

MICROSCAN[®]

Quadrus[™]
2D Code Reader
User's Manual



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About the Quadrus™

The Quadrus™ is a fully integrated 2D scanner, with the ability to illuminate, read, and decode two-dimensional (2D) data matrix symbologies. Using Microscan's Easy Setup Program (ESP™), the Quadrus™ can be quickly configured and calibrated from a computer running Windows 3.1™ or Windows 95™ operating system.

ESP™ allows you to save multiple configuration files to the host for later use or for transfer to other readers.

FOR TECHNICAL SUPPORT, ph: [425-226-5700](tel:425-226-5700)
or email: helpdesk@microscan.com.

About this Manual

This manual provides complete information on setting up and installing the Quadrus™.

[Chapter 1, "Quick Start,"](#) will get you started quickly with your setup and give you references for further information.

[Chapter 2, "Menu Configuration,"](#) has instructions for configuring the Quadrus™ by menu, using the Easy Setup Program.

[Chapter 3, "Serial Commands,"](#) has instructions for configuring the Quadrus™ by serial command.

[Chapter 4, "Utilities,"](#) describes serial operational commands and ESP™ menu commands that can be used by the host.

[Chapter 5, "Calibration,"](#) provides instructions for Calibrating your Quadrus™, first for stationary "static" symbols and then for moving "dynamic" symbols.

[Chapter 6, "Evaluation,"](#) provides details for evaluating received "captured" images.

For specifications, see [Appendix A on page A-2](#). The appendices also include an ASCII table as well as other useful information relating to bar coding and the Quadrus™.

Keystroke Entries

Keystrokes to be entered from your terminal are highlighted in bold, as in **<A>**, including a < left angle bracket symbol (unless redefined by Command Start Character command) and followed by a > right angle bracket symbol.

Approvals

This equipment is designed for approval or compliance by the following organizations:

- CDRH (Center for Devices & Radiological Health)
- UL (Underwriters Laboratories, Inc.)
- cUL (UL mark of Canada)
- TÜV (Technischer überwachungs-Verein)
- FCC (Federal Communication Commission)
- CE Compliant

Warning and Caution Summary

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

This appliance can only be connected to a VDE approved power supply with a rating voltage between 10 V DC and 28 V DC. the SELV power supply must be rated at least 6,5 W at the output to avoid any hazard.

European models must use a similarly rated Class I or Class II power supply that is certified to comply with standard for safety EN 60950.



Zulassungen

Dieses Gerät wurde für die Zulassung durch die folgenden Organisationen und in Übereinstimmung mit deren Normen entwickelt:

CDRH (Center for Devices & Radiological Health; Zentrum für Geräte und Strahlenschutz)

UL (Underwriters Laboratories, Inc.)

cUL (kanadisches UL-Zeichen)

TüV (Technischer Überwachungsverein)

FCC (Federal Communication Commission; Kommunikationsausschuß der USA)

CE konform

Sicherheitshinweis und Vorsichtsmaßnahmen

Dieses Gerät wurde geprüft und entspricht den Grenzwerten für ein digitales Gerät der Klasse A gemäß Teil 15 der FCC-Richtlinien. Diese Grenzwerte bieten ausreichenden Schutz vor schädlichen Störungen bei einer Installation in Wohnräumen. Dieses Gerät kann Hochfrequenzstrahlung erzeugen, verwenden und abgeben. Wenn es nicht den Anleitungen entsprechend installiert und verwendet wird, kann es zu Funkstörungen kommen. Es gibt jedoch keine Garantie, daß bei bestimmten Installationen keine Störungen auftreten. Sie können feststellen, ob dieses Gerät den Funk- oder Fernsehempfang beeinträchtigt, indem Sie es ein- und ausschalten. Versuchen Sie in diesem Fall, die Störung mit Hilfe einer der folgenden Methoden zu beheben:

- Richten Sie die Empfangsantenne anders aus, oder wählen Sie einen anderen Standort.
- Erhöhen Sie den Abstand zwischen diesem Gerät und dem Empfangsgerät.
- Schließen Sie dieses Gerät an eine Steckdose eines anderen Stromkreises als dem des Empfangsgerätes an.
- Setzen Sie sich mit dem Händler oder einem erfahrenen Funk- und Fernsehtechniker in Verbindung.

Dieses Gerät darf nur an eine VDE geprüfte Spannungsversorgung mit 10V $\overline{\text{~}}$ bis 28V $\overline{\text{~}}$ angeschlossen werden. Die SELV Spannungsversorgung muß mindestens 6,5 W am Ausgang liefern, um Gefahren zu vermeiden.

Modelle für den europäischen Markt müssen eine entsprechende Stromversorgung der Klasse I oder II verwenden, die nach der Sicherheitsrichtlinie EN 60950 zertifiziert ist.

**WARNING**

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

**WARNING**

There are no user serviceable parts in the MS-810 scanner. Opening the scan head voids the Microscan Systems warranty and could expose the user to laser diode power of up to 7 mW.

**WARNING**

The laser beam can be harmful to eyesight. Avoid eye contact with the laser beam. Never point the beam at other people, or in a direction where people may be passing.

**WARNUNG**

Die Verwendung von Steuerelementen, Anpassungen oder das Ausführen von Prozeduren, die von den hier beschriebenen abweichen, kann dazu führen, daß Sie gefährlichen Laserstrahlen ausgesetzt werden.

**WARNUNG**

Der Scanner MS-810 enthält keine Teile, die durch den Benutzer gewartet werden können. Durch Öffnen des Abtastkopfes wird die Gewährleistung von Microscan Systems nichtig. Außerdem können Sie einer Laserdiodenleistung von bis zu 7 mW ausgesetzt werden.

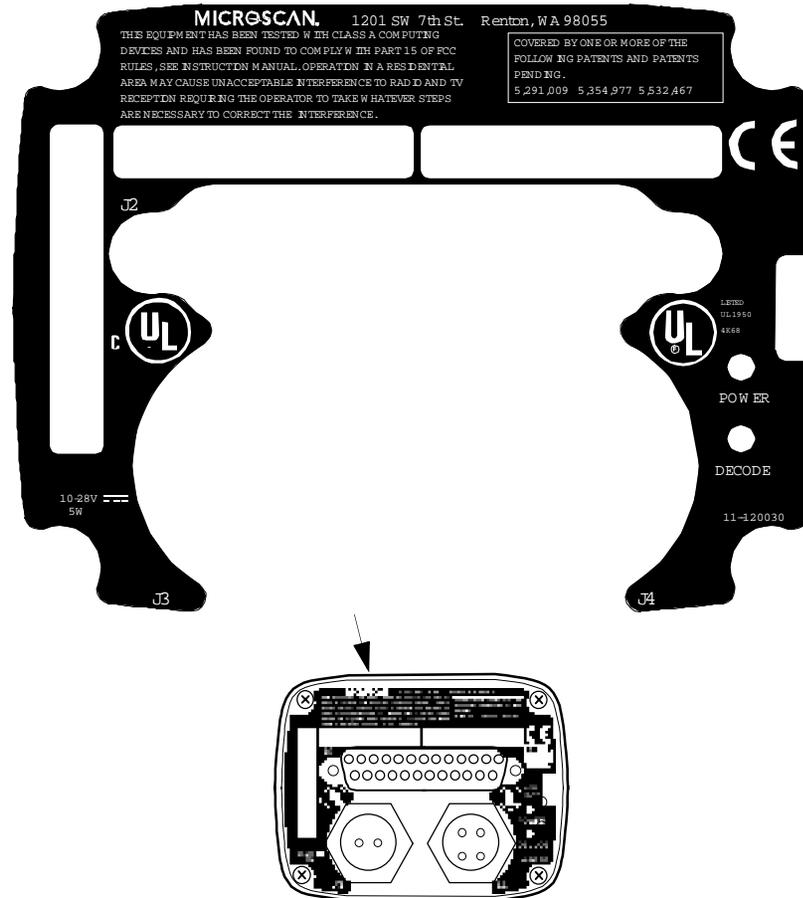
**WARNUNG**

Der Laserstrahl kann Ihre Augen schädigen. Vermeiden Sie direkten Blickkontakt mit dem Laserstrahl. Richten Sie den Strahl niemals auf anwesende Personen oder dorthin, wo möglicherweise Personen vorbei kommen könnten.

Certification Labels

This certification label is located on the back of the Quadrus™

- Designed for FCC, TÜV, CE, CDRH, UL/cUL
- ISO 9001/Cert. No. US96/0465.



Back of Quadrus™

Chapter 1

Quick Start

1-Quick Start

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This chapter will get you started quickly with your setup and give you references for further information.

Step 1 Attach Cabling

- a) Attach host cable to the Quadrus 25-pin host connector.

Note: See [Appendix A, "Quadrus™ Specifications"](#) for pinout and connector types.

Caution: Do not use a host cable with more wires connected than required for the application. The host connector of the reader has many outputs that could cause damage or interfere with normal operation if connected and improperly used.

- b) Attach power cable to power connector. If using Microscan power supply, use PN 97-100004-07 (120V) or PN 97-100004-08 (240V).
- c) If used, attach trigger device to trigger connector.
(Microscan offers object detector, PN 99-440001-08 and PN 99-440002-01).

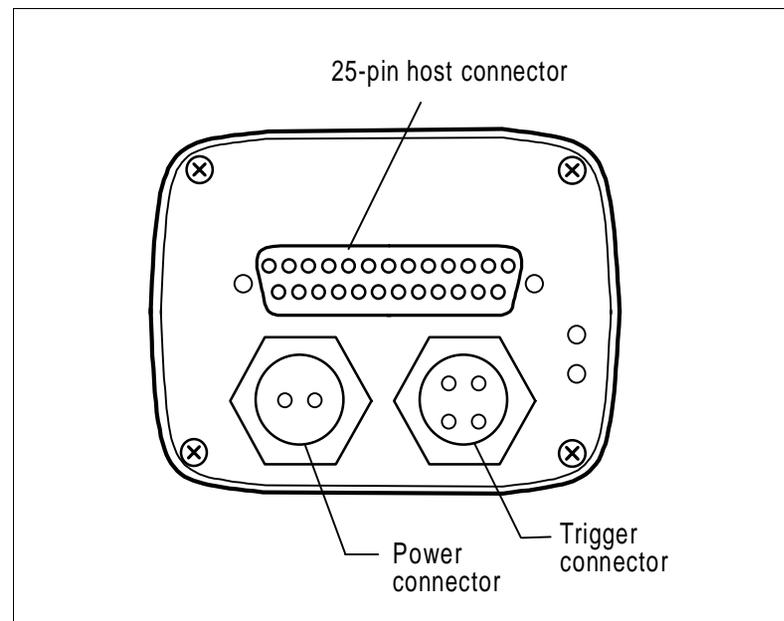


Figure 1-1 Quadrus™ Connectors on Back of Quadrus™

Step 2 Mount Quadrus™

Position Quadrus™ at the correct distance from your symbol.

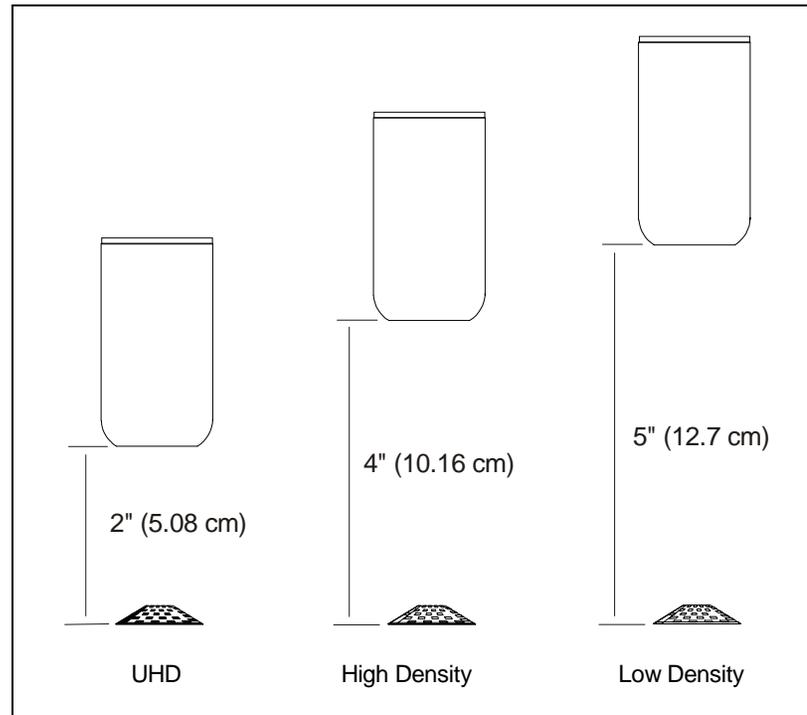


Figure 1-2 Distance from Symbols

If using an ultra high density (UHD) model, the reader should be placed 2 inches (5.08 cm) from the symbol. If using the high density, the reader should be 4 inches (10.16 cm) from the symbol. If using the low density, the reader should be 5 inches (12.7 cm) from the symbol.

For best results, pitch or skew reader 10° to 20° relative to symbol.

Note: See [“Quadrus™ Specifications” on page A-2](#) for Quadrus™ mounting dimensions.

Step 3 Install ESP™ on Host Computer

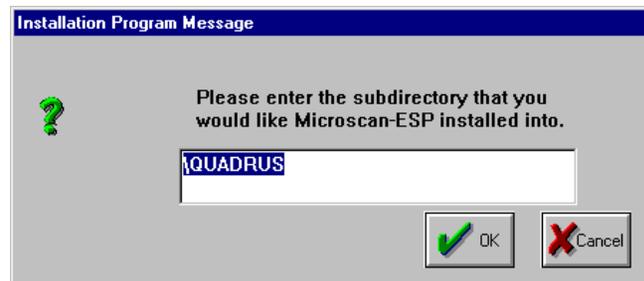
Note: ESP™ (Easy Setup Program) runs on Microsoft Windows 3.1 and Windows 95™ operating systems. It is assumed that you are familiar with your operating system and the procedures for installing Windows-based programs.

To install ESP™:

- a) Make a backup copy of the ESP™ disk(s).
- b) Double-click the setup icon and follow the on-screen directions:



- c) Select a directory and/or a sub-directory for your ESP™ as requested:



- d) Upon completion, you will have a shortcut icon that looks like this:



Step 4 Open ESP™

a) Double-click the **ESP™** icon.



b) You will see a screen similar to [figure 1-3](#)

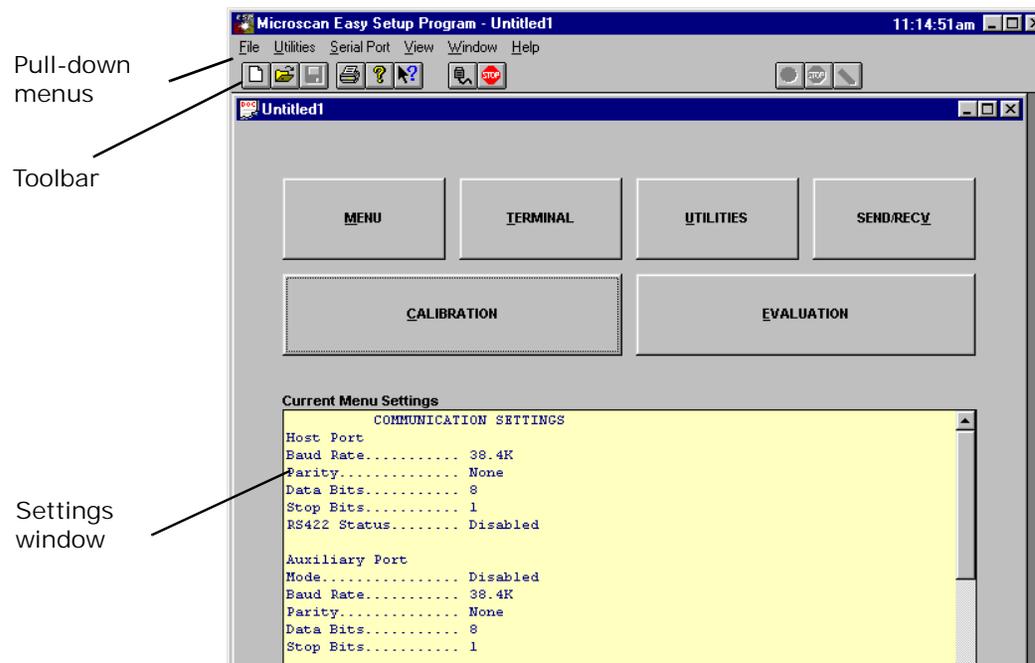


Figure 1-3 Main ESP™ Menu

Step 5 Establish Communications

- a) To set up your host communications, first select your **Serial Port** from the pull down Serial Port Configuration menu (figure 1-4).

Note: Laptops are typically set to **Com 1**; desktops are typically set to **Com 2**.

- b) From the toolbar, click on the **Auto Baud** button, which looks like this: 

Quadrus will cycle through the various baud, parity, data bit, and stop bit combinations until it finds the one that allows it to connect with your computer. Once connected, you will see a green button at the bottom of your screen like this:

CONNECTED

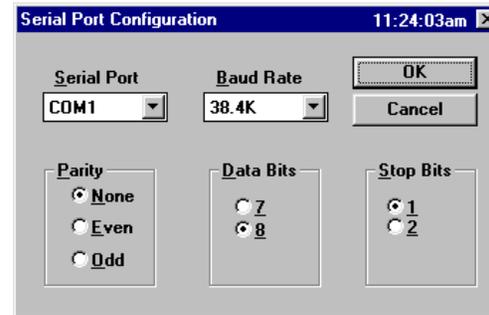


Figure 1-4 Host Serial Port Configuration

You can also select **Serial Port** (figure 1-4) and make setting directly.¹

- c) To transfer your current **ESP** settings to the reader, click **SEND/RCV** button on the main menu and click **SEND/NO SAVE** or **SEND/SAVE** to save for power up.
- d) If you want to load the settings from the reader to the host computer, click **RECEIVE FROM READER**. You will see the horizontal bar at the bottom of the box fill up with blue (figure 1-5).²

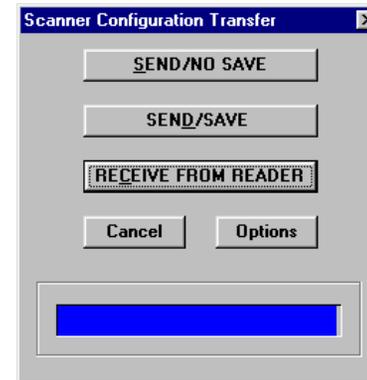


Figure 1-5 Reader Configuration Transfer

If you fail to establish communications, a communication parameter may be set incorrectly, you have a mismatched ESP/application programs, or you may have a loose or bad host cable connection.

1. The defaults are **38.4K** Baud Rate, **None** for Parity, **8** Data Bits, and **1** Stop Bits.

2. The blue bar is a timer and does not necessarily indicate a successful transfer of settings from the reader to the host.

Step 6 Locate Symbol

- a) With a label in front of the Quadrus at the proper distance, click the **CALIBRATION** button.
- b) Click the **LOCATOR** tab.

Unless you enabled Single Shot for Serial Trigger (in the Operations menu), Calibration will put the Quadrus™ in a Continuous mode (overriding any other trigger settings), and cause it to search for images and symbols.

When Quadrus™ finds an object that satisfies its criteria for a symbol, Quadrus™ displays it in the locator box as a polygon outline. The outline will be red if Quadrus™ detects an extraneous object or fails to decode a symbol. It will be green if a symbol is successfully decoded.

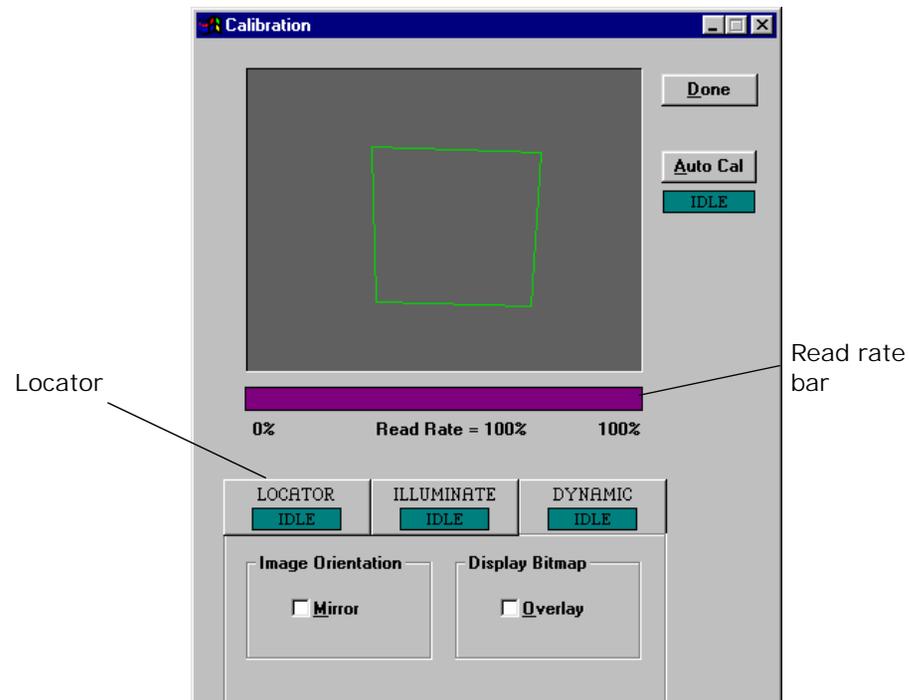


Figure 1-6 Calibration/Locate

Step 7 Center Symbol in the Field of View

When an object is detected in the field of view (FOV), it is represented by a red or green outline in the Locate Label dialog box window. If the outline is Red, the object could be a symbol that has not yet been decoded. If green, the object is a symbol that has successfully been decoded.

- a) While watching the response of the outline(s) inside the Locate Label dialog box window, reposition the label or Quadrus™ (without changing the recommended distance between them) until you've centered the label in the window.
- b) You will minimize specular reflection and improve your read rate if you are careful to set the Quadrus™ at least 15° angle relative to a line perpendicular with the label.
- c) To confirm that Quadrus™ is looking at your symbol, check **Overlay** option to see a compressed image.

Note: In Overlay mode, there is approximately 1 second delay between image captures.

Note: The read rate percentage, from 0 to 100, is indicated by the read rate bar below the message window (figure 1-6).

Note: For in depth discussion of illumination parameters, see "Illuminate" on page 5-3.

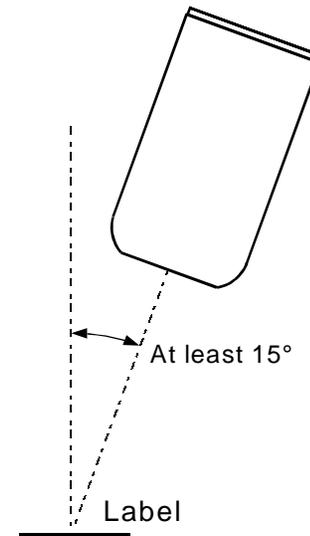


Figure 1-7 Label/Quadrus™ Position

Step 8 Static Label Setup

- a) Click THE **ILLUMINATE** tab to analyze and change illumination settings.

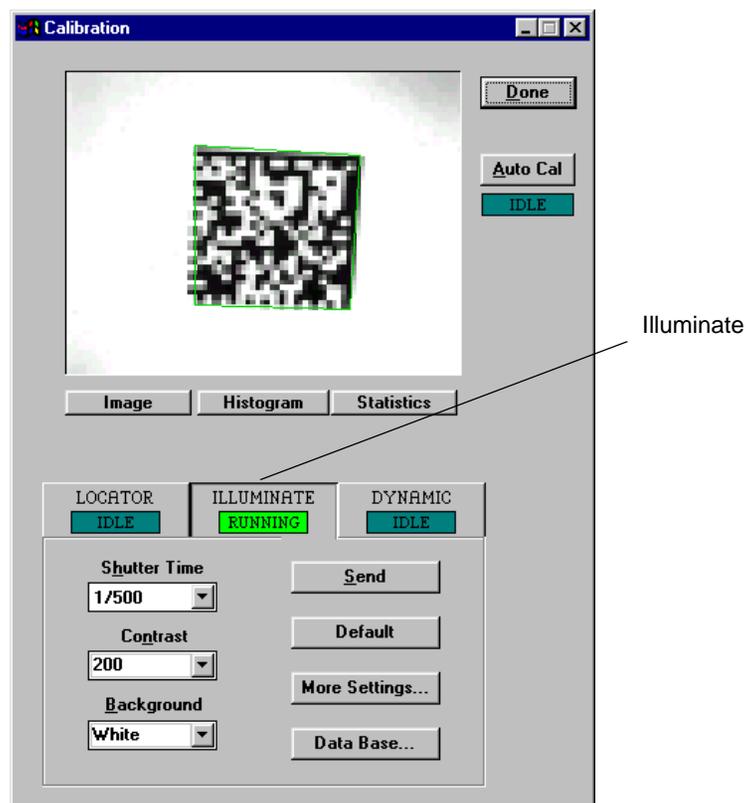


Figure 1-8 Illumination

- b) Click the **Send** button. If a decodable label is in your field of view, you will see a compressed image of the symbol, as shown in [figure 1-8](#).
- c) To see a histogram of the object represented by the polygon, place your cursor tip over the polygon and double click.

