an auxiliary terminal or device for remote viewing.

Baud Rate — The number of discrete signal events per second; bits per second.

CCD — See **Charge-Coupled Device**.

Charge-Coupled Device (CCD) — A semiconductor device with an array of light-sensitive elements that converts light images into electrical signals.

Check Character — A Modulus 43 or Modulus 10 character that is added to encoded symbol data for additional data integrity.

Connector — A plug or socket on a device or cable providing in/out connectivity for various circuits and pins.

Concentrator — Intermediary device that relays data from readers to a host and commands from the host to the readers or other devices.

DAC — See **Digital-to-Analog Converter**.

Daisy Chain — Linkage of primary and secondary readers allowing data to be relayed up to the host via auxiliary port connections.

Decode — A **Good Read**. The successful interpretation and output of the information encoded in a symbol.

Default — Restores **ROM** or flash settings and initializes serial commands.

Delimited — A delimited command or field is bracketed by predefined characters.

Decode Rate — The number of good reads per second ahieved by a reader.

Darkfield Illumination — Lighting of objects, surfaces, or particles at very shallow or low angles, so that light does not directly enter a reader's optical hardware.

Depth-of-Field — The in-focus range of a reader. Measured from the distance behind an object to the distance in front of the object with all objects appearing in focus.

Diffused Lighting — Scattered soft lighting from a wide variety of angles used to eliminate shadows and specular glints from profiled, highly reflective surfaces.

Digital-to-Analog Converter (DAC) — A **VLSI** circuit used to convert digitally processed images to analog for display on a monitor.

Digital Signal Processor (DSP) — A **VLSI** chip designed for ultra-high-speed arithmetic processing.

Discrete I/O — Inputs and outputs characterized by discrete signal transitions from one voltage level to another so that digital switching can occur.

Direct Memory Access (DMA) — A capability provided by some computer bus architectures that allows data to be sent directly to memory from an attached device.

DSP — See **Digital Signal Processor**.

EPROM — See **Erasable Programmable Read-Only Memory**.

Embedded Memory — Onboard memory device such as **EPROM** or flash.

End of Read Cycle — The time or condition at which the reader stops expecting symbol information to decode.

Erasable Programmable Read-Only Memory (EPROM) — A memory chip that retains data when its power supply is turned off; "non-volatile memory".

External Edge — Allows a read cycle to be initiated by a trigger signal from an object detector when it detects the appearance of an object (rising edge). The read cycle ends with a good read, a timeout, or a new trigger.

External Level — Allows a read cycle to be initiated by a trigger signal from an object detector. The read cycle ends when the object moves out of the detector's range.

Falling Edge — A change of state (to inactive) associated with a level trigger.

Field-Programmable Gate Array (FPGA) — A semiconductor device containing programmable interconnects and logic components.

Firmware — Software hard-coded in non-volatile memory (**ROM**), and closely tied to specific pieces of hardware.

Fixed Symbol Length — Increases data integrity by ensuring that only a symbol length will be accepted.

Focal Distance — In optics, the distance from the lens to the focal plane.

Focal Plane — Usually found at the image sensor, it is a plane perpendicular to the lens axis at the point of focus (–).

Focus — Any given point in an image at which light converges; the focal point.

FPGA — See **Field-Programmable Gate Array**.

Full Duplex — A communications system in which signals can travel simultaneously between devices.

Good Read — A decode. The successful scanning and decoding of the information encoded in a bar code symbol.

Half Duplex — A communications system in which signals can travel between devices in both directions, but not simultaneously.

Host — A computer, **PLC**, or other device that is used to execute commands and process data and discrete signals.

Image Sensor — A device that converts a visual image to an electrical signal; a **CCD**, for example.

Initialize — Implement serial configuration commands into the reader's active memory.

Input — A channel or communications line. Decoded data or a discrete signal that is received by a device.

Ladder Orientation — A linear symbol orientation in which the bars are parallel to the symbol's direction of travel.

Light-Emitting Diode (LED) — A semiconductor device that emits light when conducting current.

Lens — A transparent piece of material with curved surfaces which either converge or diverge light rays.

Multidrop — A communications protocol for networking two or more readers or other devices with a concentrator (or controller) and characterized by the use of individual device addresses and the RS-485 standard.

Normally Closed — A discrete output state that is only active when open.

Normally Open — A discrete output state that is only active when closed.

Object Plane — An imaginary plane in the field of view, focused by a reader's optical system at the corresponding image plane on the sensor.

Output — A channel or communications line. Data or discrete signals that are transmitted or displayed by a device.

Parity — An error detection routine in which one data bit in each character is set to **1** or **0** so that the total number of **1** bits in the data field is even or odd.

Picket Fence Orientation — A linear symbol orientation in which the bars are perpendicular to the symbol's direction of travel.

Pitch — Rotation of a linear or 2D symbol around an axis parallel to the symbol length on the substrate. See the illustration below.
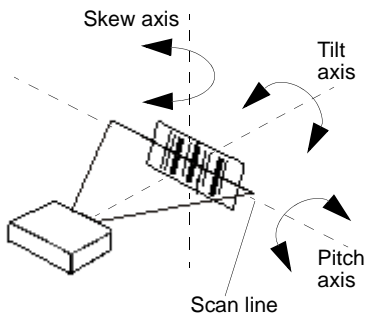
PLC — See **Programmable Logic Controller**.

Port — Logical circuit for data entry and exit. (One or more ports may be included within a single connector.)

Programmable Logic Controller (PLC) — An electronic device used in industrial automation environments such as factory assembly lines and automotive manufacturing facilities.

Protocol — The rules for communication between devices, providing a means to control the orderly flow of information between linked devices.

Random Access Memory (RAM) — A data storage system used in computers, composed of integrated circuits that allow access to stored data in any sequence without movement of physical parts.

Read Cycle — A programmed period of time or condition during which a reader will accept symbol input.

Read-Only Memory (ROM) — A data storage medium used in computers and other electronics, primarily used to distribute firmware.

Skew — Rotation of a linear or 2D symbol around an axis parallel to the symbol height on the substrate. See the illustration under the definition of **Pitch**.

Substrate — The surface upon which a symbol is printed, stamped, or etched.

Symbol Transitions — The transition of bars and spaces on a symbol, used to detect the presence of a symbol on an object.

Symbology — A symbol type, such as Code 39 or Code 128, with special rules to define the widths and positions of bars and spaces to represent specific numeric or alphanumeric information.

Tilt — Rotation of a linear or 2D symbol around an axis perpendicular to the substrate. See the illustration under the definition of **Pitch**.

Trigger — A signal, transition, or character string that initiates a read cycle.

Very Large-Scale Integration (VLSI) — The creation of integrated circuits by combining thousands of transistor-based circuits on a single chip.

VLSI — See **Very Large-Scale Integration**.

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