The goal here is to make the necessary adjustments to the illumination parameters to enable decoding and improve read quality. You can do this by analyzing quality output, histograms, and line scans.

See "[Illuminate](#)" on [page 5-3](#) for detailed instructions on setting up and fine-tuning your reader.

Step 9 Moving Label Setup

When you click **Dynamic**, you see the Dynamic parameters (figure 1-9) which allow you to set up for multiple symbols and adjust the time delay between the appearance of a moving object (as sensed by an external object detector) and the arrival of its associated symbol or symbols in the center of the reader's view.

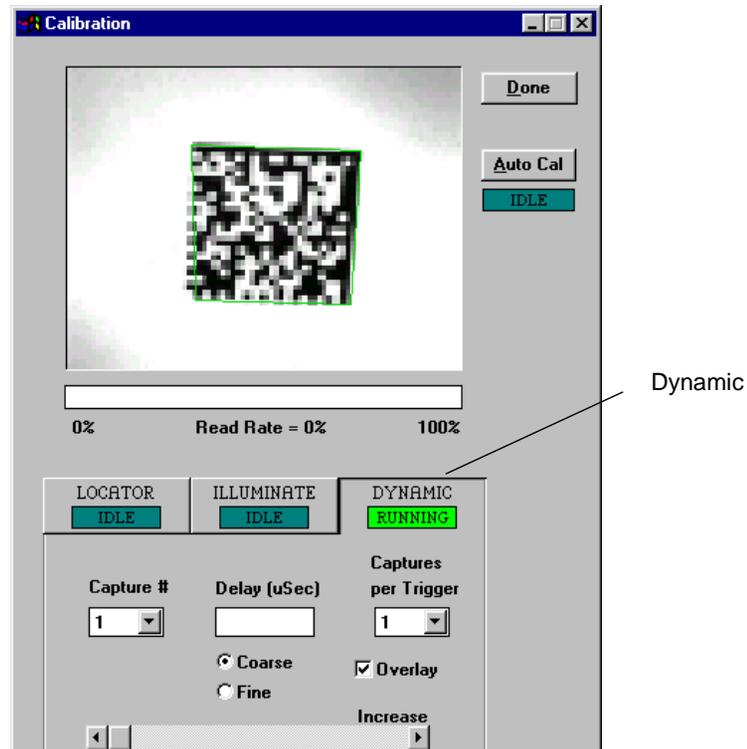


Figure 1-9 Dynamic Setup

You can also go back to static setup and adjust shutter time, etc. in the Illumination dialog box and retest in "Dynamic."

For complete info on setting up Quadrus™ for a dynamic (moving labels) application, see ["Dynamic Setup" on page 5-13.](#)

Step 10 Saving Settings

Using the Send/Recv dialog box, you can send your current settings to the reader's memory by clicking **SEND/NO SAVE**.

You can also save your current settings to the reader for power-up by clicking **SEND/SAVE**.

Once you've arrived at satisfactory settings for a particular symbol or operation, you may want to save these settings to a file on your host computer by using the **File\Save As** function and creating a file name that relates to your symbol or application.

This allows you to continue on and make additional changes to your scanner without losing the originals.

See also "Interface" on page 4-14 for other save/reset/recall operations.

Note: Allow at least 3 seconds after saving before sending a command or starting another operation.

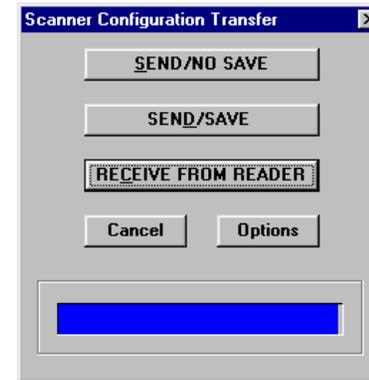


Figure 1-10 Send/Receive Dialog

Chapter 2

Menu Configuration

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This chapter tells how to configure the Quadrus™ using the ESP™ program on a Windows based (Windows 3.1 or Windows 95) computer.

Note: Related serial commands that can be entered by commands from a host or an auxiliary computer are listed in [Chapter 3, "Serial Commands."](#)

After changes are made in the configuration menus, they can be sent in total to the Quadrus™ and the current settings will be posted in a status window. It is important to note that configuration settings can be saved directly to the Quadrus™ or as files to your computer that can individually be recalled at a later date and saved to the Quadrus™.

Note: See [Step 3, "Install ESP™ on Host Computer,"](#) on page 1-4 and [Chapter 4, "Utilities,"](#) for testing and operational uses of the ESP™ program.

Using ESP™ to Configure the Quadrus™

Figure 2-1, "Configuration Setup File," shows the window you will see when you launch the Quadrus™ ESP™.

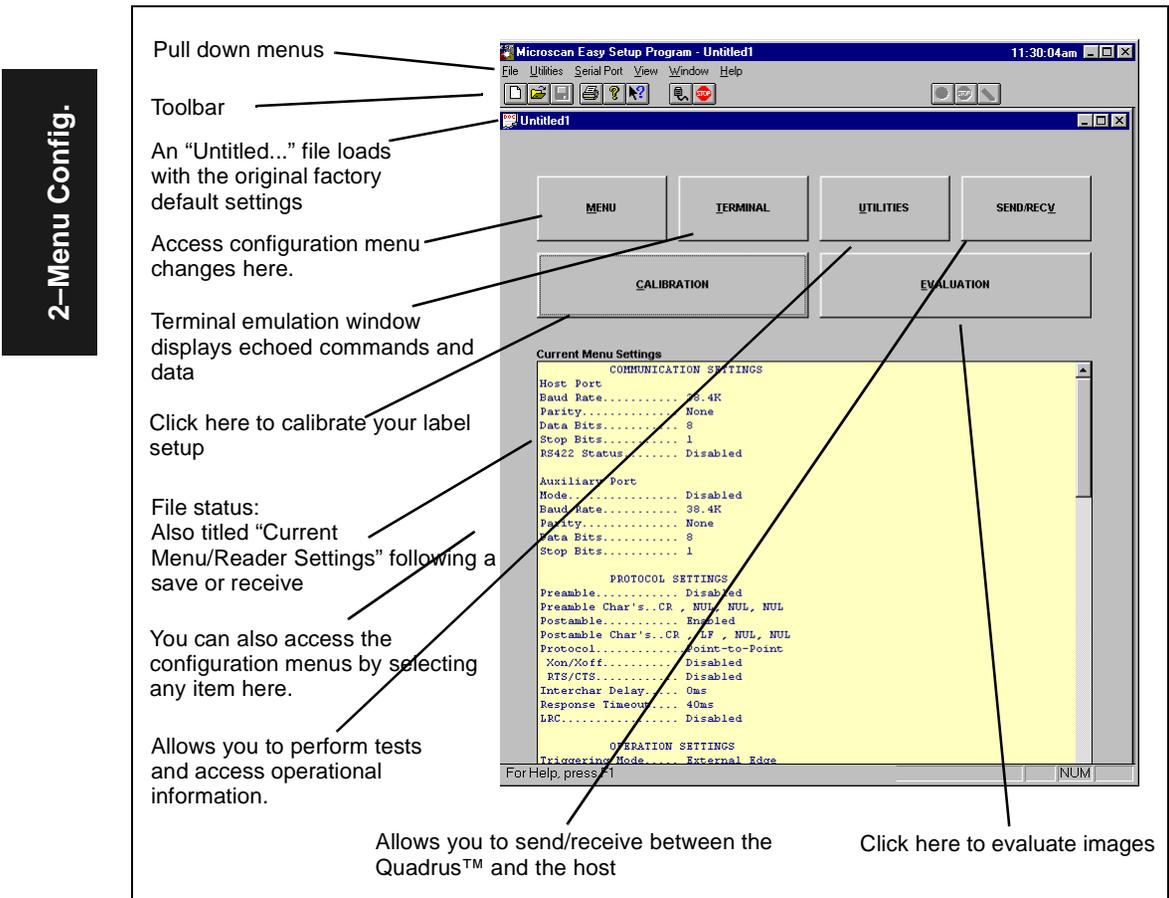
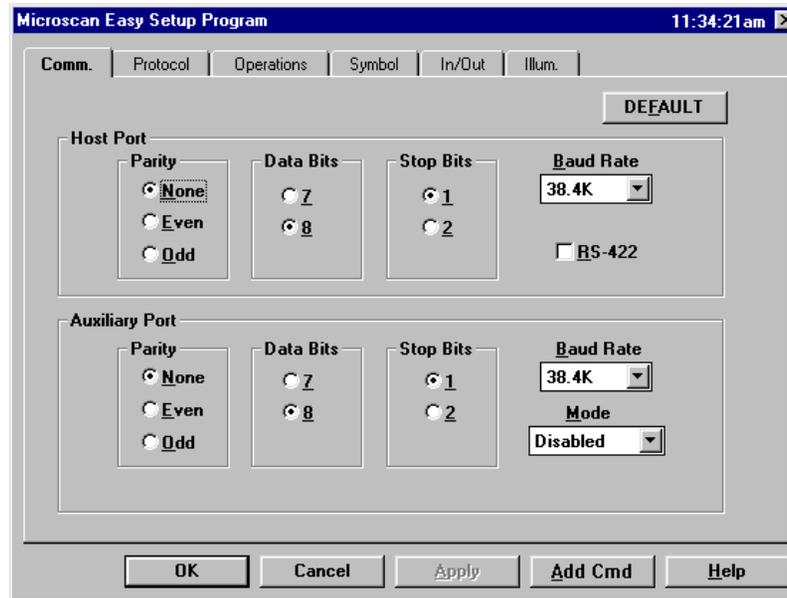


Figure 2-1 Configuration Setup File

To access the configuration menus, press the **MENU** button. If using a mouse, single click on menu items and enter text as appropriate. If using the keyboard, use the **Alt** key, underlined letters, and the tab key to move to the desired field. You can then use arrow keys or the space bar to scroll through the selections and the Enter key to accept changes.

Communications Menu

The Communications menu allows you to set the communication protocols of the Quadrus™. (See [figure 2-2.](#))



2-Menu Config.

Figure 2-2 Communications Menu Structure

When you make and save menu communications changes to the Quadrus™, those changes will automatically be matched in the Serial Port configuration.

Default

Clicking the **DEFAULT** button will reset all options on the Communications menu to factory defaults. You can then click **Apply** followed (in the pop-up dialog box) by **SEND/NO SAVE** or **SEND/SAVE**.

Host Port

Parity

Default: **None**

Options: *None, Even, Odd*

Allows you to select 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.

Chapter 2

Data Bits

Default: **Eight**

Options: *Seven, Eight*

Allows you to establish the total number of bits in each character.

Stop Bits

Default: **One**

Options: *One, Two*

Allows you to select the last one or two bits in each character to indicate the end of the character.

Baud Rate

Default: **38.4K**

Options: *1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K, 115.2K*

Allows you to set the number of bits transmitted per second.

Aux Port

Parity

Same as Host Port

Data Bits

Same as Host Port

Stop Bits

Same as Host Port

Baud Rate

Default: **38.4K**

Options: *1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K*

Allows you to set the number of bits transmitted per second.

Aux Port Mode

Default: **Disabled**

Options: *Disabled, Transparent, Half Duplex, Full Duplex, Daisy Chain, Cmd Process*

Allows you to set communications parameters between the reader and an auxiliary port. An auxiliary port can be used to configure the menus, send data to the host, and display data transmissions originating from the host or reader.

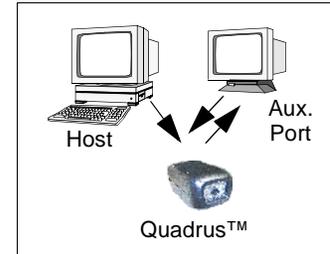
The Aux Port baud rate should never exceed Host Port baud rate or auxiliary port data could be lost.

Transparent

Used to batch data from the aux port to the host. The reader buffers data from the aux port and displays the keyed data on the aux port. The reader transmits aux port data to the host when a symbol is scanned or a carriage return is entered from the aux port.

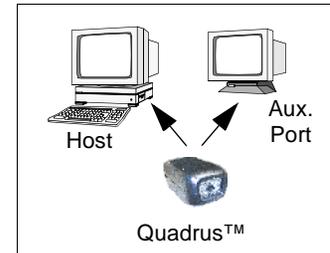
Data Initiated from the Aux Port. • Aux Port data is passed through to the host whenever a return key is pressed at the aux port or whenever bar code data is sent. If sent with bar code data, it is processed on a first-in/first-out basis

- Aux Port data to the host is always sent with a preamble and a postamble.
- If the reader is in a polled mode to the host, aux port data will still pass through.

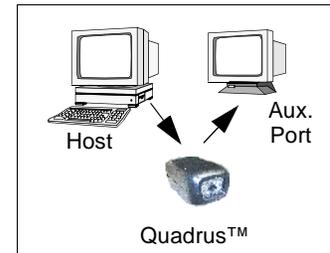


Data initiated from the Reader. • Transmission to the aux port occurs immediately upon a good read.

- Scan data to the aux port does not include a preamble or a postamble.
- Communications with the aux port is always in Point-to-Point protocol, even if the host is in a polled protocol mode.



Data initiated from the Host. • In unpolled mode, all host data is echoed to the aux port.



Half Duplex Mode

In half duplex mode all aux port data and bar code data is sent directly to the host. Bar code data is transmitted to the aux port device at the same time the data is sent to the host.

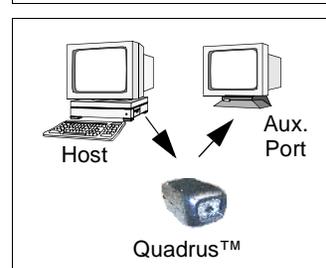
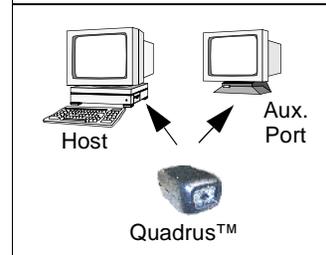
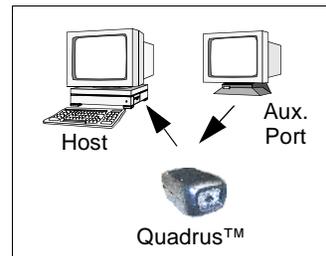
Data initiated from the Aux Port. •Aux Port data to the host is ignored if the reader is in a polled mode.

- Aux Port data or scanned data is sent to the host whenever it is received.
- Aux Port data is not echoed.
- Aux Port data to the host is always sent without a preamble or a postamble.

Data initiated from the Reader. •Scan data is transmitted to the aux port at the same time it is transmitted to the host. Data transmission conforms with all parameters specified in the configuration menu (e.g., Preamble, Postamble, End of Read Cycle).

Data is initiated from the Host. •In unpolled mode, all host data is echoed to the aux port.

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Full Duplex Mode

In full duplex mode, all aux port data and bar code data is sent directly to the host. Bar code data is not transmitted to the aux port device.

Data initiated from the Aux Port. •Aux port data is passed directly through to the host whenever it is received by the reader, unless the reader is in a polled mode, in which case the data will be ignored.

- Aux Port data is not echoed.
- Aux Port data to the host will not have a preamble or a postamble.

Data initiated from the Reader . •Scan data is not sent to the aux port.

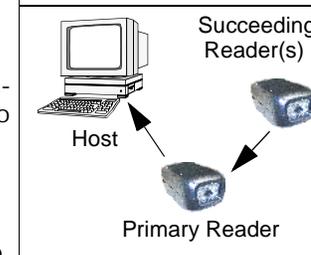
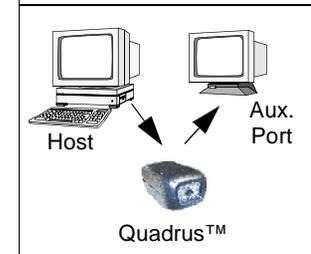
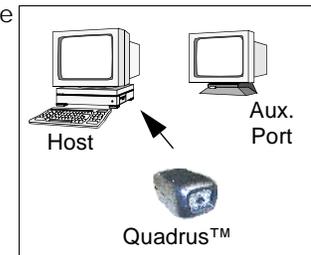
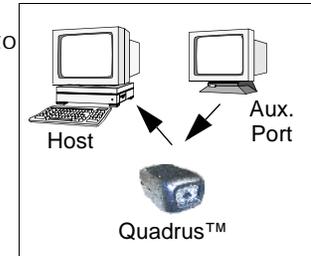
Data initiated from the Host.. •In unpolled mode, all host data is echoed to the aux port.

Daisy Chain Mode

In a daisy chain application, a primary reader is linked directly to the host and succeeding readers are linked in tandem. Data from succeeding readers is transmitted directly to the host as if it were coming from the primary reader.

The conditions for a daisy chain application are:

1. The primary reader's trigger and the succeeding readers' triggers must be set to External or Serial. If all are set to Serial, the host can send serial triggers to all readers in the chain.
2. Each succeeding reader in the daisy chain must have its host connections connected to the aux. port of its preceding reader and enabled for serial or external trigger.



2-Menu Config.

3. Each succeeding reader in the daisy chain should be set to send its data no less than 20 ms before its preceding reader. For example, if the primary reader is set to timeout in 100 ms, the first succeeding reader can be set to 80 ms, the next to 60 ms, etc.
4. Postamble must be set to CR (**^M**) and enabled.
5. Succeeding readers must have noread messages disabled.
6. Multilabel separator characters and the number of labels must match in all readers in the daisy chain.

Daisy Chain Status. *Default: Disabled*

Options: Disabled, enabled

Daisy Chain ID. *Default: 1 and /*

Options: One or two ASCII characters

Daisy Chain Description. Just before sending a noread message, the primary reader checks its auxiliary port for data. It waits a maximum of 20 ms. If no character is received in 20 ms, it sends a noread message to the host. After each character received, it waits up to 20 ms for the next character or a CR. If a complete message is received, it is sent to the host instead of the noread message.

Daisy-chained readers can send a series of symbols by enabling Multilabel and a common multilabel separator. If a reader does not receive the expected number of labels, noread messages are appended to the data string to make up the difference between the number of labels enabled in Multilabel (Number of Labels) and the number of labels read.

For example, a primary and two succeeding readers have Number of Labels set to 3 and Multilabel Separator defined as %. If the primary and the first succeeding reader do not find labels, but the next reader registers a good read, the transmitted results would be: label data % noread % noread.

Command Process

If enabled, allows you to enter ESP™ or direct serial string commands via the Quadrus™ aux port.

It is important to note that while Quadrus™ can determine which port—host or aux—to output data in response to serial commands, it has no way of knowing which port to output externally triggered read cycle data.

Therefore when Command Process mode is selected, Quadrus™ will output externally triggered read cycle data in one of two ways:

1. If the last command came from the aux port, then externally triggered read cycle data will be output to both the host and the aux ports.
2. If the last command came from the host port, then externally triggered read cycle data will only be output to the host port.

Protocol Menu

Selected Protocol

Default: **Point-to-Point**

Options: *Point-to-Point, Point-to-Point with XON/XOFF*

Protocols define the sequence and format in which information is transferred between devices.

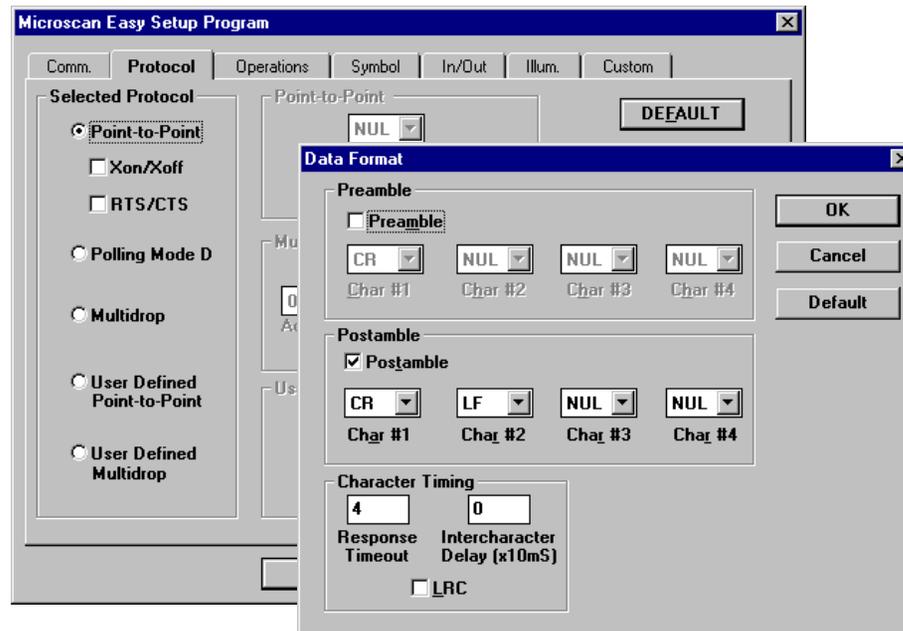


Figure 2-3 Protocol

Default

Clicking the **DEFAULT** button will reset all options on the Protocol menu to factory defaults. You can then click **Apply** followed (in the pop-up dialog box) by **SEND/NO SAVE** or **SEND/SAVE**.

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Selected Protocol

Default: **Point-to-Point**

Options: *Point-to-Point, Point-to-Point with RTS/CTS, Point-to-Point with XON/XOFF, Point-to-Point with RTS/CTS & XON/XOFF, Polling Mode D, Multidrop, User Defined, User Defined Multidrop*

Protocols define the sequence and format in which information is transferred between devices.

Point-to-Point

Has no address and sends data to the host (RS-232) whenever it is available and without any request or handshake from the host.

Point-to-Point with RTS/CTS (Request-to-Send/Clear-to-Send)

Used only with RS-232. This is a simple handshaking protocol that allows a device to initiate data transfers to the host with an RTS (request-to-send) transmission. The host, when ready, responds with a CTS (clear-to-send) and the data is transmitted. CTS and RTS signals are transmitted over two dedicated wires (see [table A-1 on page A-3](#)).

Point-to-Point with XON/XOFF (Transmitter On/Off)

Used only with RS-232. This selection enables the host to send a single byte transmission command of start (XON) or stop (XOFF). If an XOFF has been received from the host, data will not be sent to the host until the host sends an XON. During the XOFF phase, the host is free to carry on other chores and accept data from other devices.

Point-to-Point with RTS/CTS & XON/XOFF

Used only with RS-232. It is a combination of Point-to-Point with RTS/CTS and Point-to-Point with XON/XOFF.

Polling Mode D

Like Point-to-Point, Polling Mode D requires a separate connection to the host; but unlike Point-to-Point, it requires an address and must wait for a poll from the host before sending data. When in Polling Mode D, an address of 1 is automatically displayed on the configuration screen. However, during transmission, a 1C hex poll address (FS) and a 1D hex select address (GS) are substituted for the 1.

Multidrop

Note: Readers intended to link up to a Microscan MS-5000 multidrop concentrator must be configured in standard Multidrop protocol.

Note: To avoid slow or degraded performance when the Quadrus™ is networked with Microscan's MS-5000 multidrop concentrator, the MS-5000 must have Turnaround Timeout set to 35 ms and should have Baud Rate set to 38.4 and Number of Devices

set to no more than the actual number of connected devices. See MS-5000 Multidrop concentrator User's Manual.

Similar to Polling Mode D except that a unique poll address and select address are required for each multidrop device, and only one host port connection is needed for up to 50 devices. (For Multidrop poll and select characters, see [Table A-8, "Multidrop Address Characters,"](#) on page A-19.)

Requires a concentrator or controller using RS-485 communications. When Multidrop is selected, the protocol characters for RES, REQ, etc. are assigned automatically. (See ["Appendix I — Multidrop Communications"](#) on page A-17 for poll and select sequences.)

User Defined

Note: A specific ASCII character must not be assigned more than once.

Used only with RS-232. User Defined is necessary when a new protocol must be defined to match a specific host protocol. ASCII characters can be assigned as an address and as protocol commands (RES, REQ, EOT, STX, ETX, ACK, NAK, From Host). In order to enable a handshaking protocol, you must manually assign values where necessary. When User Defined is selected, the displayed protocol commands match those of the previously selected protocol. User Defined is considered to be in a polled mode only if an address has been assigned. The address can be any ASCII character from the ASCII table in [Appendix F on page A-12](#). If null is selected as the address, the reader will not function in a polling sequence. From Host, if enabled, allows the handshaking protocol to be initiated from the host, if unpolled.

Default: *Disabled*

Options: *Disabled, Enabled*

Messages sent to the host from the Quadrus™ will always include the reader's defined protocol. The status of From Host determines if messages sent to the Quadrus™ from the host must also include the defined protocol. If From Host is disabled, the defined protocol is not included. If From Host is enabled, the defined protocol must be included. (See ["Selected Protocol"](#) on page 3-7 for further information.)

User Defined Multidrop

Used when connecting to a concentrator or other device that does not match standard Multidrop protocol.

Any single character (even-numbered — 02 hex to 7E hex) in the ASCII table can be assigned as the address character. The character chosen is used as the poll character and the subsequent ASCII character becomes the select character. For example, if a **^B** (02 hex) is selected as the address, **^C** (03 hex) becomes the select address that the host will use in sending host select commands. (See [Table A-7, "ASCII Table with Control Characters,"](#) on page A-12.)

Note: Definitions of commands in User Defined and User Defined Multidrop must be duplicated in host applications to enable poll and select sequences to execute correctly during transmission.

Note: Typically, parameters in User Defined Multidrop are defined by first enabling Multidrop, then enabling User Defined Multidrop. This pre-loads Multidrop characters into the parameters. You then change individual characters to match the host or other requirements.

Output Data Format

Preamble (enable/disable)

Default: **Disabled**

Options: *Disabled, Enabled (within any protocol)*

Allows you to enable or disable the preamble character(s).

Preamble (definition)

Default: **CR** (carriage return).

Options: *Up to four ASCII characters except NUL, <, or >.¹*

If enabled, allows you to define up to four characters that can be added in front of the symbol data. For example, a carriage return.

Postamble (enable/disable)

Default: **Enabled**

Options: *Enabled, Disabled (within any protocol)*

Allows you to enable or disable the Postamble character(s).

Postamble (definition)

Default: **CR LF** (carriage return/line feed).

Options: *Up to four ASCII characters except NUL, <, or >.¹*

Allows you to define up to four characters that can be added after the symbol data. When enabled, the default CR LF causes each symbol to be displayed on its own line.

Response Timeout (character)

Default: **4** (40 ms)

Options: *0 to 255 (in 10 ms increments)*

Allows you to set the time the reader will wait between characters before timing out if ACK, NAK, and ETX are enabled, and a host response is expected.

1. In the case where only one character is entered, a NUL character is selected to serve as a place holder; however, no output will result.

Intercharacter Delay

Default: **0**

Options: 0 to 255 in 10 ms increments. Zero (0) causes no delay between characters.

Allows you to set the time interval in milliseconds between individual characters transmitted from the Quadrus™ to the host computer. A high setting will significantly slow down communications. For example, a 200 setting will result in a 2 second delay between each character that is transmitted.

Longitudinal Redundancy Check (LRC)

Default: **Disabled**

Options: Disabled, Enabled

An error-checking routine that verifies the accuracy of transmissions. It is the exclusive OR of all characters in the transmitted message. The result is appended to the end of the transmitted message.

Operations Menu

The Operations menu allows you to set the operations parameters for the Quadrus™. (See [figure 2-4.](#))



Figure 2-4 Operations Menu

Default

Clicking the **DEFAULT** button will reset all options on the Operations menu to factory defaults. You can then click **Apply** followed (in the pop-up dialog box) by **SEND/NO SAVE** or **SEND/SAVE**.

Note: Selecting the Default button will only restore those settings of the current menu.

Trigger

Click **Trigger Setup** button to set Trigger Mode, Trigger Level, Trigger Variance, Trigger Source, and Trigger Delay.

Trigger Mode

Default: **External Edge**

Options: External Edge, Continuous Read, Continuous Read 1, External Level, External Edge, Serial Data, Serial Data & Edge

Allows you to establish the type of trigger event that will initiate and end the read cycle. (See “End of Read Cycle” on page 2-19.)

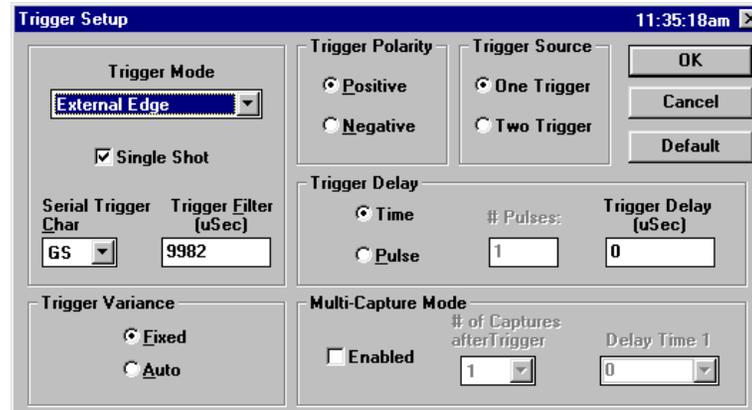


Figure 2-5 Triggering Setup

Continuous Read

Note: Continuous Read is typically used for testing only.

Trigger input options are disabled and the Quadrus™ is always in the read cycle. Symbol data is decoded, and symbol information is transmitted repeatedly, as long as the symbol is in the read range of the Quadrus™. When To Output options have no affect on Continuous Read. Continuous Read is useful in testing read performance.

Note: If Match Code is enabled, the Quadrus™ defaults to Continuous Read 1.

Continuous Read 1

When enabled, symbol data is immediately transmitted once every time new symbol data is placed in front of the Quadrus™. With End Of Read Cycle set to Timeout and the symbol not changed, the Quadrus™ repeats the output at the end of each timeout period. For example, if Timeout is set to one second, the Quadrus™ outputs the symbol data immediately, and then repeats the output at intervals of one second, for as long as the symbol continues to be scanned.

With End Of Read Cycle set to New Trigger, the Quadrus™ outputs the current symbol data immediately, but outputs it only once. A new symbol appearing at any time in the scan range will produce a new read output as long as the new symbol is not identical to the previous symbol.

Note: Enabling Continuous Read 1 will default Number of Labels ([page 2-24](#)) back to one (if set for 2) and only the first symbol in a supplemental label will be read.

External Level

Allows a read cycle to be initiated by a trigger signal from an object detector when an object appears within the detector's range. The read cycle endures until the object moves out of the detector's range unless a good read or timeout occurs (if Timeout is enabled for End of Read Cycle).

External Edge

As with Level, Edge allows a read cycle to be initiated by a trigger signal, but unlike level mode, the read cycle ends with a good read output, a timeout, or a new trigger. If Edge Single Shot is enabled then the read cycle will also end on a noread regardless of the timeout setting.

Serial Data

Quadrus™ accepts an ASCII character from the host or controlling device as a trigger to start a read cycle.

Serial Data & External Edge

The Quadrus™ accepts either an external trigger or a serial ASCII command to start and end a read cycle.

Single Shot

Default: **Enabled**

Options: Enabled, Disabled

When enabled, an edge or serial trigger will begin the read cycle which ends after one captured image, without reference to good decodes or timeout. It is useful in trend analysis and can check daisy chain output in a noread condition. It also treats data from auxiliary port as if it were decoded from the current frame of data.

Serial Trigger Character

Default: **GS** (^] corresponds to <GS> displayed in menu)

Options: Any single ASCII character except NUL, an existing host command character, or an on-line protocol character.

Note: Serial Data ([page 2-16](#)) or Serial Data & Edge ([page 2-16](#)) must be enabled for Serial Trigger Character to take effect. "N/A" is displayed in the menu when all other triggering modes are enabled.

Allows you to define a single ASCII character as the host serial trigger character that initiates the read cycle.¹ The serial trigger is considered an on-line host command and requires the same command format as all host serial commands (that is, to be entered within the < > brackets).

Trigger Filter

Default: **0**

Options: 0 to 65,535 (0 to 3 seconds) (in 46 μ s increments)

Allows you to set the duration of the trigger debounce time.

Trigger Variance

Default: **Fixed**

Options: Fixed, Auto

Applies only if Two Triggers is selected.

Choose Fixed to apply the same Trigger Delay Time to each read cycle or when setting up Two Triggers for the first time. Choose Auto for Two Triggers setup to have Quadrus™ compare subsequent edge triggers and automatically adjust Delay Time.

Trigger Level

Default: **Positive**

Options: Positive, Negative

Allows you to determine whether a positive or negative transition will initiate the read cycle.

Note: External Trigger (page 2-16), External Edge (page 2-16), or Serial Data & Edge (page 2-16) must be enabled for Trigger Level to take effect.

Note: If using the Microscan object detector, enable Positive.

Trigger Source

Default: **One Trigger**

Options: One Trigger, Two Triggers

Allows you to select one or two trigger sources. If you select Two Trigger, you can either tie both trigger inputs together into single trigger inputs (as an open collector) or wire them into separate inputs (see table A-3 on page A-3 for wiring details and notes).

Note: At this time, pin 12 accepts only TTL input.

When set to Two Trigger mode the Quadrus™ behaves as follows:

1. Upon receiving the first trigger edge, Quadrus™ will start a timer.
2. Upon receiving the second trigger edge, Quadrus™ will stop the timer.

1. For example, assigning an upper case C would nullify the **<C>** (Enter Decode Rate Test) command. For a list of operational commands used by the Quadrus™, see Chapter 4, "Operational Commands."

3. Quadrus™ determines the ratio between the current two-trigger delta time and the previous two-trigger delta time.

Note: If Trigger Variance mode is set to Auto, then Quadrus™ will decrease or increase the current Trigger Delay Time by the ratio calculated in step 3; if Trigger Variance is set to Fixed, then Trigger Delay Time will not change. You use Fixed to manually set a Trigger Delay Time for the initial setup. After that, you switch to Auto and Quadrus™ computes the speed automatically in real time.

Trigger Delay

Default: **Time**

Options: *Time, Pulse*

Allows you select and define the conditions (time or pulses) that must transpire before a read cycle can begin.

Both these methods allow you to adjust the position of the symbol and the delay time for Quadrus™ to capture the image without moving the trigger device. However, it is significant to note that of the two, only Trigger Delay Time will function with Two Triggers enabled in Trigger Source.

Trigger Delay (µSec)

Default: **0**

Options: *Any number between 0 and 65,535 (0 to 3 seconds), in 46 µs Increments.*

At the occurrence of an Edge Trigger the Quadrus™ will wait the designated time to capture an image.

Pulses

Default: **0**

Options: *0 to 255*

With Pulse enabled, the Quadrus™ will wait the designated Number of Pulses before the read cycle is activated.

Multi-Capture Mode

Note: Multi-capture mode has no corresponding serial configuration command. Serial commands for multi-capture mode are found in "[<t...> Multiple Trigger Delays](#)" in Chapter 4, "."

Default: **Disabled**

Options: *Disabled, Enabled*

If enabled, multiple captures can proceed from a single trigger. For each additional capture, a corresponding delay is set up using the **<t...>** operational command explained in "[<t...> Multiple Trigger Delays](#)" on page 4-8.

For example, if your application requires that two symbols be read from a single trigger, you need to ensure the following:

1. Multiple Trigger Events from 1 Trigger is enabled.
2. The first trigger event is set up using the trigger delay field <KG>.
3. The second shot is set up using the <t...> operational command.
4. The # Trigger Events After 1st Trigger field is set to 1.

Any number between 0 - 65,535 in 46 μ s increments

of Captures after Trigger

Default: **1**

Options: Any number from 1 to 10.

Number of captures that can occur after a trigger if Multi-Capture is enabled.

Delay Time 1

Default: **0**

Options: Any number between 0 and 65,535, in 46 μ s Increments.

At the occurrence of an Edge trigger the Quadrus™ will wait the designated Trigger Delay Time before the read cycle is activated.

Read Cycle

Allows you select the conditions for ending the read cycle and the timeout duration, if a timeout is selected.

End of Read Cycle

Default: **Timeout**

Options: Timeout, New Trigger, Timeout & New Trigger

Timeout

Can end the read cycle after a specified period of time. If no symbol has been read, a timeout causes a noread message (if enabled) to be transmitted.

When External Edge, Serial Data, or Serial Data & Edge is enabled, a timeout ends the read cycle.

With External Level enabled, the read cycle does not end until the falling edge (the second trigger) occurs. The next read cycle does not begin until the next rising edge trigger.

With Continuous Read 1 Output enabled, a timeout initiates a new read cycle and allows the same symbol to be read again.

New Trigger

Ends the read cycle at the occurrence of a new trigger event, and if no symbol has been read, causes a noread message, if enabled, to be transmitted at the occurrence of the new trigger event. With either External Edge, Serial Data, or Serial Data & Edge enabled, an edge or serial trigger ends a read cycle and initiates the next read cycle. With External Level enabled, a falling edge trigger ends a read cycle. However, the next read cycle does not begin until the occurrence of the next rising edge trigger.

Timeout & New Trigger

Ends the read cycle after a specified period of time or at the occurrence of new trigger event, and if no symbol has been read, causes a noread message, if enabled, to be transmitted. With either External Edge, Serial Data, or Serial Data & Edge enabled, a timeout, or an edge or serial trigger whichever comes first, ends the read cycle. An edge or serial trigger also initiates a new read cycle. With External Level enabled, the read cycle does not end until the occurrence of a falling edge, and the next read cycle does not begin until the next rising edge trigger.

Timeout (mS)

*Default: **1000** (one second)*

Options: 0 to 65,535

Allows you to set the length of time the read cycle will remain active before timing out.

Maximum Decode Time (mS)

*Default: **1000** (one second)*

Options: 0 to 65,535

Allows you to set the length of time the reader will spend, after a label has been located, attempting to decode a label before timing out and seeking another symbol. You can enable additional time if necessary to allow the Quadrus™ to use a special algorithm that will adjust decode parameters and continue to try to decode the label.

Noread

*Default: **Enabled***

Options: Enabled, Disabled

You can clear this box if you want to disable the noread message.

Noread Message

*Default: **NOREAD***

Options: Up to seven ASCII characters (except NUL)

Allows you to define any combination of ASCII characters (except NUL) up to seven characters as the noread message. When enabled, the noread message will be transmitted to the host at a timeout or the end of a read cycle if the symbol has not been decoded.

Match Code

Default: **Disabled**

Options: *Disabled, Enabled, Sequential, Wild Card*

Note: A triggered mode (page 2-15 to page 2-16) must be enabled for Match Code to take effect.

Note: Enabling Continuous Read 1 will default Number of Labels (page 2-24) back to one (if set for 2) and only the first symbol in a supplemental symbol will be read.

Allows you to enter a master label into the Quadrus™ memory to be compared with subsequently scanned symbols. (See “Master Label” on page 4-10.) The results of this comparison determine the reader’s data and output pulses.

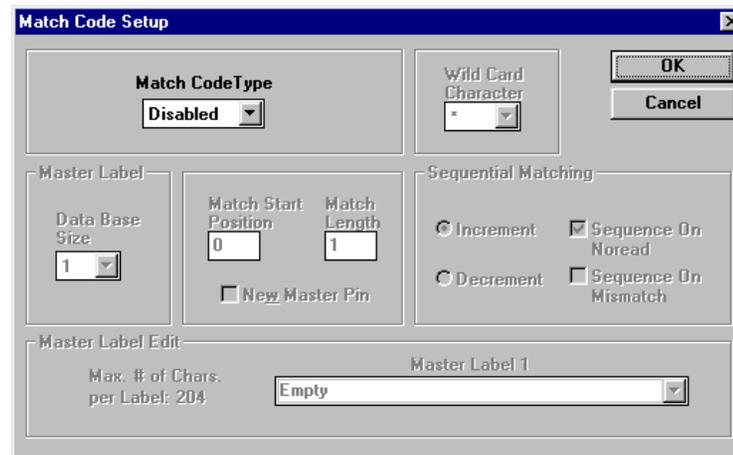


Figure 2-6 Match Code Setup

The following conditions apply:

- A triggered mode must be enabled for Match Code Type to take effect.
- Multi-labels will not work when Match Code Type is enabled. (Enabling Match Code will cause Number of Labels to default back to one.)
- If you wish to send a pulse on a Good Read, Match Code Type must be disabled.

Match Code Type

Disabled. No effect on operations.

Enabled. Instructs the reader to compare symbols or portions of symbols with the master label.

Sequential Matching. Instructs the reader to compare symbols or portions of symbols for sequential numbers in ascending or descending order. Sequencing occurs after each match. It is important to note that all sequential match code operations are performed on Master Label #1 in the Master Label Data Base.

Wild Card. Allows you to enter user-defined wild card characters in the master label. For example, with wild card defined as a default asterisk, entering URGENT** as your master label will result in matches for URGENT, URGENT1, and URGENT12 but not for URGENT123.

As in the above example, when wild cards are appended to the end of the master label, symbols of variable lengths can result in matches. However, wild cards in the beginning or center of a symbol (e.g., UR**NT) do not allow for variable symbol lengths.

Data Base Size

Default: 10

Options: 1 to 10

You can setup from 1 to 10 the master labels. It is important to note that changing the number of master labels in the data base changes the maximum length for each master label due to a fixed data base size for the aggregate. The aggregate Master Label Data Base is 2048 bytes in size, so if The # of Master Labels is set to 1 (see <KM> command in ["Multilabel" on page 2-24](#)) then the max value for Match Start Position and Match Length is 2048. If the # of Master Labels is set to 2, the maximum data base size would be 1024, and so on until at ten symbols, the maximum per label is 204 (see ["Master Label Data Base" on page 4-12](#)).

Note: Since the size of the master label data base varies according to the number of Master Labels enabled, the Match Start Position and Match Length maximum values will vary as well.

Caution: You must be careful when changing the Number of Master Labels (1 to 10), because if you enter a value for Number of Master Labels that is different than the current value and any of the master labels exceed the new size limitation, all Master Labels will be deleted except Master Label #1, unless its size exceeds the new maximum.

Match Start Position

Match Start Position must be set to 1 or greater to enable this feature. Defines the first character in the symbol (from left to right) that will be compared with those of the master label when Match Code Type is set to Enabled or Sequential. For example, if you set Match Start Position to 3, the first 2 characters read in the symbol will be

ignored and only the 3rd and subsequent characters to the right will be compared, up to the number of characters specified by Match Length.

Match Length

Defines the length of the character string that will be compared with that of the master label when Match Code Type is set to Enabled or Sequential and Match Start position is set to 1 or greater. For example, if Match Length is set to 6 in a 10 character symbol, and Match Start Position is set for 2, only the 2nd through 7th characters (from left to right) will be compared.

New Master Pin

Default: **Disabled**

Options: Disabled, Enabled

Enabling New Master Pin will allow you to momentarily connect the New Master Pin to ground (must be held low for a minimum of 10 ms) in order to clear any existing master label information from Master Label #1 buffer in the master label data base, and to record the next good read as the new master label information for Master Label #1.

Note: This pin will not work for any of the other master labels in the data base.

Sequence on Noread

When disabled, the reader does not sequence (increment or decrement) on a noread. When enabled, the reader sequences on every noread.

Sequence on every Mismatch

When disabled, and if a mismatch is out of sequence by no more than 1, then the sequence resumes and searches indefinitely. When enabled, the reader sequences on every mismatch.

Master Label Edit

Allows you to enter in master label data for up to 10 labels. Enter data under Master Label 1, scroll down to Master Label 2 and enter data for that label, and so on.

Reader Output

When to Output (symbology data)

Default: **As Soon As Possible**

Options: As Soon As Possible, End of Read Cycle

Allows you to choose when the symbol's data is sent to the host computer.

As Soon As Possible

Causes symbol data (good reads) to be transmitted immediately upon a good decode.

End of Read Cycle

Causes symbol data output to be delayed until the end of the read cycle.

Bar Code Output

Default: **Good Read**

Options: *Good Read, Disabled, Match, Mismatch*

Note: If Bar Code Output is set to Match or Mismatch, symbol data will not output unless Match Code is enabled and a master label is received into memory.

Beeper Status

Default: **On Good**

Options: *On Good, On Noread, Disabled*

A beep is emitted either after each good read or noread.

Multilabel

Allows you to define the number of different symbols that the reader will read during a single trigger event (including multiple symbols decoded within a frame).

Separator

Default: *,* (comma)

Options: *Any ASCII character except NUL, <, or >.*

Allows you to define the ASCII character that will separate symbol data when it is sent to the host.

Number of Labels

Default: **1**

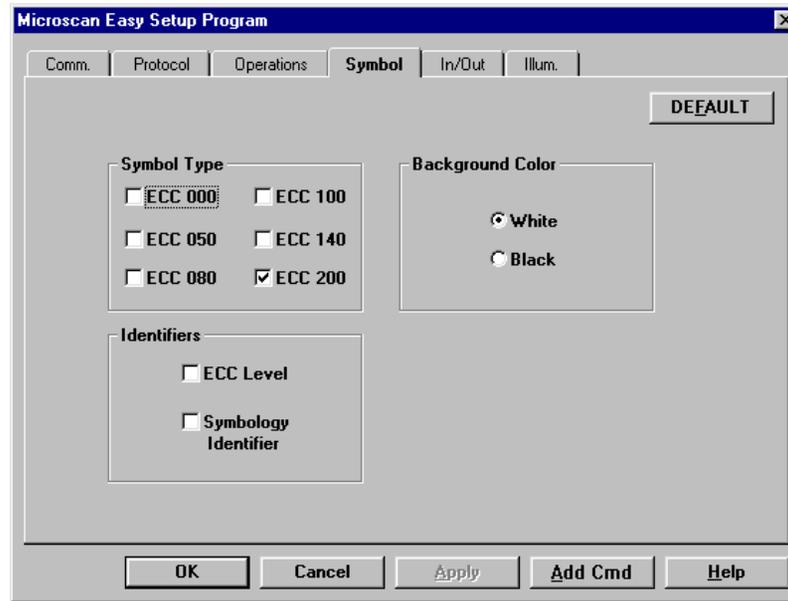
Options: *1 to 6*

Note: If Number of Labels is set to 2 while Match Code or Continuous Read 1 is enabled, Number of Labels will default back to one.

Allows you to choose the number of different symbols that will be read in a single trigger event. The labels can be a mix of any enabled bar code symbologies and more than one label can be decoded per frame.

Symbol Menu

The Symbol menu allows you to setup specific parameters of each symbology. (See [figure 2-7.](#))



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Figure 2-7 Symbol Setup

Default

Clicking the **DEFAULT** button will reset all options on the Symbol menu to factory defaults. You can then click **Apply** followed (in the pop-up dialog box) by **SEND/NO SAVE** or **SEND/SAVE**.

Background Color

Default: **White**

Options: *White, Black*

Background color is important. Use the finder pattern as your reference. If the finder pattern is white (or light), the background color should be black (or dark). The terms Black and White are relative and you should think in terms of lighter or darker.

Symbol Type

Default: **ECC 200**

Options: *ECC 000, ECC 050, ECC 080, ECC 100, ECC 140, ECC 200*

See ["Data Matrix Symbology" on page A-13](#) for descriptions.

Identifiers

You can instruct the reader to output the ECC Level (symbol type) and/or the symbology identifier along with the label data.

ECC Level (symbol type)

Default: **Disabled**

Options: *Disabled, Enabled*

Allows you to enable the reader to output the symbol type (ECC 200, ECC 000, etc.).

Symbology Identifiers

Default: **Disabled**

Options: *Disabled, Enabled*

If Symbology Identifier is enabled, it adds a prefix to the decoded data.

The symbology identifier for Data Matrix is: **]*dm***

where:

] is the symbology identifier flag (ASCII value 93).

d is the code character for the Data Matrix symbology.

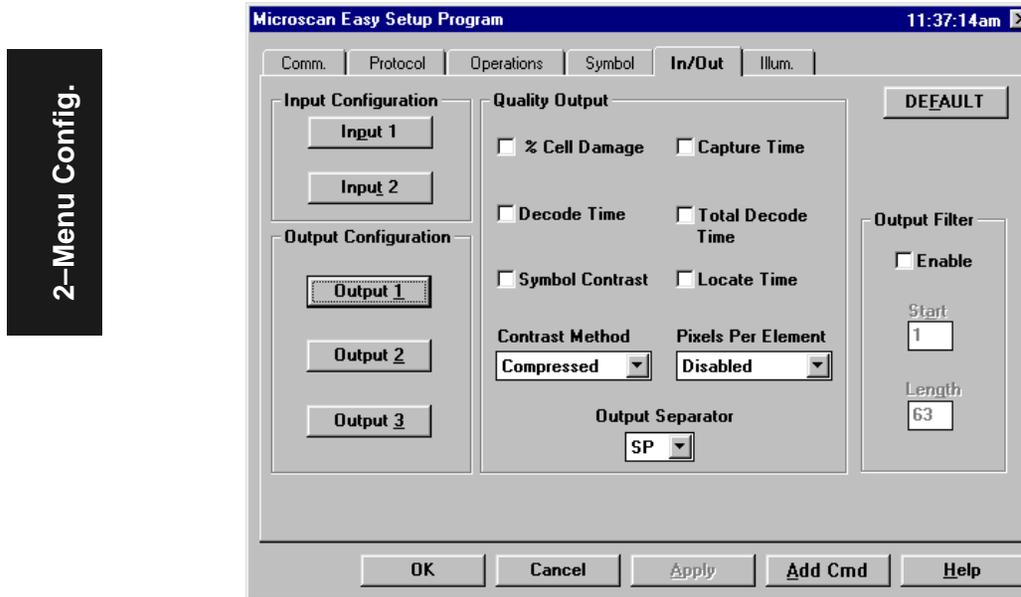
m is a modifier character with one of the values defined in [table 2-1](#).

Table 2-1 Symbology Identifier Option Values for Data Matrix

Option Value	Option
0	ECC 000-140
1	ECC 200
2	ECC 200, FNC1 in 1st or 5th position
3	ECC 200, FNC1 in 2nd or 6th position
4	ECC 200 supporting ECI protocol
5	ECC 200, FNC1 in 1st or 5th position plus supporting ECI protocol
6	ECC 200, FNC1 in 2nd or 6th position plus supporting ECI protocol

In/Out Menu

The Reader In/Out menu allows you to set the conditions under which Quadrus™'s inputs and outputs symbol data, signals, and pulses.



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Figure 2-8 Reader In/Out Setup

Symbology output data and noread messages are transmitted on pin 2 under conditions set principally in Bar Code Output. Pulses are transmitted via pins 6 and 8 (Output 1 and Output 2 respectively) and individually configured under conditions set in Output 1 and Output 2.

Default

Clicking the **DEFAULT** button will reset all options on the In/Out menu to factory defaults. You can then click **Apply** followed (in the pop-up dialog box) by **SEND/NO SAVE** or **SEND/SAVE**.

Allows you to choose the conditions that will send symbol data (or noread messages) to the host computer via RS-232 on pin 5.

Input Configuration

Input 1 applies to host pin 12, Input 2 applies to host pin 21.

Default

Click the **DEFAULT** button to display factory default settings for Input 1.

Polarity

Default: **Positive**

Options: Positive, Negative

Allows you to choose a positive or negative transition.

Input Mode

Default: **Disabled**

Options: Disabled, Reset Counts, Unlatch Output, Set Trigger Delay

Disabled

No input signals.

Reset Counts

Resets all counters.

Unlatch Output

Sends a pulse to end active state of Latch Mode 1 set in Output 1, Output 2 or Output 3.

Trigger Delay

When Trigger Delay is enabled, both the 1st and 2nd trigger input pulses will be expected at the Trigger Input (pin 10). When Set Trigger Delay is not enabled, trigger input from the 1st trigger will be expected at Input-1 (pin 12).

Caution: Input-1 accepts TTL level voltage only.

Output Configuration

Output 1 applies to host pin 6.

Output 2 applies to host pin 8.

Output 3 applies to host pin 15.

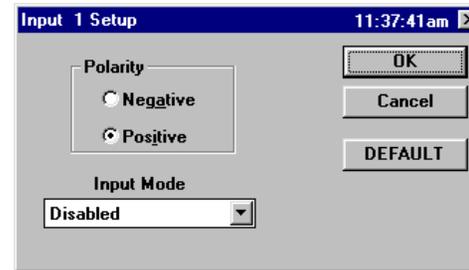


Figure 2-9 Input 1 Dialog Box

Upon selecting this option a dialog box will appear:

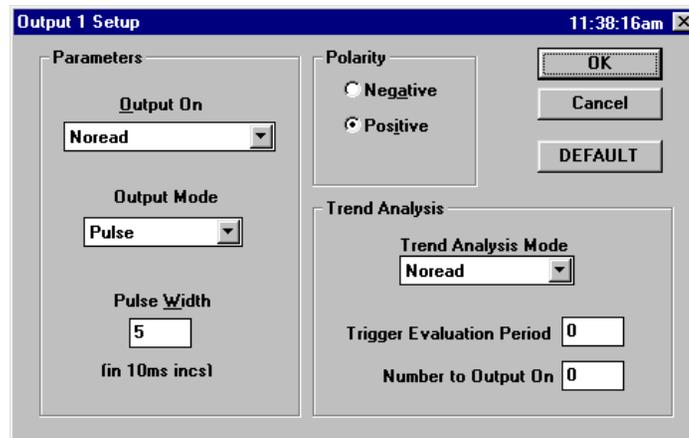


Figure 2-10 Output 1

Default

Click **DEFAULT** button to display factory default settings.

Output On

Default: **Mismatch or Noread**

Options: Mismatch or Noread, Match, Mismatch, Noread, Trend Analysis

Allows you to set the conditions that will output a pulse. To see the options for enabling Match Code and receiving a master label into memory see [“Master Label” on page 4-10](#).

Note: If Output On is set to Mismatch or Noread, or Mismatch, a relay pulse will not output unless Match Code is enabled and a master label is received by reader memory.

Mismatch or Noread

Sends a pulse (to the output pin that is enabled) when the symbol's data does not match that of the master label or the label is not decoded before the end of the read cycle.

Note: Matchcode must be enabled for a pulse to be sent. (See [“Operations Menu” on page 2-14](#).)

Match

Sends a pulse (to the output pin that is enabled) when the decoded symbol matches the master label. (If Match Code is disabled, a good read will have the same effect.)

Note: Matchcode must be enabled for a pulse to be sent. (See [“Operations Menu” on page 2-14.](#))

Mismatch

Sends a pulse (to the output pin that is enabled) when the decoded symbol does not match the master label.

Note: Matchcode must be enabled for a pulse to be sent. (See [“Operations Menu” on page 2-14.](#))

Noread

Sends a pulse (to the output pin that is enabled) when the symbol's data is not decoded before the end of the read cycle.

Trend Analysis

Outputs a pulse when a trend analysis condition is met. (See [“Trend Analysis” on page 2-32.](#))

Output Mode

Default: **Pulse**

Options: *Pulse, Latch Mode 1, Latch Mode 2, Latch Mode 3*

Allows you to select either pulse or latch output mode.

Pulse

Enabling Pulse allows a pulse to be sent when the selected Output On condition is met. Enabling Latch causes the output to toggle high or low (depending on selected polarity) when the selected Output On condition is met.

Latch Mode 1 (unlatch pin)

The programmable output is pulled active when the Output On condition has been met and is held active until either Input #1 or Input #2 is toggled to the opposite polarity.

Note: In order for this mode to work correctly, you must set either Input #1 or Input #2 to the correct polarity and set Input Function for Unlatch Output.

Latch Mode 2 (unlatch opposite condition)

The programmable output is pulled active when the Output On condition has been met and is held active until the opposite of the Output On condition is met. For example, if Noread is the condition set in Output On, Output will be pulled active upon a Noread condition and held active until a Good Read condition occurs.

Latch Mode 3 (unlatch Enter Read Cycle)

The programmable output is pulled active when the Output On condition has been met and is held active until the Read Cycle is re-entered.

Pulse Width (in 10 ms incs)

Default: **5** (.05 seconds)

Options: 0 to 255 (divide the number entered by 100 for time in seconds)

Allows you to set the duration of the good match/noread output signals at the output pin that is enabled. When the edit box is selected, you can use the arrow keys to increase or decrease the settings, or you can just enter the value.

Polarity

Default: **Negative**

Options: Negative, Positive

Allows you to choose a positive or negative transition.

Trend Analysis

Trend Analysis Mode

Outputs a pulse when a trend analysis condition is met.

Default: **Noread**

Options: Image Degradation, Mismatch, Noread

Allows you to select the type of analysis that the reader will monitor.

Note: Image Degradation is for future use and is not functional at this time.

Trigger Evaluation Sample

Default: **10**

Options: 0 to 255

Allows you to set the number of triggers.

Number to Output On

Default: **5**

Options: 0 to 255

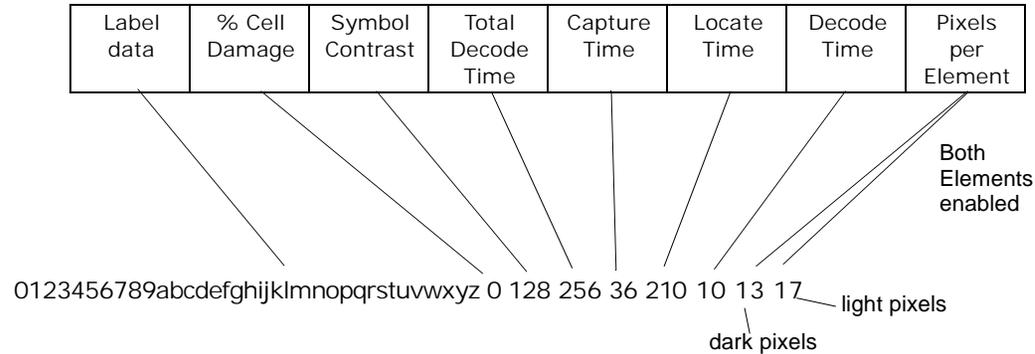
Allows you to set the number of times a condition that you define in Trend Analysis Mode occurs in the Trigger Evaluation Sample to cause an output.

Quality Output

When you check Quality Output parameters, Quadrus™ calculates each and appends these values to each label output. For example, if you enable all the outputs, they will be returned in the order shown in [table 2-2](#).

See “[Sample Symbol # 1, Thermal](#)” on [page 5-9](#) for a functional description and examples with different labels.

Table 2-2 Full Quality Outputs



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You can choose to output symbol quality values by checking any of the following check boxes:

% Cell Damage. Number of cells (also called elements) damaged per total number of cells x 100. The ideal reading is 0 (zero).

Symbol Contrast. The difference between the arithmetic means of the darkest 10% and lightest 10% of the image pixels which fall within the area of the symbol, extending outward to the limits of any required quiet zones. A value of 80 is considered optimum, with 70 as a minimum for an A-grade threshold.

Total Decode Time. Displays the sum of Capture Time, Locate Time, and Decode Time. A target total is anything under 200 ms that guarantees you are getting at least 5 scans per second (1000 ms/200 ms).

Capture Time. Displays the time elapsed between the CCD trigger and all the CCD data has been DMA'd to external memory.

Note: Capture time is dependent on the shutter time.

Locate Time. For the first label in the field of view, the time from the start of image processing until the label has been located and is ready to be decoded. For each additional label in the field of view, the time from the exit of the decode function of the previous label until the current label has been located and is ready to be decoded.

Decode Time. Time required to decode label.

Pixels Per Element.Default: **Disabled**Options: *Disabled, Dark Elements, Light Elements, Both Elements*

You can output pixels per dark element, pixels per light element, or both. This calculation records the number of pixels for each element, either dark or light, in the clocking pattern for both x and y directions.

Enabling **Both Elements** is very useful since you can quickly compare the balance between dark and light pixels.

Contrast Method.Default: **Compressed**Options: *Compressed, Full Size*

Method used to calculate the symbol contrast of the image, either compressed or full-sized.

Output Separator. Allows you to select an ASCII character as a separator between the label data and the appended Quality information.

Recommended Quality Output Setup

1. In the In/Out menu, check **% Cell Damage**, **Symbol Contrast**, and **Total Decode Time**.
2. Set **Pixels per Element** to Both Elements, as shown in [figure 2-11](#).

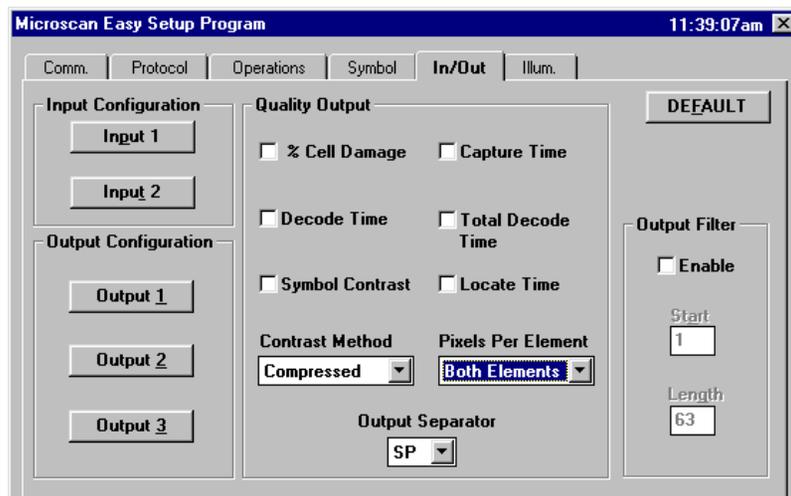


Figure 2-11 Quality Output Options

3. In the Trigger menu under Utilities, click the Serial Trigger Character **SETUP** Button and click **Send**.

Output Filter

Default: **Disabled**

Options: *Disabled, Enabled*

If only part of the information in a label is to be transmitted to the host, Output Filter can be used. It allows a preset number of characters to be transmitted starting at a set position in the label. In the multilabel mode, partial output is performed on each separate label.

For example, if the start position is set to 3 and the length to 5, the following occurs:

"1234567890"	is transmitted as "34567"
"1234"	is transmitted as "34"
"1234,abcde"	is transmitted as "34,ab"
"12"	is transmitted as ""

Start

Default is **1**.

Range is 1 to 300

Length

Default is **63**.

Range is 1 to 300

Illumination Menu

Upon selecting this menu a dialog box will appear which will contain the following:

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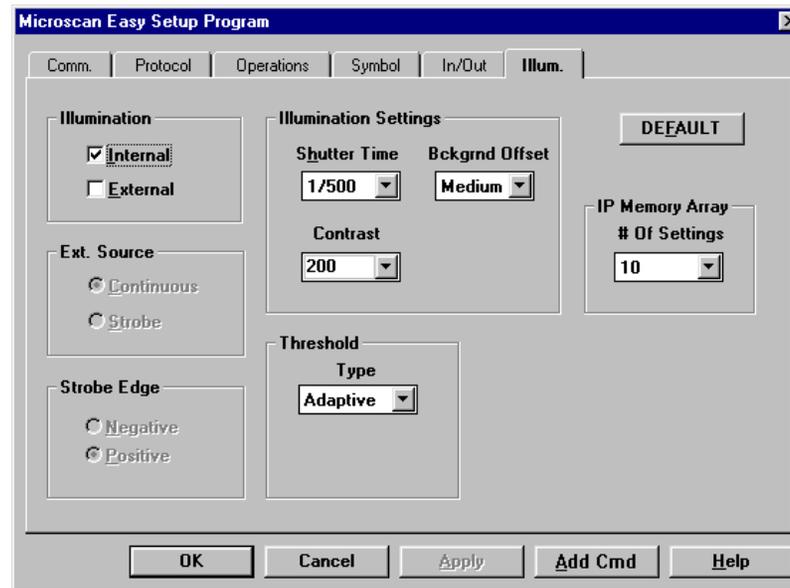


Figure 2-12 Illumination Menu

Note: See “Illumination Adjustment Flow” on page 5-8.

Default

Clicking the **DEFAULT** button will reset all options on the Illumination menu to factory defaults. You can then click **Apply** followed (in the pop-up dialog box) by **SEND/NO SAVE** or **SEND/SAVE**.

Illumination

You can enable or disable the Internal Illumination. You can also adjust the duration of time the LEDs will be on. However, the Quadrus™ ESP™ will do this automatically when you set shutter time in ESP™ Illumination menu. Therefore you should make your exposure time adjustments in Shutter Time before attempting to change LED Illumination Time.

However, if you do need to fine-tune your exposure time, you can make adjustments in LED Illumination Time (by serial command only), but should observe the following:

- If you select an LED Illumination Time that is longer than Shutter Time, the LED's will shut off at the end of exposure time since there is no benefit in applying power to the LED's while the CCD is not active.
- Setting the LED Illumination Time to less than the exposure time will effectively shorten the time the image is received by the CCD array.

For comparison, think of LED Illumination and shutter time in terms of a conventional camera's flash and shutter speeds, respectively.

Default: *Internal*

Options: *Internal, External, Internal and External*

Internal. Uses the Quadrus™' internal light source to illuminate the symbol at the time of capture.

External. Relies on an exterior light for illuminating the symbol. If disabled, regardless of the mode of operation, the external strobe output will be in an inactive state.

Internal and External. Allows you to use both internal and external illumination.

External Source

Default: *Continuous*

Options: *Continuous, Strobe*

Continuous. If Continuous is enabled for External Source, strobe output will depend on the read cycle mode. If in Continuous Read (in Operations menu), the strobe output will be continuously active. However, if the read cycle is in a triggered mode, then the strobe will be pulsed active upon entering the read cycle and pulled inactive upon leaving the read cycle.

Strobe. If Strobe mode is selected, the strobe output will pulse active during the CCD exposure time only.

Strobe Edge

Default: *Positive*

Options: *Positive, Negative*

You can select either Negative or Positive transition for the Strobe Edge. This selection will be grayed out if External Illumination is disabled or Continuous External source is selected.

Illumination Settings

(See [“Manual Settings” on page 5-6](#) for additional explanations.)

Shutter Time

Default: **1/500**

Options: 1/60, 1/125, 1/ 250, 1/500, 1/1000, 1/2000, 1/4000, 1/10K, 1/20K, 1/50K, and 1/100K.

Allows you to select the desired shutter time. This is similar in function to an everyday photo camera. The rule of thumb is the faster the object is passing through your field of view, the shorter your shutter time must be to capture an undistorted image. If you select durations of 1/20K or shorter, shutter time is controlled by illumination time.

Background Offset

Default: **Medium**

Options: Dark (50), Medium (100), Light (150), Custom (0 to 255)

Allows you to change the Offset value. This adjustment is usually made experimentally during calibration (see [“Illumination Adjustment Flow” on page 5-8](#)). Also see

Contrast

Default: **200**

Options: 0 to 255

This adjustment is usually made experimentally during calibration. A higher setting brightens the image.

Threshold Type

Default: **Adaptive**

Options: Adaptive, Fixed (0-255)

Adaptive. An Adaptive routine sets the light/dark threshold from data acquired from the current read. Fixed applies the same gray scale threshold value to each and every symbol. Generally, Adaptive gives better results than Fixed. See following descriptions of each.

Fixed. Allows you to enter a fixed number (from 0 to 255) that determines how the reader distinguishes light from dark pixels. Unlike Adaptive, a Fixed Threshold value is applied consistently to each and every label. Fixed works best when decode time must be as short as possible and the reflectance and illumination of the symbol area is uniform and unchanging.

Custom Menu

In some cases there may be a discrepancy between your application code and the ESP™ version. If so, after you've sent a **Receive from Reader** command, you will see the following Custom Menu:

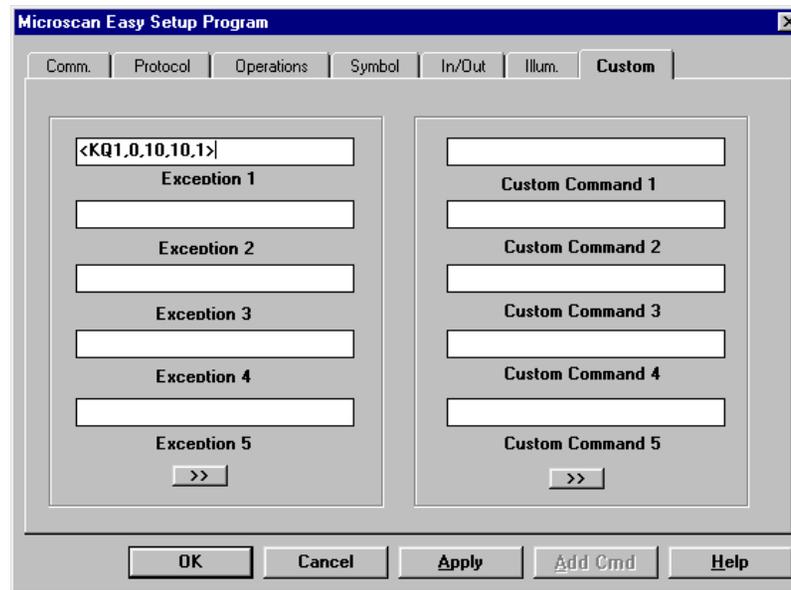


Figure 2-13 Custom Menu

In this case, the application code residing in this reader has a KQ command that does not match the command in the current ESP™ version and the commands listed here are those that do not match.

The Custom menu provides a way of identifying those commands that vary from your current version of ESP™. When you save your current ESP™ configuration file, the same custom commands will be available upon recall.

If you subsequently download a version of the application code to the reader that matches your version of ESP™, the Custom menu tab will no longer appear.

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Chapter
3

Serial Commands

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3-Serial Commands

Serial command strings are entered from an ASCII terminal, from a host computer, or within the Terminal window of the Quadrus™ ESP™ for Windows™. As with menu configuration commands, serial configuration commands relate to the initial reader setup.

Note: For a more detailed explanation of Quadrus™ serial commands, see explanations of corresponding ESP™ commands in [Chapter 2, “Menu Configuration.”](#)

Note: The order that serial commands are presented in this chapter conforms to the serial command groupings established in the application software and therefore may not always follow the order established in [Chapter 2, “Menu Configuration.”](#)

Table 3-1 Summary of Serial Configuration Commands

Function	K	Command	Format
Communications	Ka	Host Port	< Ka baud,parity,stop bits,data bits >
	Ky	Aux Port	< Ky mode,baud rate,parity,stop bits,data bits,daisy chain status, daisy chain ID >
	Kb	Host Port RS-422	< Kb status >
Protocol	Kf	Protocol	< Kf protocol,address >
	Kd	Preamble	< Kd status,preamble character(s) >
	Ke	Postamble	< Ke status,postamble character(s) >
	KA	Response Timeout	< KA timeout setting >
	KB	Intercharacter Delay	< KB time interval >
	Kc	LRC	< Kc status >
	KT?	Comm./Protocol Status Request	< KT? >
Operations	Kg	Trigger	< Kg mode,trigger filter time,single shot,multi-capture,# captures after trigger >
	Ki	Serial Trigger Character	< Ki trigger character >
	KJ	Trigger Variance	< KJ trigger variance mode >
	Kj	Trigger Polarity	< Kj polarity >
	KI	Trigger Source	< KI trigger source >
	KG	Trigger Delay	< KG trigger delay type,trigger delay time,number of delay pulses >
	Kh	Read Cycle	< Kh end of read cycle,timeout,max decode time >
	Kk	Noread Message	< Kk status,noread message >
	KL	Multilabel	< KL number of labels,multilabel separator >
	Kn	Match Code	< Kn type,sequential matching,match start position,match length,wild card character,sequence on noread,sequence on every mismatch >
	KM	Master Label Database Size	< KM number of master labels >
	Kz	New Master Pin	< Kz status >
	Ku	Beeper Status	< Ku status >
	KI	Reader Output	< KI bar code output,when to output >
KV?	Operations Status Request	< KV? >	

Table 3-1 Summary of Serial Configuration Commands (continued)

Function	K	Command	Format
Symbol	KQ	Data Matrix	< KQ status>
	Ko	Narrow Margins/Symbol-ogy Identifier	< Ko narrow margins status,symbology identifier status>
	KW?	Code Types Status Request	< KW ?>
In/Out	KE	Partial Output	< KE status,start position,length>
	KK	Input # 1	< KK mode,polarity>
	KC	Input # 2	< KC mode,polarity>
	Kv	Output # 1	< Kv output on,polarity,pulse width,output mode,trend analysis mode,trigger evaluation period,# to output on>
	Kw	Output # 2	< Kw output on,polarity,pulse width,output mode,trend analysis mode,trigger evaluation period,# to output on>
	KH	Output # 3	< KH output on,polarity,pulse width,output mode,trend analysis mode,trigger evaluation period,# to output on>
	KP	Coordinate Data Status	< KP status>
	KO	Quality Output	< KO % cell damage,symbol contrast,total decode time,capture time,locate time,decode time,pixels per element,ECC level,symbol contrast,output separator>
	KS	Serial Verification	< KS command echo status,command beep status,control/hex output>
	K/	Operation Command Output Format	< K/ command output format>
KX?	In/Out Status Request	< KX ?>	
Illumination	KR	Internal Illumination	< KR status,LED illumination time>
	KY	External Illumination	< KY status,source,stroke edge,pulse width>
	KZ	Illumination Parameters	< KZ shutter time,AGC min,offset,AGC max.>
	Kx	Image Settings	< Kx threshold type,quiet zone color,number of symbols to find,fixed threshold value,flag early out>
	KU	Illumination Status Request	< KZ ?>

3-Serial Commands

About Serial Configuration

Serial Configuration Command Format

The format for a serial configuration command is,

<Kparameter data,data,...etc.><initializing command>

Where:

- Less than < and greater than > symbols are included as part of the commands.
- “parameter,” as used here, are those character(s) that precede the data.
- The “initializing command” <A> or <Z> is sent after configuration is complete. <Z> resets and saves for power up. <A> initializes the change to RAM. (For more information on additional resets and saves, see [page 4-14.](#))

For example, to change Baud Rate and reset without saving changes for power-up, enter **<Ka3><A>**.

Or, to enable UPC and save the change for power-on, enter **<Ks1><Z>**.

When using serial configuration commands, note also the following conventions:

- Parameters and data are “case sensitive.” That is, characters must be entered as upper or lower case, as specified.
- All data fields (except the last) must be followed by a comma (without a space).
- If there is no change in a given field, then commas can be entered alone, or with the existing data (for example, **<Ka,,,0>** or **<Ka4,1,0,0>**).
- All fields preceding the modified field must be included. For example, in Host Port, to change Data Bits to Eight without changing any other field, enter either: **<Ka,,,1>** or **<Ka4,1,0,1>**.
- All fields following the modified field can be left out. For example, in the RS-232 port, to change Baud Rate to 4800, enter **<Ka3>**.

(See examples on following pages.)

Concatenating Serial Commands

Commands can be concatenated (added together) to a maximum of 64 characters in a single string or data block. Additional data blocks of 64 or less characters can be sent provided there is at least a 10 ms pause between blocks.

For example, **<Kc1><Kh1><Ko1><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

The status of parameters can be requested by entering the command followed by a question mark. For example, enter **<Ke?>** to request the status of Postamble. Commands **<KT?>**, **<KV?>**, **<KW?>**, **<KX?>**, and **<KU?>** are used to request the status of groups of parameters (see [table 3-1 on page 3-2](#)).

Loss of Communications

Making changes to communications parameters such as Baud Rate, Parity, Stop Bits, LRC, etc. without corresponding changes in linked device(s) can result in the loss of communications. If this should occur, with power applied to the reader, default the reader by:

1. momentarily connecting pin 11 to ground (pin 17) until the beeper sounds, then
2. breaking the connection and within three seconds reconnecting.

Caution: The reader will reset all standard configuration parameters.

Communications Port

Host Port

Format: <**K**baud rate,parity,stop bits,data bits>

<i>baud rate:</i>	<i>parity:</i>	<i>data bits:</i>
1 = 1200	0 = None	0 = Seven
2 = 2400	1 = Even	1 = Eight
3 = 4800	2 = Odd	
4 = 9600		
5 = 19.2K	<i>stop bits:</i>	
6 = 38.4K	0 = One	
7 = 57.6K	1 = Two	
8 = 115.2K		

Aux Port

Format: <**Ky**mode,baud rate,parity,stop bits,data bits,daisy chain status,daisy chain ID>

<i>mode:</i>	<i>baud rate:</i>	<i>parity:</i>	<i>stop bits</i>
0 = Disabled	1 = 1200	0 = None	0 = One
1 = Transparent	2 = 2400	1 = Even	1 = Two
2 = Half Duplex	3 = 4800	2 = Odd	
3 = Full duplex	4 = 9600		
4 = Daisy Chain	5 = 19.2K		
5 = Command Processing	6 = 38.4K		
	7 = 57.6K		

<i>data bits:</i>	<i>daisy chain status</i>	<i>daisy chain ID</i>
0 = Seven	0 = Disabled	1 or 2 ASCII characters
1 = Eight	1 = Enabled	

Host Port RS-422

Format: <**Kb**status>

- 0 = Disabled**
- 1 = Enabled

Protocol

Selected Protocol

If selecting one of the options from 0 to 4 (Point-to-Point, Point-to-Point with RTS/CTS, Point-to-Point with XON/XOFF, Point-to-Point with RTS/CTS and XON/XOFF, or Polling Mode D), use this format:

Format: **<Kfprotocol>**

protocol:

0 = Point-to-Point	4 = Polling Mode D
1 = Point-to-Point with XON/XOFF	5 = Multidrop (requires address)
3 = Point-to-Point with RTS/CTS and XON/XOFF	6 = User Defined
	7 = User Defined Multidrop

To change the Protocol to Point-to-Point with XON/XOFF, enter **<Kf2>**

If selecting Multidrop (5), you must define an address and append it to the command string.

Format: **<Kf5,address>**

protocol:

5 = Multidrop

address:

Any number from 1 to 50

To change the Protocol to Multidrop with an address of 33, enter **<Kf5,33>**.

If selecting User Defined (6) or User Defined Multidrop (7), complete the format by either choosing new parameters or concatenating unchanged data fields (separate by commas).

Note: For User Defined, first select Point-to-Point **<Kf0>** and then User Defined **<Kf6...>**. For user Defined Multidrop, first select Multidrop **<Kf5>**, then User Defined Multidrop **<Kf7...>**.

Format: **<Kfprotocol,RES,address,REQ,EOT,STX,ETX,ACK,NAK>**

protocol:

6 = User Defined;

From Host: **0 = disabled** 1 = enabled

To select an unpolled ACK/NAK User Defined protocol with LRC disabled, enter **<Kf0><Kf6,,,,,,^F,^U><Kc0>**. ACK and NAK will be displayed in the menu. <Kf0> nulls the address and <Kc0> disables LRC.

Address, can be assigned any ASCII character except a null. Control characters are used to define RES through NAK (except Address). [Table 3-1](#) lists the control characters

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used for these data fields. (Refer to Table A-7, "ASCII Table with Control Characters," on page A-12 for more information.)

Format: **<Kf***protocol,RES,address,REQ,EOT,STX,ETX,ACK,NAK***>**

protocol:

7 = User Defined Multidrop

To select an unpolled ACK/NAK User Defined protocol with LRC disabled, enter **<Kf0><Kf6,,,,,,,,^F,^U><Kc0>**. <Kf0> nulls the address and <Kc0> disables LRC.

ACK and NAK will be displayed in the menu.¹

Note: Address, can be assigned any ASCII character except a null. Control characters are used to define RES through NAK (except Address). Table 3-1 lists the control characters used for these data fields. (Refer to Table A-7, "ASCII Table with Control Characters," on page A-12 for more information.)

Table 3-1 Protocol Commands

Protocol Command (Mnemonic displayed on Microscan menu)	Control Characters (Entered in menu or serial command)	Effect of Command
RES	^D	Reset
REQ	^E	Request
EOT	^D	Reset
STX	^B	Start of Text
ETX	^C	End of Text
ACK	^F	Acknowledge
NAK	^U	Negative Acknowledge

Preamble

Format: **<Kd***status,preamble character(s)***>**

status:

0 = Disabled

1 = Enabled

preamble character(s):

Enter one to four preamble characters

Default is **CR**

1. A control character, although conventionally represented here and in the ASCII table on page A-12 as two characters (^F or ^U, etc.), is actually a single ASCII character that is entered on the keyboard by holding down the control key while pressing the desired letter.

Postamble

<**K***status,postamble character(s)*>

status: *postamble character(s):*

0 = Disabled

1 = Enabled

Enter one to four postamble characters

Default is **CR, LF**

Response Timeout

Format: <**KA***timeout setting*>

Any number from 0 to 255 in 10 ms increments

Default is **4** (40 ms)

Note: A zero creates an indefinite wait.

Allows you to set the time the reader will wait before timing out if ACK, NAK, and ETX are enabled, and a host response is expected.

Intercharacter Delay

Format: <**KB***time interval*>

Any number from 0 to 255 in 1ms increments.

Default is **0**

Allows you to set the time interval in milliseconds between individual characters transmitted from the Quadrus™ to the host computer.

Longitudinal Redundancy Check (LRC)

Format: <**Kc***status*>

0 = Disabled

1 = Enabled

An error-checking routine that verifies the accuracy of transmissions.

Communications/Protocol Status Request

Format: <**KT?**>

Returns status of each command in the group.

Operations

Trigger

Format: <**Kg**mode,trigger filter time,single shot,multi-capture,
captures after trigger>

mode:

- 0 = Continuous Read
- 1 = Continuous Read 1 Output
- 2 = External Level
- 3 = External Edge**
- 4 = Serial Data
- 5 = Serial Data & Edge

single shot:

- 0 = Disabled
- 1 = Enabled**

multi-capture:

- 0 = Disabled**
- 1 = Enabled

trigger filter time:

Any number between 0 - 65,535
Default is **217**

captures after trigger:

Any number between 1 - 10
Default is **1**

Mode

Allows you to establish the type of trigger event that initiates or ends the read cycle.

Trigger Filter Time

Any number between 0 and 65,535 (3 seconds) in 46 μ s increments.
Allows you to set the duration of the trigger debounce time.

Edge Single Shot

When enabled the read cycle ends after a single captured image, whether or not it is successfully decoded. This is valid only if External Edge trigger is enabled.

Multi-Capture

If enabled, multiple captures can proceed from a single trigger.

of Captures after Trigger

Number of captures that can occur after a trigger if Multi-Capture is enabled.

Serial Trigger Character

Format: <**KI***trigger character*>

Default is ^]

Allows you to define a single ASCII character as the host serial trigger character that initiates the read cycle.

Trigger Variance

Format: <**KJ***trigger variance mode*>

0 = Fixed

1 = Auto

Applies only if Two Triggers is selected.

You can choose Fixed to apply the same Trigger Delay Time to each read cycle or you can choose Auto to have Quadrus™ compare subsequent edge triggers and automatically adjust Trigger Delay Time dynamically. (See Important Note under Trigger Source.)

Trigger Polarity

Format: <**Kj***trigger polarity*>

0 = Negative

1 = Positive

Allows you to determine whether a positive or negative transition will initiate the read cycle.

Trigger Source

Format: <**KI***trigger source*>

0 = One Trigger

1 = Two Trigger

Allows you to select one or two trigger sources.

Trigger Delay

Format: <**KG***trigger delay type,trigger delay time,# pulses*>

<i>trigger delay type:</i>	<i>trigger delay time:</i>	<i># pulses:</i>
0 = Time	Any number from 0 to 65,535 (in 46 μ s Increments)	Any number from 0 to 255.
1 = Pulse	Default is 0	Default is 0

If you select Time for the Trigger Delay Type, at the occurrence of an Edge trigger, the Quadrus™ will wait the designated time before the read cycle is activated.

If you select Pulse, the Quadrus™ will wait the designated number of pulses before the read cycle is activated.

Read Cycle

Format: <**Kh***end of read cycle,timeout*>

<i>end of read cycle:</i>	<i>timeout:</i>
0 = Timeout	Any number from 0 to 65,535
1 = New Trigger	Default is 100
2 = Timeout & New Trigger	(in 10 ms Increments)

Allows you select the conditions for ending the read cycle and the timeout duration, if a timeout is selected.

Noread Message

Format: <**Kk***status,noread message*>

<i>status:</i>	<i>noread message:</i>
0 = Disabled	Any ASCII string up to 7 digits.
1 = Enabled	Default NOREAD

Allows you to enable (or disable) and define the noread message.

Multilabel

Format: <**KL***number of labels,multilabel separator*>

<i>number of labels:</i>	<i>multilabel separator:</i>
Any number between 1 and 6	Any valid ASCII character
Default is 1	Default is ,

Allows you to define the number of different labels that the reader will read during a single trigger event. The labels can be a mix of all enabled bar code symbologies and more than one label can be decoded per frame.

Match Code

Format: <**Kn***type,sequential matching,match start position,match length,wild card character,sequence on noread,sequence on every mismatch*>

<i>type:</i>	<i>match length:</i>	<i>sequence on noread:</i>
0 = Disabled	1 to Max length of	0 = Disabled
1 = Enabled	allowed. Default is 1 ^a	1 = Enabled
2 = Sequential		
3 = Wild Card		
<i>sequential matching:</i>	<i>wild card character:</i>	<i>sequence on every mismatch:</i>
0 = Increment	Any ASCII character	0 = Disabled
1 = Decrement	Default is *	1 = Enabled

match start position:

0 to Max length allowed. Default is **0**^a

a. See ["Master Label Data Base" on page 4-12.](#)

When set to other than Disabled, you can receive a master label into the reader's memory to be compared with subsequently scanned labels. The results of this comparison determine the data display and output pulses, if enabled.

Master Label Database Size

Format: <**KM***number of master labels*>

You can select and define from 1 to 10 master labels with this command or by entering or reading in master labels directly in the Master Label dialogue box in ["Master Label Data Base," on page 4-12.](#)

New Master Pin

Format: <**Kz***status*>

0 = Disabled

1 = Enabled

When Match code is enabled, enabling New Master Pin will allow you to momentarily connect the New Master Pin to ground.

Reader Output

Format: <**K***bar code output,when to output*>

bar code output:

- 0 = Disabled
- 1 = Match
- 2 = Mismatch
- 3 = Good Read**

when to output:

- 0 = As soon as possible**
- 1 = End of Read Cycle

Allows you to choose whether or not to output a good decode (label data) or a noread to the host. When disabled, a label is decoded and the read cycle transpires as usual, but neither label data nor the noread message is transmitted to the host. The read cycle counters are updated, and the current number of good reads or noreads can be obtained via operational commands.

Beeper Status

Format: <**K***status*>

- 0 = Disabled
- 1 = On Good**
- 2 = On Noread

Symbol

Symbol Type

Format: <**KQ**ECC 200 status,ECC 000 status,ECC 050 status,ECC 080 status,
ECC 100 status,ECC 140 status>

status: (for each of the six matrix symbols identified above)

0 = Disabled

1 = Enabled

default is **ECC 200**

Narrow Margins/Symbology Identifier

Format: <**Ko**narrow margins status,symbology identifier>

narrow margins status (not used): *symbology identifier status:*

0 = Disabled

1 = Enabled

0 = Disabled

1 = Enabled

If Symbology Identifier is enabled, it adds a prefix to the decoded data.

In/Out

Allows you to choose the conditions that will allow the Quadrus™ to receive or output pulses and data to the host computer.

Output Filter

Format: <**KE**status,start position,length>

status:	start position:	length:
0 = Disabled	1 to 1556	1 to 1556
1 = Enabled	Default is 1	Default is 1556

Input # 1

Format: <**KK**mode,polarity>

mode:	polarity:
0 = Disabled	0 = Negative
1 = Reset Counts	1 = Positive
2 = Unlatch Output	
3 = Set Trigger Delay	

Input #2

Format: <**KC**mode,polarity>

Functions the same as Input # 1, except that mode 3 option is not available.

Output # 1

Format: <**Kv**output on,polarity,pulse width,output mode trend analysis mode,trigger evaluation period,# to output on>

output on:	polarity:	pulse width:
0 = Mismatch or Noread	0 = Negative	Any number
1 = Good Match	1 = Positive	from 0 - 255 (in 10 ms incr.)
2 = Mismatch		Default is 5
3 = Noread		
4 = Trend Analysis		

*output mode:***0 = Pulse**

- 1 = Latch Mode 1 (Unlatch Pin)
- 2 = Latch Mode 2 (Unlatch Opposite Condition)
- 3 = Latch Mode 3 (Unlatch Re-enter Read Cycle)

trigger evaluation period:

Any number from 0 - 255
Default is **0**

Output On

Allows you to determine the conditions under which a output pulse will be output (high or low depending on polarity) to the host connector.

Mismatch or Noread. Sends a pulse when the label's data does not match that of the master label, or the label is not decoded before the end of the read cycle.

Good Match. Sends a pulse when the decoded label matches the master label.

Mismatch. Sends a pulse when the label's data does not match that of the master label.

Noread. Sends a pulse when the label's data is not decoded before the end of the read cycle.

Trend Analysis. Sends a pulse when a trend analysis condition is met.

Output Mode

Pulse. Normal mode of operation. Pulled active when Output On condition is met and held active for the duration of the selected pulse width.

Latch Mode 1. (Unlatch Pin)

Pulled active when Output On condition is met and held active until either Input #1 or Input #2 sends a pulse to end the active state.

Note: In order for this mode to work correctly, you must set either Input #1 or Input #2 to the correct polarity and set Input Function for Unlatch Output.

Latch Mode 2. (Unlatch Opposite Condition) Pulled active when Output On condition is met and held active until the opposite condition of the selected Output On condition has been met. For example, if Noread is the selected Output On condition, the Programmable Output will be pulled active on a Noread condition and held active until a Good Read occurs.

Latch Mode 3. (Unlatch Enter Read Cycle)

Pulled active when the Output On condition is met and held active until the Read Cycle is re-entered.

Polarity. Allows you to choose a positive or negative transition for the output pulse.

trend analysis mode:

0 = Image Degradation

1 = Mismatch

2 = Noread*# to output on:*

Any number from 0 - 255
Default is **0**

Chapter 3

Trend Analysis Mode

A pulse will be sent when the value entered for # To Output On has been reached within the trigger window selected in Trigger Evaluation Period.

Note: Image Degradation is for future use and is not functional at this time.

Output #2

Format: <**Kw**output on,polarity, pulse width,output mode trend analysis mode,trigger evaluation period, # to output on>

Functions the same as Output # 1.

Output #3

Format: <**KH**output on,polarity,pulse width,output mode, trend analysis mode, trig evaluation period,# to output on>

Functions the same as Output # 1.

Quality Output

Format: <**KO%** cell damage,symbol contrast,total decode time,capture time,locate time,decode time,pixels per element,ECC level,contrast method,output separator>

% cell damage:	symbol contrast:	total decode time:
0 = Disabled	0 = Disabled	0 = Disabled
1 = Enabled	1 = Enabled	1 = Enabled

capture time:	locate time:	decode time:
0 = Disabled	0 = Disabled	0 = Disabled
1 = Enabled	1 = Enabled	1 = Enabled

pixels per element:	ECC level:*	symbol contrast method:
0 = Disabled	0 = Disabled	0 = Compressed (dynamic read)
1 = Dark elements	1 = Enabled	1 = Full Size (static read)
2 = Light elements		
3 = Both elements		

output separator:
any ASCII character
default is **SP** (space)

* ECC level is found in the Symbol menu.

Serial Verification

Note: This group of commands is not available in the ESP™ menus.

Format: <**KS**command echo status,serial command beep status,control/hex output >

command echo status: serial command beep status:

0 = Disabled

1 = Enabled

0 = Disabled

1 = Enabled

control/hex output:

0 = Control

1 = Hex

Command Echo Status

When enabled, serial configuration commands is processed and the new string for that command is echoed back to the host. If an invalid command is sent to the host, the reader will echo back the current setting of that command. For example, if the current Noread Message is "NOREAD" and <Kk1, NONSENSE> is entered, the reader will echo back <Kk1, NOREAD>. In this example the attempted entry "NONSENSE" exceeds the maximum allowable seven character. Therefore it is rejected and the current NOREAD message is echoed back and remains the Noread Message. It is important to note that if a command with multiple fields is processed, some of the fields may have been processed properly following an "invalid" command. These changes will be in the string echoed back so that you will know what did or did not change.

Serial Command Beep Status

When enabled, the reader beeps once whenever a serial command is entered to indicate that the command was accepted and processed. If an invalid command is entered, the reader beeps five times to indicate an invalid entry. However, this does not necessarily mean that all data fields have been entered incorrectly. Only one bad field needs to be found in order to activate the five beep response.

Control Hex Output

Determines response to an Echo serial command or status request command. When set to Control, ASCII control character output is enabled. for example a carriage return would be output as ^M. When set to Hex, the output is the actual character, for example, a carriage return would be output as "D".

Illumination

Internal Illumination

Format: <**KR***status,LED illumination time*>

<i>status:</i>	<i>LED Illumination time:</i>
0 = Disabled	Any number between 0-65535
1 = Enabled	Default is 25641 (16.66 ms). (in 0.65 μ s Increments)

External Illumination

Format: <**KY***status,source,stroke edge,pulse width*>

<i>status:</i>	<i>source:</i>	<i>stroke edge:</i>
0 = Disabled	0 = Continuous	0 = Negative
1 = Enabled	1 = Strobe	1 = Positive

Illumination Settings

Format: <**KZ***shutter time,contrast,offset,AGC max.*>

<i>shutter time:</i>	<i>contrast:</i>	<i>offset:</i>
0 = 1/60	Any number between 0-255	Any number between 0-255
1 = 1/125	Default 200	Default 150
2 = 1/250		
3 = 1/500		
4 = 1/1000		
5 = 1/2000		<i>AGC maximum:</i>
6 = 1/4000		Any number between 0-255
7 = 1/10,000		Default 255

Shutter Time. Shutter Time allows you to set shutter time down to 1/10,000 of a second.

Note: If you adjust Shutter Time in the ESP™ Illumination menu, you can select even shorter times, down to 1/100,000. This is possible because the ESP™ adjusts LED Illumination Time to effectively achieve exposures consistent with shutter times less than 1/1000. Therefore it is recommended that you use Shutter Speed either here or in ESP™ to adjust exposure.

Image Settings

Format: <**Kx***threshold type,quiet zone color,number of symbols to find,fixed threshold value,flag early out*>

threshold type:

0 = Adaptive

1 = Fixed

quiet zone color:

0 = Black

1 = White

number of symbols to find:

Any number from 1-6

Default is **1**

fixed threshold value:

Any number from 0 to 255

Default is **125**

flag early out:

0 = Disabled

1 = Enabled

Chapter
4

Utilities

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Operational commands for the Quadrus™ reader can be entered as serial command strings or, in most cases, as menu selections via the Quadrus™ ESP™.

This chapter includes both operational serial command strings and corresponding ESP™ commands.

Summary of Serial Operational Commands

Table 4-1 Summary of Serial Operational Commands

Command Type	ESP™ Cmd?	Serial Command	Name
Read Rate	Yes	<C>	Enter Decodes/Second Read Rate Test
	Yes	<Cp>	Enter Percent Read Rate Test
	Yes	<J>	Exit Read Rate Test
Counters	Yes	<O>	Noread Counter Reset
	Yes	<N>	Noread Counter Request
	Yes	<T>	Trigger Counter Request
	Yes	<U>	Trigger Counter Reset
	Yes	<V>	Match Code/Good Read Counter Request
	Yes	<W>	Match Code/Good Read Counter Reset
	Yes	<X>	Mismatch Counter Request
Trigger	No	<t...,...>	Trigger Delay Number,Value
	No	<t#?>	Request Trigger Delay Value
Master Label	No	<E>	Enable Match Code
	No	<F>	Disable Match Code
	Yes	<)XXXX)>	Send Master Label
	Yes	<)>	Request Master Label Data
	Yes	<))>	Delete Master Label Data
	Yes	<G>	Store Next Label Scanned as Master Label
	No	<G...>	Store Next Label Scanned as Master Label #____
	No	<M...,...>	Send Master Label # and Data
Checksum	Yes	<!>	Display Checksum of application software
	Yes	<#>	Display Software Part Number

Table 4-1 Summary of Serial Operational Commands

Command Type	ESP™ Cmd?	Serial Command	Name
Interface (Outputs and Resets)	Yes	<L1>	Output # 1 Pulse
	Yes	<L2>	Output # 2 Pulse
	Yes	<L3>	Output # 3 Pulse
	Yes	<A>	Reset
	Yes	<Ad>	Restore Default Operating Parameters
	No	<An>	Read Saved Operating Parameters
	No	<Af>	Read Saved Factory Settings
	Yes	<Z>	Save for Power-on
	No	<Zd>	Restore Default Operating Parameters & Save for Power-on
	No	<Zp>	Save Factory Settings
Download	Yes	<d1>	Send Application Code
	Yes	<d3>	Send Image File
Receive	No	<u1>	Receive Active Image (659 x 494 pixels)
	No	<u2>	Receive Compressed Image (82 x 61 pixels)
	No	<u3>	Receive Entire CCD Image (780 x 517 pixels)
Status	No	<?>	Request Reader Error Status
	No	<?1>	Request Software Status
Self Test	No	<\$>	Self Test & Output Results
Imaging	No	<c>	Image Capture
	No	<D1>	Capture and Decode Image
	No	<D2>	Decode Current Image
Histogram	No	<h1>	Histogram Request
	No	<h2>	Histogram Statistics Request
Matrix	No	<e>	Number of Pixels per Element

Most of the commands listed above can be also be accessed from the **Utilities** menu.

Chapter 4

For your convenience, at the bottom of each utility menu, you will see a **Options** button which when clicked allow you to address specific scanners on a multidrop network.

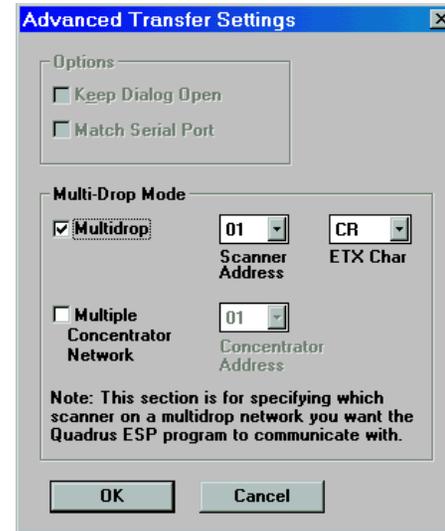


Figure 4-1 Options

Read Rate

You can check the percentage read rate by accessing **Read Rate** from the Utilities pull down menu or clicking the **Utilities** button and **Read Rate** tab to see the following:

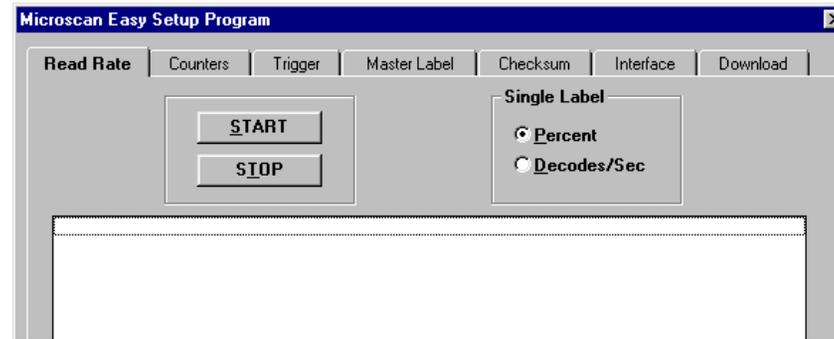


Figure 4-2 Read Rate

With a readable symbol in place and **Percent** enabled, click **Start** to see the read rate percentage.

<C> Decodes/Second Read Rate Test

Click on **Decodes/Sec.** under Single Label and click **Start** or send **<C>** to enter Decodes/Second Read Rate Test to output the decodes per second and label data (if any) for single labels. The Decodes/Second Read Rate Test processes 25 images and records the time required to do so. The decodes per second is then calculated from this value.

<Cp> Percent Read Rate Test

Click on **Percent** and click **Start** or send **<Cp>** to output the percentage of scans decoded and label data (if any). The Percent Read Rate Test processes 25 images and calculates the percentage of good decodes.

<J> Exit Read Rate Test

Click on **Stop** or send **<J>** to end Decodes/Second Read Rate Test **<C>** or Percent Read Rate Test **<Cp>**.

Counters

You can request counter numbers or reset the counters by accessing **Counters** from the Utilities pull-down menu or by clicking the **Utilities** button and **Counters** tab to see the following:

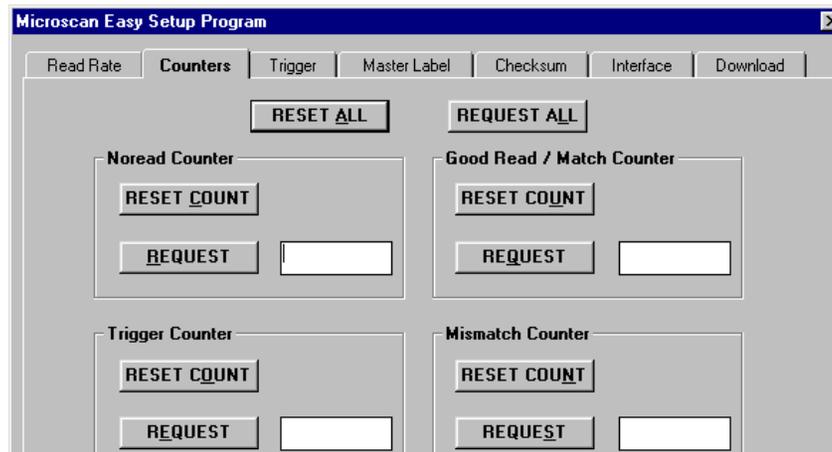


Figure 4-3 Counter

The Xs in all counter commands denote a numeric value from 00000 to 65,535. After reaching the maximum numeric limit of 65,535, an error message will be displayed and the counter will automatically rollover and start counting again at 00000. To obtain the cumulative total of counts after the rollover has occurred, add 65,536 per each rollover (the reader does not keep track of the number of rollovers) to the current count.

Note: All counter values will be lost if you cycle power to the reader or send an **<A>** command.

Clicking **Reset** for any counter will reset that counter to 0.

Clicking **Request** for any counter will return the current number for that counter.

<N> *Noread Counter Request*

Clicking **Request** or sending serial command **<N>** displays the total number of noreads that have occurred since power-on or the last Noread Counter Reset command.

<O> *Noread Counter Reset*

Clicking **Reset** or sending serial command **<O>** sets Noread Counter to 00000.

<T> *Trigger Counter Request*

Clicking **Request** or sending serial command **<T>** displays the total number of triggers since power-on or the last Trigger Counter Reset command.

<U> *Trigger Counter Reset*

Clicking **Reset** or serial command **<U>** sets the trigger counter to 00000.

<V> *Match Code/Good Read Counter Request*

Clicking **Request** or sending serial command **<V>** displays the total number of good reads matching the master label or, if Match Code is not enabled, the number of good reads since power-on or the last Match Counter Reset command. This counter is always enabled, but will only work as a match count when Match Code is enabled. If Match Code is not enabled, this counter records the number of good reads. This count can be requested at any time.

<W> *Match Code/Good Read Counter Reset*

Clicking **Reset** or sending serial command **<W>** sets the Match Counter to 00000.

<X> *Mismatch Counter Request*

Clicking **Request** or sending serial command **<X>** displays the message the number of labels successfully read that do not match the master label since power-on or the last Mismatch Counter command.

<Y> *Mismatch Counter Reset*

Clicking **Reset** or sending serial command **<Y>** sets the Mismatch Counter to zero.

Trigger

A serial trigger initiates a read cycle in the reader. It is useful testing the reader in a triggered mode.

You can select, set up, and send serial trigger characters by accessing **Trigger** from the Utilities pull-down menu or by clicking the **Utilities** button and the **Trigger** tab to see the following:

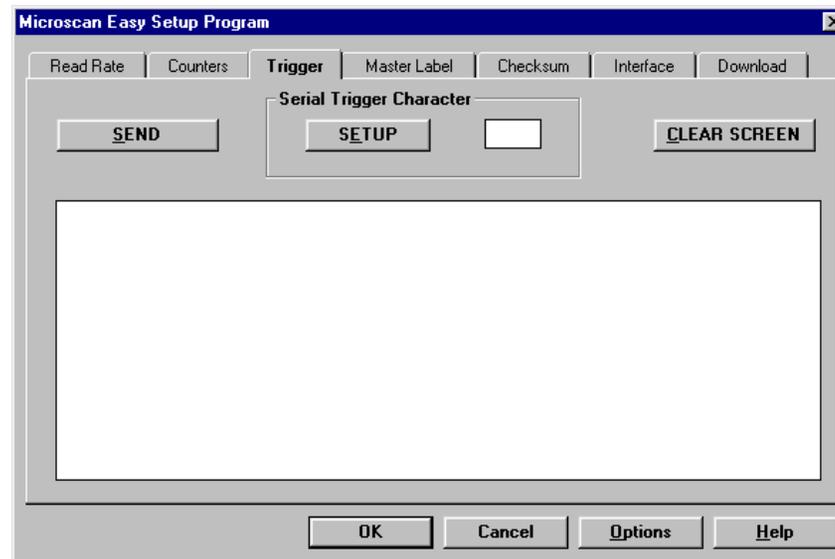


Figure 4-4 Serial Trigger Character

Setup

Clicking **SETUP** loads the current serial trigger character.

Send

Clicking **Send** sends a trigger character to the reader.

Note: The trigger character can also be defined by serial configuration command as <Ki...> (see "Serial Trigger Character" on page 3-11).

<t...> Multiple Trigger Delays

Format:

<ttrigger delay # [1 to 10], trigger delay value [0 - 65,535 in 46 μ s incr.]>

You can enter the trigger delays for the multiple triggers from a single trigger event mode of operation. You enter the trigger delay number, followed by a trigger delay value. The multiple triggers from a single trigger mode functions as follows:

The multiple triggers from a single trigger mode functions as follows:

1st Trigger Delay = Normal Trigger delay set up using the <KG> command.

2nd Trigger Delay = Multiple trigger delay set up using the <t1,XXXXX> command.

3rd Trigger Delay = Multiple trigger delay set up using the <t2,XXXXX> command.

4th Trigger Delay = Multiple trigger delay set up using the <t3,XXXXX> command.

5th Trigger Delay = Multiple trigger delay set up using the <t4,XXXXX> command.

6th Trigger Delay = Multiple trigger delay set up using the <t5,XXXXX> command.

7th Trigger Delay = Multiple trigger delay set up using the <t6,XXXXX> command.

8th Trigger Delay = Multiple trigger delay set up using the <t7,XXXXX> command.

9th Trigger Delay = Multiple trigger delay set up using the <t8,XXXXX> command.

10th Trigger Delay = Multiple trigger delay set up using the <t9,XXXXX> command.

11th Trigger Delay = Multiple trigger delay set up using the <t10,XXXXX> command.

<t#?> *Request Trigger Delay Value*

You can request the trigger delay value for any trigger by entering a question mark (?) immediately following the trigger delay number. For example, if you wanted the trigger delay value for the 5th trigger delay, enter **<t5?>**. If a value of 3500 had been entered, the Quadrus™ would return <t5/X3500>. If no value had been assigned, it would return <t5/0>.

Note: Trigger Delay Value is returned in brackets with a forward slash regardless of the status of Operation Command Output Format.

Master Label

Note: Match code operations are intended for use when the reader is in a triggered mode, that is with an external or serial trigger enabled. If Match Code is enabled while the reader is in Continuous Read, the reader defaults to Continuous Read 1 Output and label data must change before the reader will output data again, unless a timeout, if enabled, occurs.

When a master label has been defined, scanned labels are compared with the master label and under certain conditions relay driver signals may be output and internal counters advanced.

You can set up master label functions by accessing **Master Labels** from the Utilities pull down menu or clicking the **Utilities** button and **Master Label** tab to see the following:

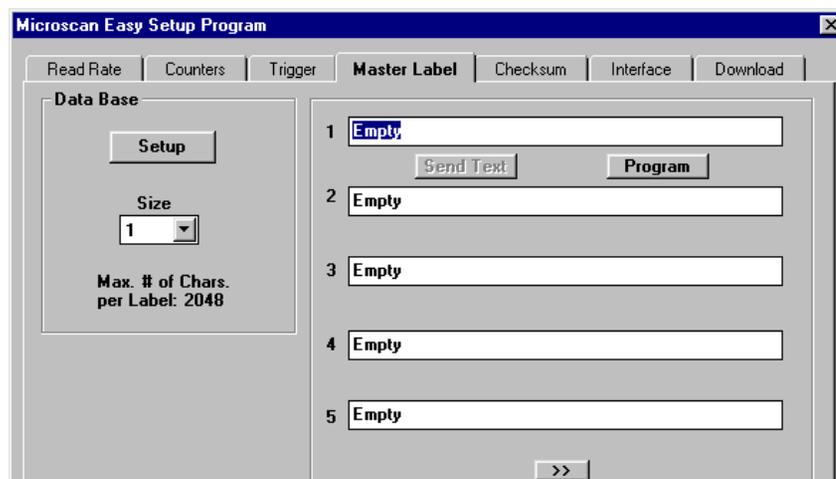


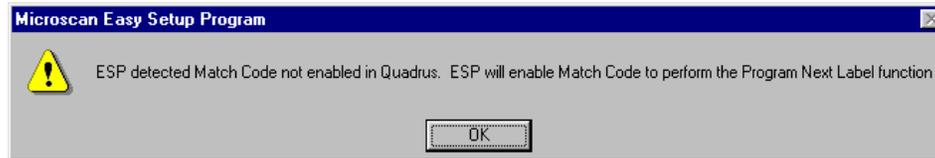
Figure 4-5 Master Label Commands

<E> Enable Match Code

You can enable Match Code by clicking **Setup** in MENU\Operations or by sending **<E>**. This allows you to subsequently enter a master label and begin comparing labels against the master label.¹

You can also enable Match Code (if not enabled) anytime you click the **Program** button in any of the 10 Master Label text blocks. You will see the following message:

1. If no master label is entered following the Enable Master Label, every subsequent decoded label will be a "mismatch" and will increment the mismatch counter by one.



<F> *Disable Match Code*

You can disable match code by clicking **Disable** in MENU\Operations\Match Code Type or by sending an **<E>** command.

After enabling Match Code, a master label can be sent to the reader by entering the master label data by keystroke (SEND) or by instructing the reader to load the next label scanned as the master label (NEXT LABEL/MASTER).

<)> *Send Master Label Data*

Typing in data into the first master label text block of the Master Label dialogue (figure 4-5) and clicking **Send Text** or sending a serial command **<)>** (with data in place of the Xs) sends master label information as Master Label #1 in the master label data base from the host or a terminal. Master label information can be sent at any time and saved in nonvolatile memory with a **<Z>** command. A stored master label will not affect standard operations unless Match Code is enabled. The Xs denote alphanumeric data.

<)> *Request Master Label Data*

Clicking **Setup** in the Master Label dialogue (figure 4-5) or sending serial command **<)>** immediately sends master label #1 data to the host.

Note: If Operation Command Output Format is set for Bracketed, the data from the reader will be returned with brackets and forward slash, such as **<)/XXXX>**.

Note: If the master label information has previously been stored in nonvolatile memory (by a **<Z>** command), cycling the power will restore that information.

<))> *Delete Master Label Data*

Selecting and deleting the data on data line 1 in the Master Label dialogue (figure 4-5) or sending serial command **<))>** deletes master label #1.

<G> *Store Next Label Scanned as Master Label*

With **Serial Data** or **External Edge** enabled, clicking **Setup** followed by **Program** under the #1 master label text block in the Master Label dialogue, or sending serial command **<G>** causes the reader to read the next bar code label scanned as the master label #1 and all subsequently decoded labels are compared against the new master label data. (See "Multilabel" on page 3-12.)

Master label # can be any number from 1 to 10. For example if **<G5>** is entered the next label read will be saved as master Label #5.

Master Label Data Base

All match code operations, except sequential, utilize up to 10 labels that can be saved to non-volatile memory for access on power on.

It is important to note that changing the number of master labels in the data base changes the maximum length for each master label due to a fixed data base size. The maximum characters per each master label as the numbers change, as can be seen in [table 4-2](#) or in [figure 4-5](#). Max. # of Chars. per Label: XXX is updated as you change the total number of master labels.

You can send up to 10 master labels to the master label data base by using this command or by using the Master Label dialogue ([figure 4-5](#)) by clicking **Serial Data** or **External Edge** and clicking **Program** for each master label that you want to add.

<G...> Store Next Label Scanned as Master Label

Allows you to assign a master label number (1 through 10) for the next label you are scanning.

<M...,...> Send Master Label Information

Clicking **OK** or entering **<Mmaster label #,master label data>**¹

<M...?> Request Master Label Data

You can request master label information about a specific master label by following the master label # with a question mark. For example, to request data for master label #5, enter **<M5?>**. Quadrus™ will display master label #5 data in brackets. If no master label data is present then the label number **<M5>** (or **<M/5>** if Operation Command Output Format is enabled) would be displayed without label data.

<M...,> Delete Master Label Data

You can delete specific master labels. For example, to delete master label # 5, enter **<M5,>**. The blank master label data field following the comma tells the reader to delete the indicated master label from the data base.

Table 4-2 Maximum Characters

Master Label Number	Maximum Characters
#1	2048
#2	1024
#3	682
#4	512
#5	409
#6	341
#7	292
#8	256
#9	227
#10	204

1. You can set up your number of master labels by configuration command "[Master Label Database Size](#)" on [page 3-13](#); it will only allow the user Master Labels up to the number of master labels available. So, if the number of master labels has been set to 5, then this command will not allow you to enter a master label # (index) above 5.

Checksum/Part Number

You can request the software part # or check sum figures by accessing **Checksum** from the Utilities pull down menu or clicking the **Utilities** button and **Checksum** tab to see the following:

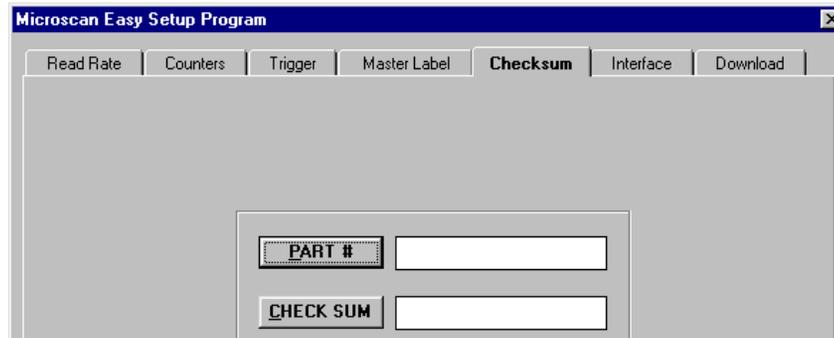


Figure 4-6 Checksum/Part Number

<#> Part Number Request Command

Clicking **Part #** or sending **<#>** displays the software part number as 35-XXXXXX-XX, or as **<#/35-XXXXXX-XX>** if Operation Command Output Format is enabled.

<!> Check Sum Request Command

Clicking **Checksum** or sending **<!>** returns a four-digit hex number (specific to a given software version) used to verify a reader's software.

Interface

You can control pulses and perform resets by accessing **Interface** from the Utilities pull-down menu or by clicking the **Utilities** button and the Interface tab to see the following:

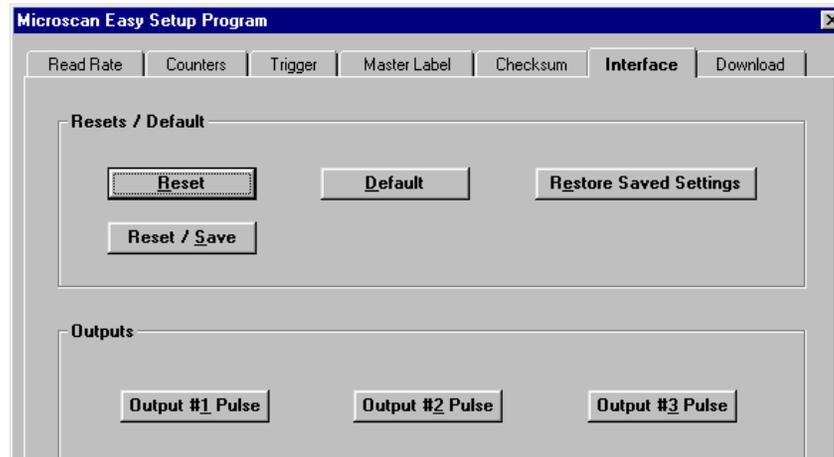


Figure 4-7 Interface

Software Reset

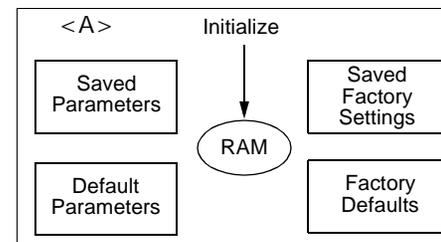
Caution: Record all data that you wish to save prior to sending these commands. A reset will cause the numeric counters in use to lose their count.

For your convenience certain factory settings (Shutter Time, Offset, Contrast, and AGC Max) are saved apart from all other operating parameters. You can define and save your own set of factory settings as “Saved Factory Settings” or recall “Factory Defaults,” those set in the factory and not changeable, at any time. In the following diagrams the oval RAM box represents volatile memory and the rectangular boxes, non-volatile memory. The two rectangles on the right hold the special factory settings, those on the left apply to all other parameters.

The following are accessed in Utilities/Interface menu under Software Reset:

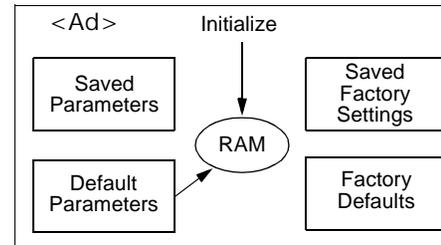
<A> Reset

Clicking **Reset** in the Interface menu or sending serial command **<A>** resets all configuration commands in RAM and resets all counters and operating parameters.



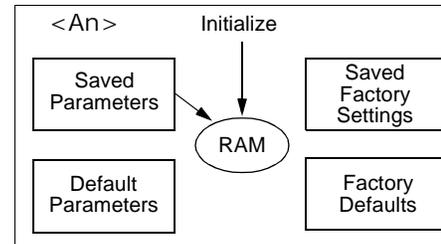
<Ad> Restore Default Operating Parameters

Sending serial command **<Ad>** performs an **<A>** reset and copies default parameters (except factory settings) to RAM.



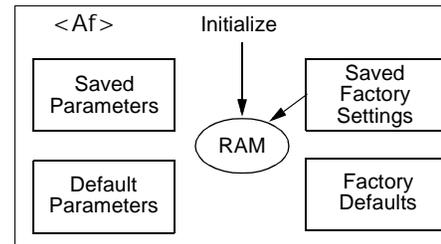
<An> Restore Saved Settings

Clicking on **Restore Saved Settings** in the **Interface** menu or Sending serial command **<An>** performs an **<A>** reset and copies saved parameters to RAM.



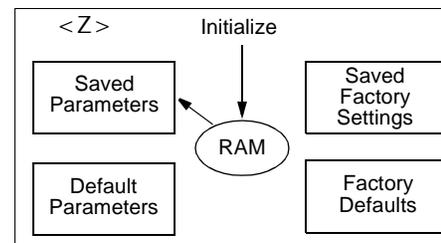
<Af> Read Saved Factory Settings

Sending serial command **<Af>** performs an **<A>** reset and copies saved factory settings to RAM.



<Z> Reset/Save

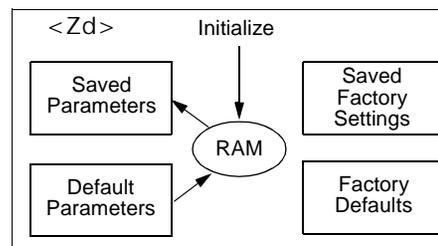
Clicking **Reset/Save** in the Interface menu or sending serial command **<Z>**, performs an **<A>** reset and saves parameters (except factory settings) to non-volatile memory for power on.



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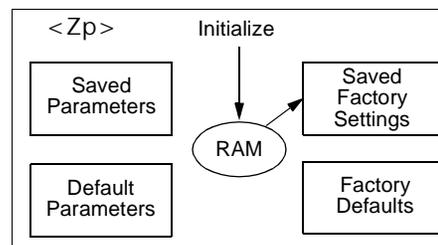
<Zd> Restore Default Operating Parameters/ Save for Power-on

Clicking **Default** in the Interface menu or sending serial command **<Zd>** performs an <A> reset, restores default parameters, and saves them (except factory settings) to non-volatile memory for power on.



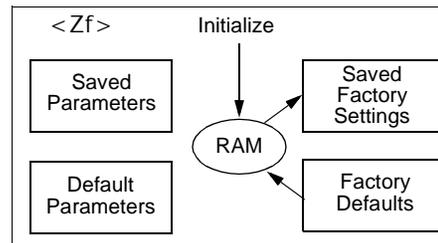
<Zp> Save Factory Settings

Sending serial command **<Zp>** performs an <A> reset and saves **ONLY** factory settings to non-volatile memory for power on.



<Zf> Restore Factory Defaults & Save for Power-on

Sending serial command **<Zf>**, performs an <A> reset, copies special factory defaults to RAM, and saves **ONLY** the factory settings for power-on.



Outputs

<L1> Output # 1 Pulse

Clicking **Output # 1 Pulse** or sending serial command **<L1>** sends a pulse to pin 6 (at any time regardless of Match Code or Output # 1 Driver status).

<L2> Output # 2 Pulse

Clicking **Output # 2 Pulse** or sending serial command **<L2>** sends a pulse to pin 8 (at any time regardless of Match Code or Output # 2 Driver status).

<L3> Output # 3 Pulse

Clicking **Output # 3 Pulse** or sending serial command **<L3>** sends a pulse to pin 15 (at any time regardless of Match Code or Output # 3 Driver status).

Download

You can select and send image files or application code by serial command or by accessing **Send** from the Utilities pull-down menu or by clicking the **Utilities** button and the **Send** tab.

Send Application Code

Caution: Do not update the ap code unless you are certain the .hex file is the correct file for your application and compatible with your ESP™.

If you need to update your application code, use the **<d1>** serial command, or

1. Click **Send Application Code** button and use the dialog box to locate the “ap” code file (ending in .hex).
2. Click **OK**. You should see a solid bar moving across the menu and a message below, as shown in [figure 4-8](#).
3. Be sure to wait for the beep.

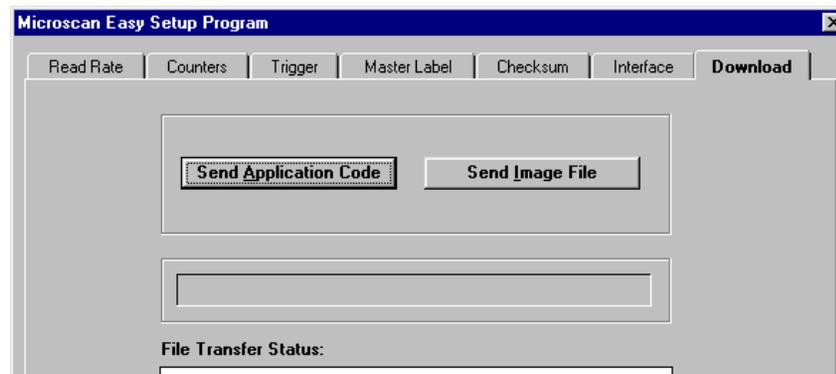


Figure 4-8 Download

Immediately after receiving the Send command, a switch to 8 bit data length (if not already present) must be made for serial communication. The answer from the reader will be ACK (in 8 bit data length).

The following format will then be sent to your reader:

<length indicator(4 bytes), data (binary), CRC (4 bytes)>

Length Indicator

A 4 Byte binary value indicating the length of the binary data file to be sent, most significant byte first. A maximum length of 65,535 can be sent (Length = 0xFFFF). Note that the length does not include the check sum.

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Data

8 bit binary data, either an image file or code.

CRC

Cyclical Redundancy Check. A 32 bit string of the length value and binary data file received.

If the Receive was successful the reader will respond with an ACK, otherwise a NAK will be transmitted. Afterwards the communications will return to the previous data bit length.

Current status and response messages are displayed in the Message Box.

Send Image File

Click **Send Image File** or send **<d3>** to bring up a browse box from which you select an image that is automatically sent to the reader upon selection.

Send Boot Code

Click **Send Boot Code** or send **<d2>** to send a boot code to program the in-circuit flash memory in the reader. A dialogue box appears that prompts you for a password and upon entry, a horizontal bar shows transfer progress.

Self Test

<\$> Self Test Command

Instructs reader to run self test and output results.

```

LABEL1.QDS:2
  Start of System Self Test...
Testing Bus State Controller.....RESULT: = PASSED
Testing Cache Memory.....RESULT: = PASSED
Testing Power Down Register.....RESULT: = PASSED
Testing Interrupt Unit.....RESULT: = PASSED
Testing Direct Memory Controller...RESULT: = PASSED
Testing Divide Unit.....RESULT: = PASSED
Testing WatchDog Timer.....RESULT: = PASSED
Testing Free Running Timer.....RESULT: = PASSED
Testing Host Port.....RESULT: = PASSED
Testing Aux Port.....RESULT: = PASSED
  Start of Memory Test.....
Testing SDRAM.....RESULT: = PASSED
Testing FLASH.....RESULT: = PASSED
  Start of CCD Test.....
Capture Image.....RESULT: = PASSED
Verifying Compressed Image.....RESULT: = PASSED
  Start of FPGA Test.....
Read Write to FPGA Registers.....RESULT: = PASSED
Scanner System Test Passed!
```

Reader Status

<?> Request Reader Error Status

Displays certain operating parameters. After sending <?>, the reader immediately responds with <XX>, where "XX" is a two character ASCII hex value. The hex characters offer a "shorthand" code for displaying status.

To interpret the reader's code, follow this example:

1. You send a <?> command to Quadrus™.
2. It responds with an ASCII hex value of **82**.
3. Refer to [table 4-3](#) to find the Hex value's binary conversion.
4. For example, the binary bit digits for **8** is 1000 and the binary bit digits for **2** is 0010. Hence, the binary conversion of **82** is **10000010**.
5. Next plug in these numbers into the Bin. Code column of [table 4-4](#).

Note: You do this "backwards." That is, from the bottom up, the first binary digit with the last bit.

6. The binary zero indicated a zero status (not enabled), the 1 next to Command Received indicates that the Command Received flag is set.

Table 4-3 Hex Value to Binary Conversion

Hex Value Digits	Binary Bit Digits			
	7	6	5	4
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
A	1	0	1	0
B	1	0	1	1
C	1	1	0	0
D	1	1	0	1
E	1	1	1	0
F	1	1	1	1

Table 4-4 Reader Status from Binary Code

Bit	Reader Status	Bin. digit
0	Command error detected	0
1	Command received	1
2	Communication error detected	0
3	Flash sector unprotect failure	0
4	Host/Aux port buffer overflow	0
5	Reader is in a Read cycle	0
6	Watch dog reset	0
7	Parity (0=enabled, 1=disabled)	1

[Table 4-4](#) shows status byte and the meaning of the individual bits (the bin. digits are only entered as part of the above example):

<?1> Request Software Status

Returns the following in this order: status byte, part-number, Flash checksum, current RAM parameter checksum, and Flash parameter checksum. The status byte is output with brackets around it and the rest of the data is comma delimited with brackets around the packet.

Imaging

You can choose to capture an image and decode, or decode the current image generated from image processing.

<D1> Capture Image and Decode

You first enable the coordinate data output by sending <KP1>. After decoding, the reader outputs the following:

<number of objects,coordinate data,decode status,length of decoded data, decode data>.

The following example represents two objects with one successful decode:

<002,040,050,100,100,025,020,010,010,000,040,023,030,100,125,120,110,030,001,014,ABCD1234000127>

The bold values represent, in order: Number of Objects, Noread, and Good Read.

Number of objects.

Three digit output indicating the number of objects in the field of view. For example, if there are 2 objects in the field of view, as in the above example, it will output as "002".

Coordinate Data

This field outputs the x, y pixel coordinates from top left, top right, bottom left, and bottom right corners of each object, in that order. Each x and y coordinate is represented by three digits and there should be eight fields for each object, separated by commas.

Decode Status

Decode status. A "000" represents no decode and a "001" represents a successful decode.

Length of Decoded Data

Length of each decoded label fields (maximum of 6 fields). In the above example the decoded data has a field length of 14 which is represented as "014".

Decode Data

Decode data for each object that is successfully decoded. In the above example the decoded data is "ABCD1234000127".

<D2> Decode Current Image

Similar to **Decode** command in Evaluation dialog.

Decodes the current image in memory and output either the label data or a NOREAD message. Note, if coordinate data output is enabled, with <KP1>, then the data will be output in the above format; otherwise just the label data or Noread message will

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be output.

<c> Image Capture Command

Similar to **Capture** command in Evaluation dialog.

Captures the image in the field of view.

Histogram

<h1> **<h3>** Histogram Request Command

Similar to **Histogram** command in Calibration dialog.

Allows you to define specific areas of an image for evaluation by providing coordinates in ASCII format.

Format is returned as follows:

<h1*point1.x,point1.y,point2.x,point2.y,point3.x,point3.y,point4.x,point4.y***>** or

<h3*point1.x,point1.y,point2.x,point2.y,point3.x,point3.y,point4.x,point4.y***>**

The coordinates, in ASCII format, are top left to bottom right corner. The Quadrus™ then calculates the histogram from the compressed data that resides inside of these coordinates.

Use **<h3...>** format for ASCII return.

Use **<h1...>** format for 8 bit data communications in binary format

<h2> *Histogram Statistics Request Command*

The Quadrus™ returns the statistics in this format:

<h2*Mean,Median,Variance,Min,Max,Low Peak,High Peak***>**

The statistics data is returned in ASCII decimal format.

Matrix

<e> Number of Pixels per element Command

Outputs the number of pixels per element for current bar code as XX or if Operation Command Output Format is enabled, as **<e/XX>**.

Chapter 5

Calibration

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For many 2D labels, particularly where symbols have low contrast between light and dark elements, you will not achieve the best decode rate without some manual adjustments of the Illumination parameters: Shutter Time, Offset, Threshold, and Contrast. You can adjust these experimentally and by analyzing Quality Outputs, histograms, and line scans.

Calibration is done first statically with a stationary label, and then dynamically, with labels in motion.

Calibration Tips

- Always check the distance from the reader to the label. It should be 2" for UHD model and 4" for high density, and 5" for low density Quadrus™ readers.
- Make certain your reader is angled at least 15° relative to a perpendicular from the label.
- Shorten shutter time for faster moving labels; increase it for slower moving labels.
- Ensure that the threshold is close to midway between histogram curves or use Adaptive threshold.
- Adjust so that histogram curves are widely spaced.
- Make experimental adjustments in small increments, generally no more than 5 at a time.
- Try to balance dark and light pixel per element values.
- Keep a running log of Illumination and Quality Output settings, read rates, and decodes per second and always save settings you may want to revisit.

Locate Label

Refer to the start-up steps in [Chapter 1, “Quick Start.”](#)

1. Place a test label in front of the Quadrus™ at the correct distance with at least 15° pitch.
2. From the main menu click the **CALIBRATION** tab to open the Calibration menu.
3. Click the **LOCATOR** tab. Quadrus™ begins capturing images and searching for symbols. When it finds an object that satisfies Quadrus™' criteria for a symbol, Quadrus™ displays it in the Locator window as an polygon outline, red if an extraneous object or an undecoded label, green if a successfully decoded label. This is measured by the purple bar at the bottom of the image, which in this case is at the 100% read rate mark.
4. At this point you may need to reposition your label or reader to center the image while maintaining the correct distance, and achieving the maximum read rate.
5. Check **Overlay** to see a current screen image of the label similar to the image you see in Illumination.

Note: Check **Mirror** to reverse the image to make the screen object movements congruent with your label movements relative to the reader.

Note: Under Serial Trigger, you should use the default **Continuous** to repeat captures without timing out. Check **One Shot** to check daisy chain input or data from an auxiliary port. If you select Continuous you can see a graphical representation of the percentage read rate in the Read Rate bar at the bottom of the menu.

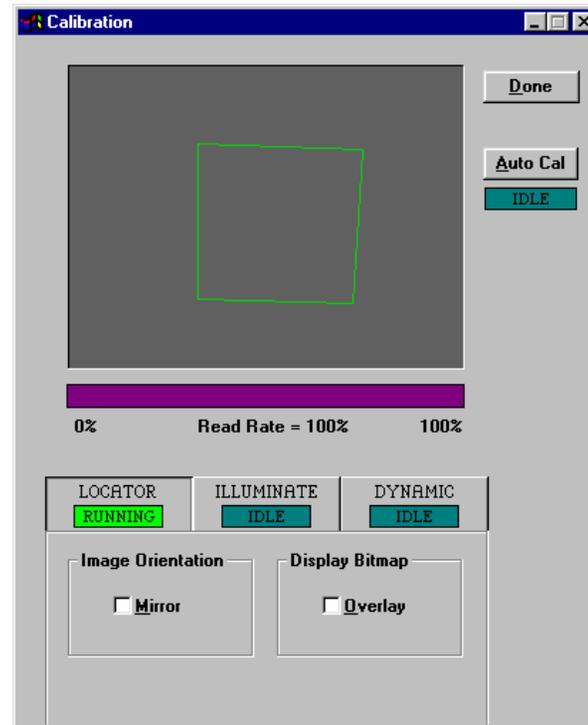


Figure 5-1 Calibration

Illuminate

The Illuminate dialog allows you view the symbol on screen, adjust parameters and immediately review the changes to the image.

1. Illuminate dialog by clicking the **ILLUMINATE** tab.
2. Click **Send** to display the image. (figure 5-2).¹

Note: A blurry image may indicate that the symbol is not at the correct focal length from the reader; however, since this is a compressed version of the image that Quadrus™ has captured, it may give an erroneous indication of an out-of-focus condition. See "Image Flow" on page 6-4 for instructions on receiving a full resolution image from Quadrus™.

Histogram

To generate a histogram for the first time, place the tip of your mouse pointer on the image and double click. Subsequently you just click the **Histogram** button or the **Image** button to toggle back and forth. You can also click the **Statistics** button to see associated histogram data. See sample symbol

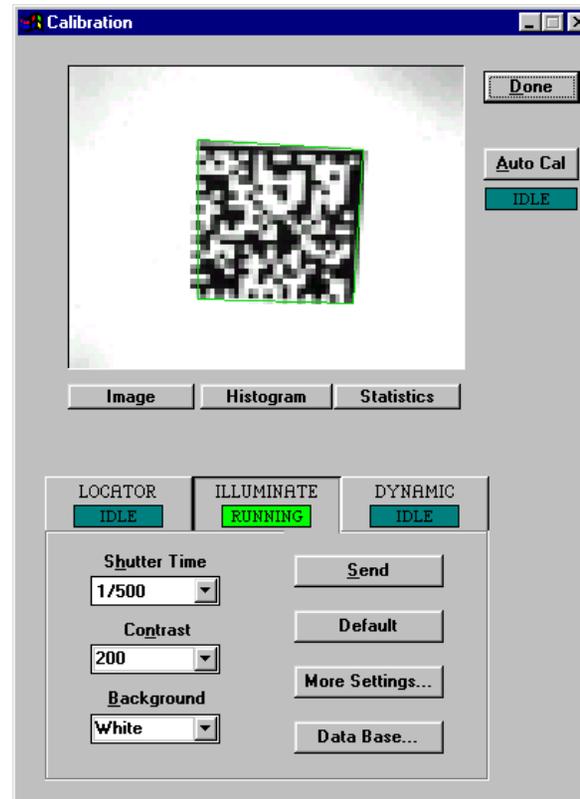


Figure 5-2 Typical Overlay Image

1. You only need click the Send button the first time to generate an image. After this you make adjustments to either Shutter Time, Offset, Threshold, or Contrast and an updated image is automatically generated.

Auto Calibration

If—when in the Illuminate dialog (under Calibration)—you click **Auto Cal**, a dialog like the one in [figure 5-3](#) will appear which lets you set the shutter time or allow the Auto Calibrate routine to calculate it for you by clicking **Calculate**. In general, the faster the application (or line speed), the shorter the shutter time. However it is recommended that you click Calculate.

If you click **Calculate**, you will see a dialog like the one in [figure 5-4](#).

Enter the **Density Type** of your model.

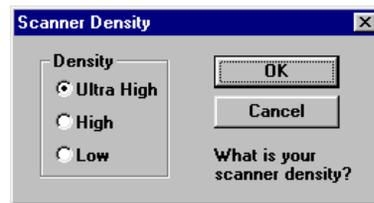


Figure 5-4 Scanner Density

Click **OK** and **OK**. The Quadrus will go through several iterations before picking the optimum settings for your application.

Data Base

If you click **Data Base**, an IP (image processing) data base dialog is opened, such as seen in [figure 5-4](#).

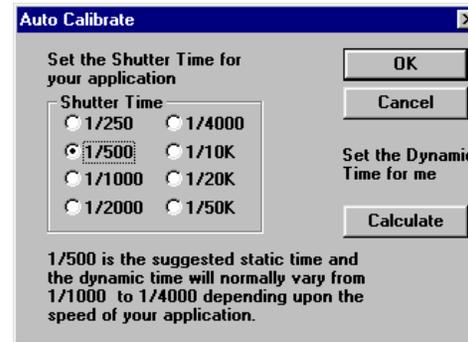


Figure 5-3 Auto Calibrate

Note: The FIS number on your Quadrus' label will identify your model type by its ending: -UHD is "Ultra High" density, -HD is "High" density, -LD is "Low" density, etc.

Click **OK** to set label speed ([figure 5-5](#)).

Enter your label speed in inches per second (2.54 cm/inch for conversion).



Figure 5-5 Label Speed

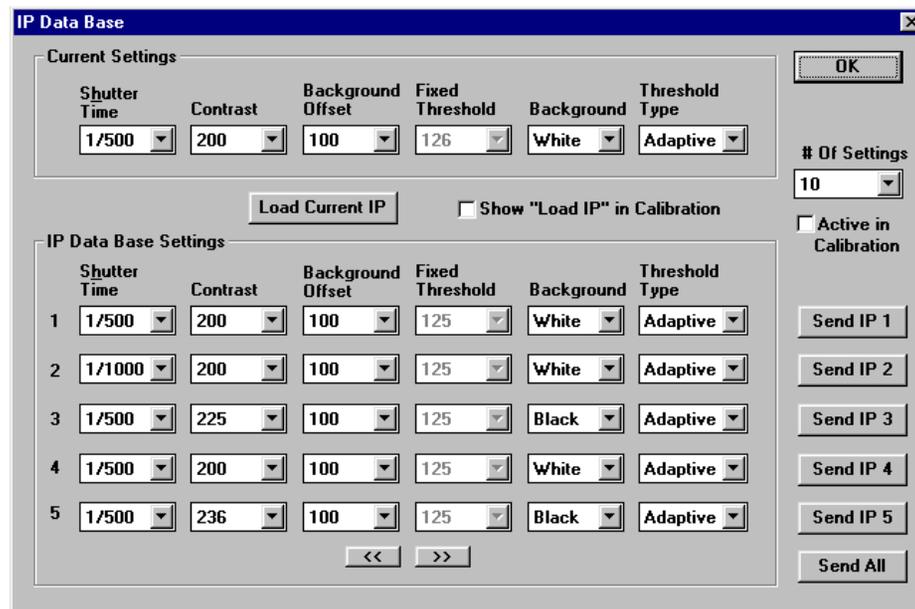


Figure 5-6 IP Data Base

The IP Data Base allows you setup and store a data base with up to 20 different IP (Image Processing) settings for various combinations of symbols and conditions. Clicking the chevrons >> or << at the bottom of the dialog will advance or return you to the next group of 5 settings.

Notice that your current settings are displayed in the block at the top of the dialog. If you click **Load Current IP**, you will see the current settings being applied to the first data base row 1. Each time you click **Load Current IP**, your current settings are applied to data base row 1 and all data base row settings shift down one so that row 2 now has row 1's settings, and so forth on down to the last row whose earlier settings are discarded.

In operation, the Quadrus reads the current settings first. If successfully decoded, it will output the data; if not, it continues on, using the settings from data base row 1, then 2, and so on until the number of settings enabled is reached. When a settings row successfully decodes the symbol, it is moved to Current Settings and the current settings shift down to #1. The settings from #1 drop down into #2, and so forth until all the rows enabled by # of Settings are updated. In this manner, the last successful settings are always applied first.

For each row of settings you will need to click **Send IP [#]** to save these settings to Quadrus. Or you can click **Send All** to send all settings to the reader at once.

When you are in Calibration mode—doing Locator, Illuminate, or Dynamic—you will need to click **Active in Calibration** after you set **# Of Settings** in order to have Quadrus cycle through the data base.

Manual Settings

You can also make adjustments manually while in the Illuminated dialog to Shutter Time, Contrast, and Background (explained in Symbol menu) and, by clicking **More Settings**, you can also set Background Offset and Threshold Type.

At the core of image decoding, each pixel on the Quadrus™ CCD receives a quantity of light that must be designated light or dark. The distribution of these pixels can be understood graphically by histograms. See [Figure 5-8, "Illumination Adjustment Flow,"](#) on page 5-8 for sequence of adjustment for static labels.

Shutter Time

Default: 1/500

Options: 1/60, 1/125, 1/ 250, 1/500, 1/1000, 1/2000, 1/4000, 1/10K, 1/20K, 1/50K, and 1/100K.

The duration that light is received by the reader, similar to the shutter speed of a conventional camera. When shutter time is shortened, less light is absorbed and more pixel values appear on the dark side of the histogram. (For shutter times 1/20K or less, exposure time is controlled by the LED or external illumination duration.) In general, you increase shutter time to lighten the image. However, for moving labels, too long of a shutter time can cause blurring (see "[Adjust Shutter Speed](#)" on page 5-14).

Contrast

Default: 200

Options: 0 to 255

Controls the photo-sensitivity of Quadrus™. Similar to Offset in that higher values lighten the image and vice versa, but all changes are amplified. (In terms of histograms, increasing contrast expands pixel values to the right by a multiplier affect.) Increase contrast when contrast is low (pixels values tightly clustered to the left). Find the upper and lower range of Contrast and set at the midpoint.

Background

Default: 200

Options: 0 to 255

If the finder pattern is **White** (or light, relative the background), the background color should be set to **Black**. The terms Black and White are relative and you should think in terms of lighter or darker.

Background Offset

Default: Medium

Options: Medium (100), Light (150), Dark (50), and Custom (0-255)

Controls overall darkness/lightness. Increasing Offset lightens the overall image and vice versa. (In terms of histograms, pixel values are changed as an additive affect.)

The Find the upper and lower range of Offset and set at the midpoint.

Threshold

Default: Adaptive

Options: Adaptive, Fixed (1-255)

The dividing line between dark and light pixels is represented in Quadrus™ histograms as a vertical dashed line. Threshold should be midway between light and dark pixel clusters. Significant shifts in threshold can make decoding difficult or impossible. If using Fixed Threshold, find the upper and lower range of Threshold and set at the midpoint.

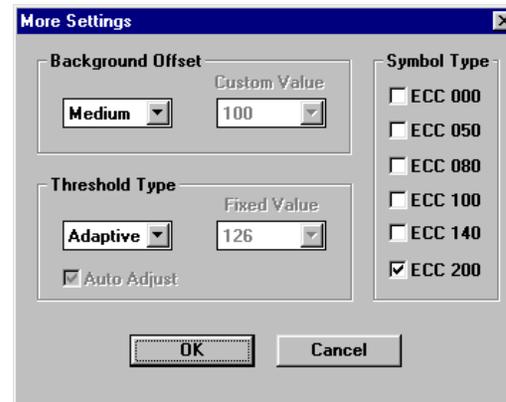


Figure 5-7 More Settings

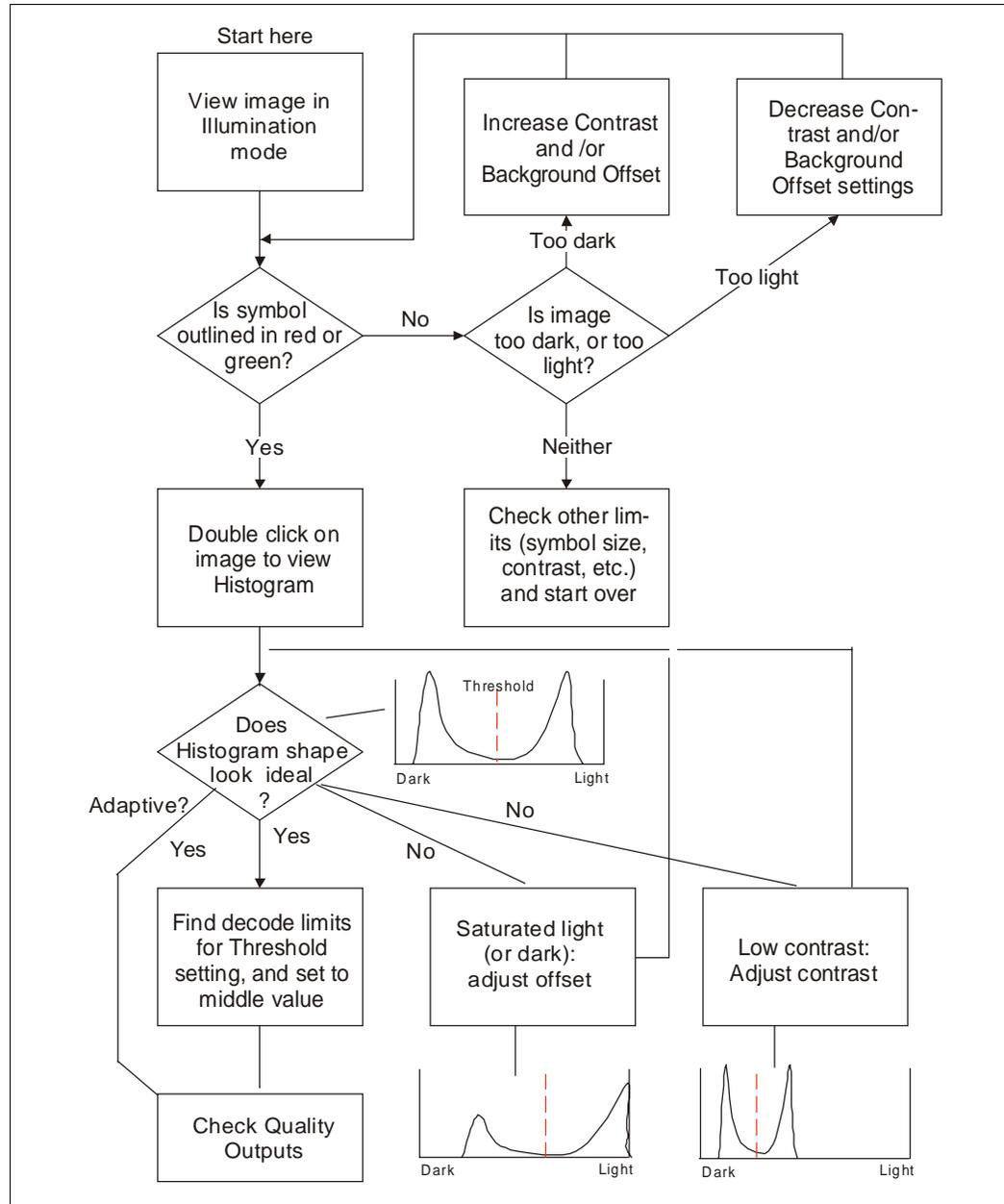


Figure 5-8 Illumination Adjustment Flow

Sample Symbol # 1, Thermal

With a black on white background thermal label, and Using factory defaults, that is, loading an untitled file in ESP™, we did the following:

1. Performed a Locate Label, positioned label, and obtained a 100% read rate.
2. Generated a crisp image in Illumination (figure 5-9).

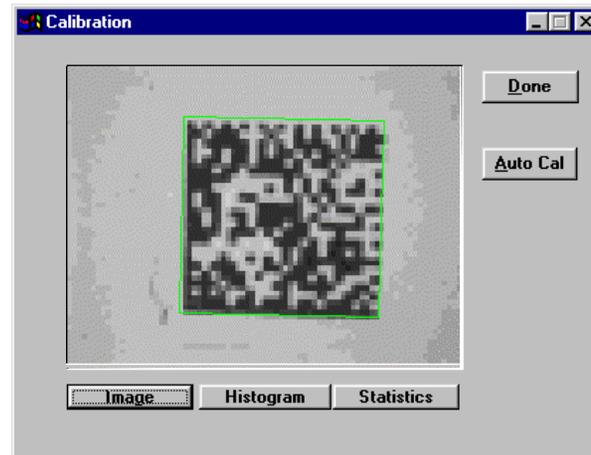


Figure 5-9 Thermal Label Image

3. Generated a histogram that had well-separated light/dark distribution (figure 5-10).

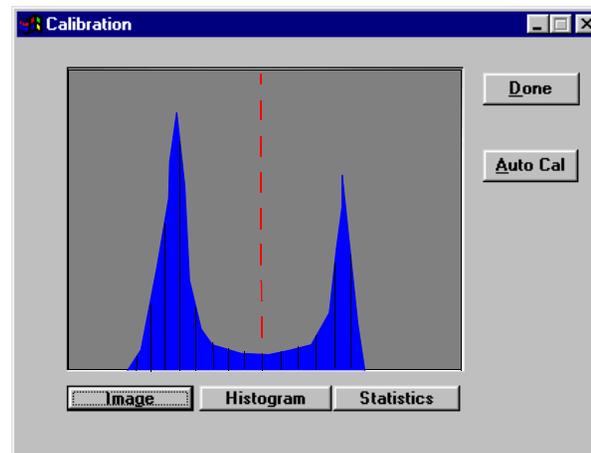


Figure 5-10 Thermal Label Histogram

4. Generated a Quality Output reading of 0 121 186 14 15 (table 5-1).

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With a zero cell damage rate, and a close balance between dark and light ratios of Pixels per Element (14/15), and 100% read rate, there seemed to be little reason to try to improve on these readings.

Sample # 2, Laser Etch

For this example, we used a gold on green background, laser etched label, and a new default ESP™ file.

1. First we selected the Image menu and reversed the background to black (since the green background appeared darker than the etched gold).
2. Then we ran a test image (in Illumination). The result was almost black.
3. To compensate, we doubled the shutter time (from 1/500 to 1/250).
4. Next we increased the contrast to lighten the image. At a value of 210 a green outline appeared around the image, indicating good reads.
5. We continued to increase the contrast until the outlines turned red (at 234).
6. We split the difference and pegged the contrast at 222 (see [figure 5-11](#)).
7. Next we checked the histogram (this looked good) and the Quality Outputs. These were 0 139 208 15 9.
8. The 15 9 indicated a disproportionate white to black pixel ratio and the 208 was slightly above our target of 200 ms to give us our five scans per second.
9. We lowered the offset to 80. This darkened the image and the resulting Quality Outputs was an acceptable 198 for total decode time and dark to light numbers of 14 and 9, a slight improvement.
10. The resulting read rate was 100% and the decodes per second was five, both satisfactory for our purposes.

Table 5-1 Quality Outputs

Label data	% Cell Damage	Symbol Contrast	Total Decode Time	Pixels per Element
0123456789abcdefg	0	121	186	14 15

dark pixels light pixels

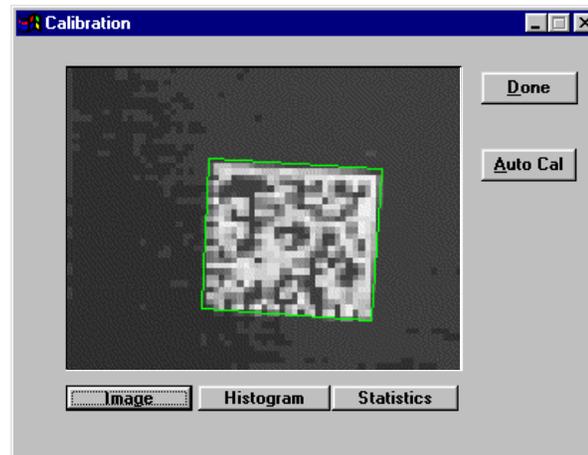


Figure 5-11 Adjusted Laser Etch Image

Quality Output Analysis – Label # 3, ink jet

This symbol was printed on the top of a milk cap, black with a light purple background.

1. After locating the image, we clicked Illumination, then Send, we got a dark image that was only reading at 89% read rate. (figure 5-12).



Figure 5-12 Dark Image

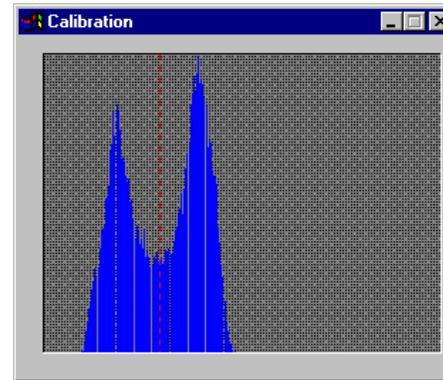


Figure 5-13 Label #3 Histogram

2. When a histogram was generated, the curves were very close together (figure 5-13). So we increased contrast to spread the curves, and decreased offset to lower the brightness.
3. Because of extraneous objects and low contrast inherent in the label, the threshold was not holding from image to image. Therefore we unchecked the Auto Threshold Adjust and set threshold at 70.
4. We succeeded in enhancing the separation by intensifying contrast while bringing down the offset.
5. The result was a histogram that while separated, had too much “noise” and little or no distinction between the light and dark curves.
6. The approach we took was to double shutter time to 1/125 (this brightened the image), compensate for this by decreasing contrast, and increase offset accordingly.
7. Finally, we allowed threshold to float automatically to 134.
8. This worked! The new image was crisp (figure 5-14) and the histogram curves, while low, were wide apart and distinct (figure 5-15). The Quality numbers went to 2 126 158 14 16, all acceptable. Most importantly, the read rate rose to 100%.

Summary

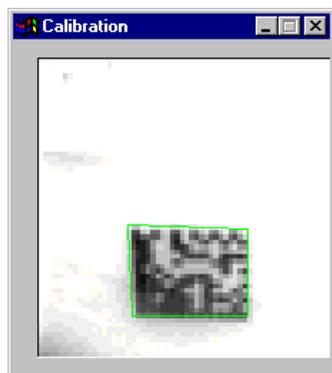


Figure 5-14 Adjusted Image

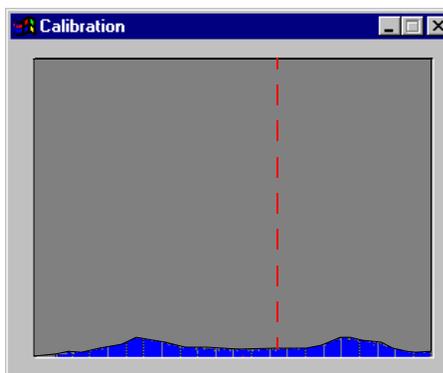


Figure 5-15 Adjusted Histogram

Quadrus™' robust features make the task of adjusting Illumination parameters both challenging and rewarding.

Once again, you can experiment with Illumination parameters by increasing contrast to widen those curves, decreasing offset to lower the overall brightness, holding threshold in one place while you work the other parameters, allowing it to float only when your histogram, quality outputs, and/or read rate have been established.

Remember to double-click the image outline to generate a histogram.

See Calibration Tips at the beginning of this chapter.

You can further analyze and improve read rates by capturing full images and analyzing line scans with advanced features described in [Chapter 6, "Evaluation."](#)

Dynamic Setup

After you've calibrated your static symbol in "LOCATOR" and "ILLUMINATE," you can use Dynamic Setup to configure your application for moving symbol applications.

Trigger Delay Settings (Constant Speed)

The Quadrus™ can capture up to 11 images per trigger, provided you set up the timing for each. When you click Dynamic Setup, the dynamic parameters appear and a symbol outline appears in the Calibration window so you can tell immediately if your image capture is timed correctly.

To setup:

1. Enter the number of image captures in Capture #.
This is the number of images the Quadrus™ will be capturing for each trigger.
2. Calculate the time delay, Delay (Sec), the distance from where the object is detected to the center of Quadrus™ FOV, divided by the speed of the object.
3. This will give you a starting point for your timing.
4. Starting with the first, Capture # 1, enter the time delay in the Delay box. Do the same for all Captures.
5. With your application in motion and symbols moving through the reader's FOV, observe the delay between the trigger event (usually an object detector) and the flash from the Quadrus™. Does the flash occur before or after the symbol passes through the FOV?
6. Use the slider button on the horizontal bar to adjust your timer so that the flashing occurs when the symbol is in passing under the Quadrus™.
7. Notice that the numbers in the Delay window will increment rapidly as you slide the button corresponding to a span of approximately 3 seconds.
8. Check the Calibration window for the appearance of the symbol's image.
9. Fine tune your timer until the image moves to the center of the window.

Clicking to the right or left of the slider button will increment or decrement the timing in small steps. Once you get the image centered with good decodes (green image), move on to Capture # 2 and so on until all subsequent symbols associated with this trigger are timed to pass under the Quadrus™.¹

1. Delay values for each capture number are computed in reference to the initial trigger event, which means that small errors in timing are not cumulative as you setup for subsequent captures.

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10. If you are not getting good reads, do a Capture and Load in Evaluation. If the image appears blurry, the likely cause is label speed. If so, see ["Adjust Shutter Speed."](#)
11. Make shutter speed or any other adjustments as you did in "Illumination" until you get good decodes with the new shutter time.
12. Repeat ["Trigger Delay Settings \(Constant Speed\)"](#) for this symbol, and after a good reads are obtained, move on to Capture Number 2 and subsequent symbols.

If you are getting good reads, but the symbols arrive in the Quadrus™' FOV at varying times, you may need to add another object detector and proceed to ["Trigger Delay Settings \(Variable Speed\)."](#)

Adjust Shutter Speed

Just as with any picture camera, to prevent blurry images you might need to decrease shutter time as the speed of your subject increases. For the Quadrus™, labels should move no more than 2 pixels (and ideally less than 1) over shutter time.

The formula for shutter time is:

$$\text{Shutter Time} = \frac{2 \times \text{Horizontal FOV (in.)}}{659} \div \text{label speed (in./sec)}$$

Where 659 is the number of horizontal pixels in every Quadrus™ and Horizontal FOV (field of view) is 1.67" for the low density model, 1.0" for the high density model, and 0.65" for the UHD model.

For example, a label moving at 10 inches per second past a UHD model,

$$\text{Shutter Time} = \left(\frac{2 \times 0.65}{659} \div 10 \right) = 200 \mu\text{sec}$$

200 μsec is 1/5000 of a second, which for 10 inches per second is your maximum shutter time and of course half this (or 1/10,000) is your ideal shutter time.

Trigger Delay Settings (Variable Speed)

If you are getting good reads, but the symbols arrive in the Quadrus™' FOV at varying times, you may need to add another object detector and configure for two triggers in order to adjust the capture timing of your Quadrus™ to match the arrival of your symbols.

1. Add second object detector halfway between the first detector and the Quadrus™, as in [figure 5-16](#).
2. Configure Menu\Operations\Trigger Setup\Trigger Source for Two Triggers.
3. Click OK, Apply, and Send to Reader.
4. Go back to Calibration\Dynamic Setup and set Trigger Variance for Fixed.
5. This allows you to manually set the first trigger delay.
6. Start up your operation and calibrate your delay for the first symbol just as you did in "[Trigger Delay Settings \(Constant Speed\)](#)."
7. Now set Trigger Variance to Auto.
8. Subsequent trigger delays will be set automatically.
9. If the symbol is not centered in the FOV, set trigger Variance to Fixed again, adjust the Delay to center the symbol, then change the Trigger Variance back to Auto.
10. Repeat for additional captures.

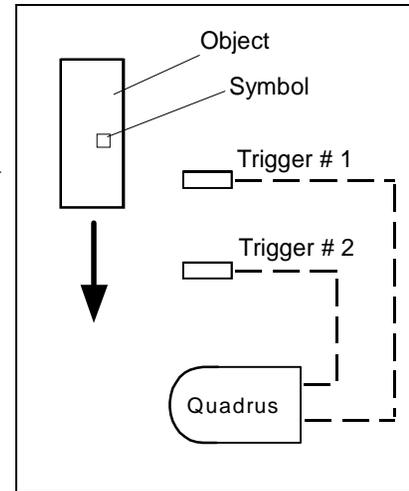


Figure 5-16 Two Trigger Setup

Chapter
6

Evaluation

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Overview

The Evaluation menu and its routines are an integral part of the ESP™. You can use it to evaluate several symbology features and pinpoint problems in your reads and/or symbols.

When you click the **EVALUATION** tab you generate the evaluation dialog and a blank image screen as shown in [figure A-1](#).

The image, captured dynamically from a symbol or received from a previously captured file, appears on the Image View screen.

Image files are saved to disk as **.img** or optionally as **.bmp** for viewing on third party software.

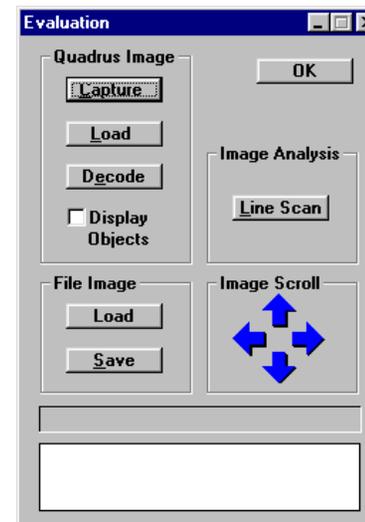


Figure 6-1 Evaluation Menu

Image Source

Reader

When enabled, the image to be evaluated will be received from the Quadrus.

File

When enabled, the image is retrieved from a saved computer image file.

Image Flow

Note: Bypass this procedure if you want to receive and evaluate the last image captured by the Quadrus.

Capture

To capture an image:

1. Ensure that the label is positioned and decodable by checking in **Calibration\Locate**.
2. Open the Evaluation dialog and click the **Capture** button (under **Quadrus Image**) to take a snapshot of the symbol.

You should see the Quadrus flash once as it captures the image.

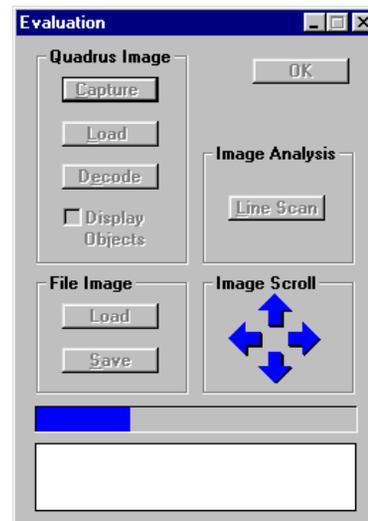


Figure 6-2 Capture and Load

Load

From Reader

Click **Load** (under Quadrus Image) to transfer the image (figure 6-2).

After the bar fills with blue the image is shown in the Image View window (figure 6-3).

Decode

Click the **Decode** button to see the symbol's data displayed in the box below the load bar.

Save

Click **Save** (under File Image) to name and store the image in your computer's files.

(by clicking **Load** under **File Image**)



Figure 6-3 Captured Image

Analysis

Once received, you can analyze line scans that you draw across the image. Because line scans are drawn horizontally, it is recommended that you position your symbol so that the resulting image is perpendicular to the Image View dialog.

Line Scan

You can see a graphic representation of a lineal portion of your captured symbol by:

1. Clicking and dragging your cursor across the symbol in Image View to form a horizontal line (figure 6-4).
2. Next click the Line Scan button to see the plotted line scan (figure 6-5).

You can move this line up or down on this image by clicking on the up or down blue arrows on the left. You can also analyze specific points on the symbol by clicking anywhere along the x-axis to generate a vertical red dashed line. Click right and left arrows to move this line incrementally. In the example in figure 6-5 there are a total of 243 pixels along the horizontal line.

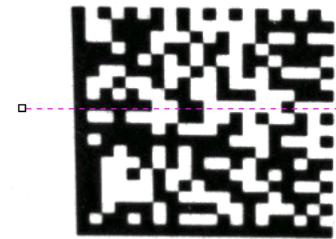


Figure 6-4 Line through Symbol

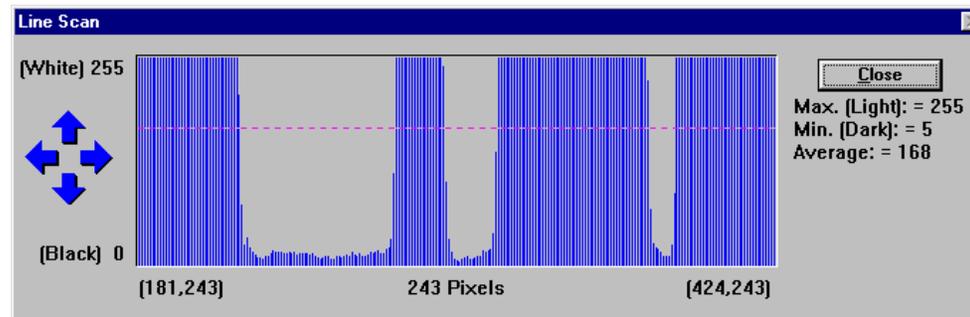


Figure 6-5 Line Scan

Action

After your analysis, you can return to the Calibration menu, make changes in Illumination, then check read rates and resulting histograms and line scans. Be sure to save your settings to file when you arrive at the optimum reads.

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Appendix A — Quadrus™ Specifications

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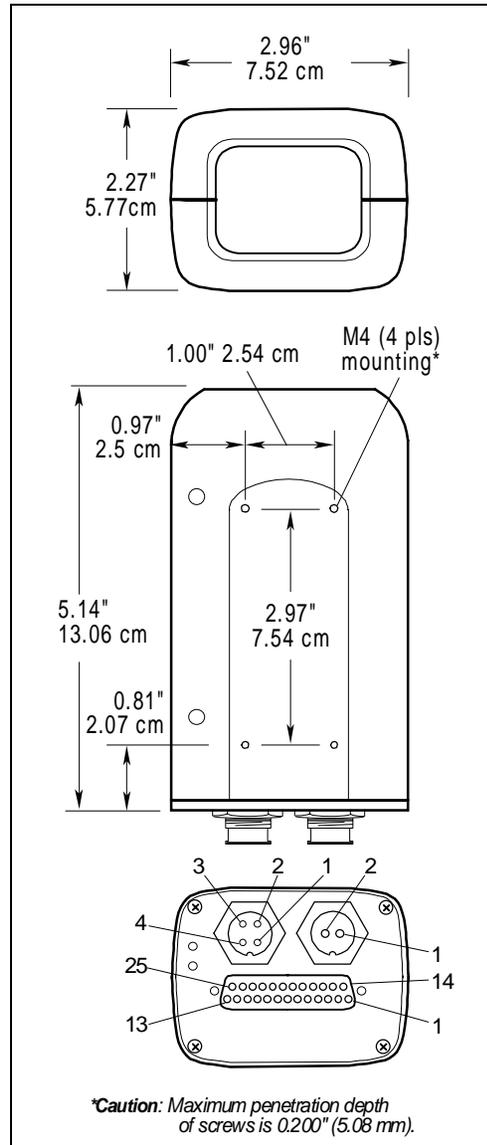


Figure A-1 Quadrus™ Dimensions

Mechanical

- Weight:** 1 lbs. (0.5 kg)
- Housing:** IP65
- Operating temperature:** 0 to 40°C
- Humidity:** 5% to 90% (non-condensing)

Light Source

- Type:** High Output LEDs
- Software-adjustable strobe time

Light Collection

- CCD array, 659 x 494 pixels
- Progressive scan, square pixel

Interface Protocols

- RS-232, RS-422, RS-485

Communication Protocols

- Point-to-point, Point-to-point w/RTS/CTS, Point-to-point w/XON/XOFF, Point-to-point w/RTS/CTS & XON/XOFF, Polling Mode D, Multidrop, User Defined, User Defined Multidrop

Electrical

- Power requirement:** 10 to 28 VDC, max. 3.5 W, max. 2A inrush current

Power Supplies:

- 97-100004-07 120 VAC version
- 97-100004-08 240 VAC version

Safety & Compliance Certifications

- Designed for: FCC, TÜV, CE, UL/cUL
- ISO 9001/Cert. No. 06-1080

Status Lights

Yellow Power LED: On power-on

Green Status LED: Normal operations: illuminates whenever a data matrix label is decoded and remains on until a new trigger occurs. Continuous Read or Continuous Read 1 Output: flashes for each good read.

*Outputs sink 8 mA, source 400 µA

**Inputs $V_{IL} = 0.8V$, $V_{IH} = 2.0V$
(see 74 LS for further details)

*** $V_{IL} = 2.0V$, $V_{IH} = 3.0V$

Appendix B — Electrical Specifications

Host Connector

Mates with 25-pin D-Subminiature socket.

Table A-1 Host Connector

1	Signal ground
2	Transmit data RS-232 (out)
3	Receive data RS-232 (in)
4	Request-to-send (out)
5	Clear-to-send (in)
6	Output-1 (out) (TTL level)*
7	Signal ground
8	Output-2 (out) (TTL level)*
9	Strobe (out)
10	Trigger Input (in) (max. 24 V)***
11	Default (in) (TTL level)**
12	Input-1 (in) (TTL level)**
13	RXD 485 + (in)
14	TXD 485 – (out)
15	Output-3 (out) (TTL level)
16	RXD 485 – (in)
17	Power ground
18	Power 10 to 28 VDC (in)
19	TXD 485 + (out)
20	Aux transmit data RS-232 (out)
21	Input-2 (in) (TTL level)**
22	Ground
23	Aux receive data RS-232 (in)
24	+12VDC (out) @50 mA maximum
25	New master (in) (TTL level)**

*Outputs sink 8 mA, source 400 μ A

**Inputs $V_{IL} = 0.8$ V, $V_{IH} = 2.0$ V (see 74 LS for further details)

*** $V_{IL} = 2.0$ V, $V_{IH} = 3.0$ V

Power Connector

Mates with Microscan power pack PN 97-100001-14 or 97-100001-15, or with Switchcraft EN3C2F16K

Table A-2 Power Connector

1	Power 10 to 28 VDC (in)
2	Power ground

Trigger Connector

Mates with Microscan Object Detector PN 99-440002-01 or Switchcraft EN3C4MK

Table A-3 Trigger Connector

1	Trigger (in)
2	+12 VDC (out) @50 mA maximum
3	Ground
4	Strobe (out)

(Power/Trigger Connector Kit 98-200025-03)

Important Note: When using two triggers (see “Trigger Source” on page 2-17). You can wire two trigger devices to a single input (either pin 1 of the trigger connector or pin 10 of the host connector) provided that you are using open collector devices (“wire-or”); or you can wire two triggers inputs independently, the first to either pin 1 of the trigger connector or pin 10 of the host connector and the second to pin 12 of the host connector.

Appendices

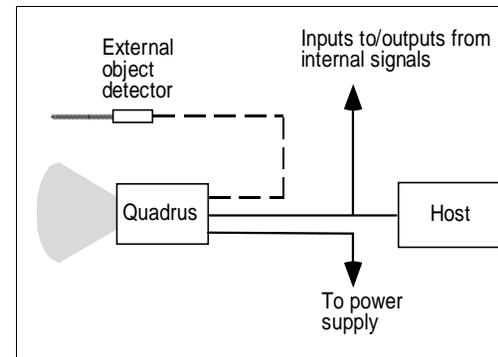


Figure A-2 System Diagram

Ground and Shield Considerations

Proper grounding is necessary for operator safety, noise reduction, and the protection of equipment from voltage transients. Buildings, including any steelwork, all circuits, and all junction boxes must be grounded directly to an earth ground in compliance with local and national electrical codes.

RS-232 signals have a common signal ground (pin 4). Pin 4 is normally connected to pin 13 (chassis ground) in the scanner; however, under certain conditions (e.g., when potential differences exist between power outlet grounds) signal and chassis grounds can be isolated from each other inside the scanner by Microscan technicians.

Ground Loops

Ground loops, signal degradation due to different ground potentials in communicating devices, can be eliminated or minimized by ensuring that both the host, scanner, and their power supplies are connected to a common earth ground.

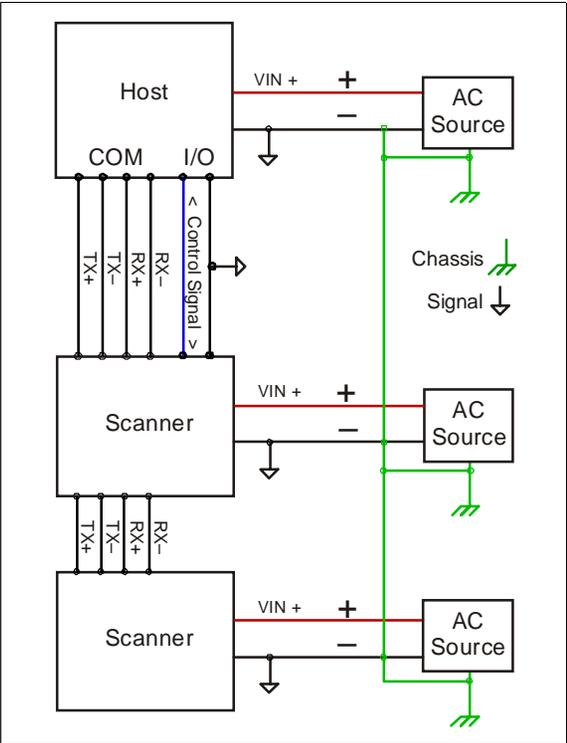


Figure A-3 Grounding Diagram, Scanner-Host

Appendix C — Transferring Files

Receiving Settings

from Quadrus™

If you want your host computer to receive the current settings from Quadrus™, click **RECEIVE FROM READER**.

If receiving scan data and you are in Continuous Read, symbols being scanned may interfere with your data request.

from a File

If you want to load the settings from a saved settings file to your host computer, open the desired file and then click **SEND/NO SAVE** and follow this with **RECEIVE FROM READER**. (Clicking **RECEIVE FROM READER** in this context ensures that the reader's current settings will appear in your host settings list.)

Saving Current Configuration

to Quadrus™

You can save in two ways:

1. Click **Apply** in the current menu page. **Note:** Selecting OK on these menu pages will only update the items in the Current Settings window.
2. From within the SEND/RECV box, click **SEND/NO SAVE** to initialize settings and reset counters only, or click **SEND/SAVE** to initialize, reset counters, and save these settings to the Quadrus™'s memory for power up.

to File

You can save a file by selecting **SAVE AS** (or **SAVE**) from the File pull-down menu. The settings are saved only on the computer's hard drive or other storage media. This is particularly useful for backing up files or for configuring multiple configurations.

Creating a New Configuration File

To create a new file of configuration settings, first be sure you've saved the current configuration file to the computer's hard drive or other storage media. Next pull down the **File** menu in the ESP™ and select **New**. A new Untitled window will open with a listing of the factory default settings. Change these settings to suit your requirements and save this file to the computer's hard drive under a new name.

You can also load, edit, and save an existing configuration file.

Restoring Factory Default Settings

Note: Be certain that you've saved any other configuration files to the host computer that you may want to reload later.

Defaulting by Menu Commands

Default settings can be reset for individual menu pages or for all menus at once.

To restore factory defaults for individual menus (Communications, Operations, Code Types, or Reader Settings),

1. Click the **DEFAULT** button on the specific menu,
2. Click **SEND/NO SAVE**, and then **RECEIVE FROM READER**.

To restore factory defaults for ALL menus, select the **DEFAULT** button on the Reset page of the Utilities menu.

Defaulting by New

1. Close and save your current file.
2. Select **New** in the File pull-down menu.

The resulting File will have your original factory default settings. Give it a new name and save to it as you make changes.

3. Click **SEND/NO SAVE**, and then **RECEIVE FROM READER**.

See "[Software Reset](#)," on page 4-14 for a complete discussion of transfer options.

Appendix D — Maximum Symbol Sizes

Each of the three Quadrus™ models—low density, high density, and ultra high density (UHD)—have finite fields of view that limit symbol size as well as the number of characters per element dimension. A symbol does not exceed the maximum symbol size if its diagonal dimension plus 25% is not greater than the Y dimension of the Quadrus™’s field of view. For example the diagonal dimension plus 25% of a 30 mil symbol with 22 x 22 elements is equal to 2.0" which is less than 1.5".

Low Density Symbol Sizes

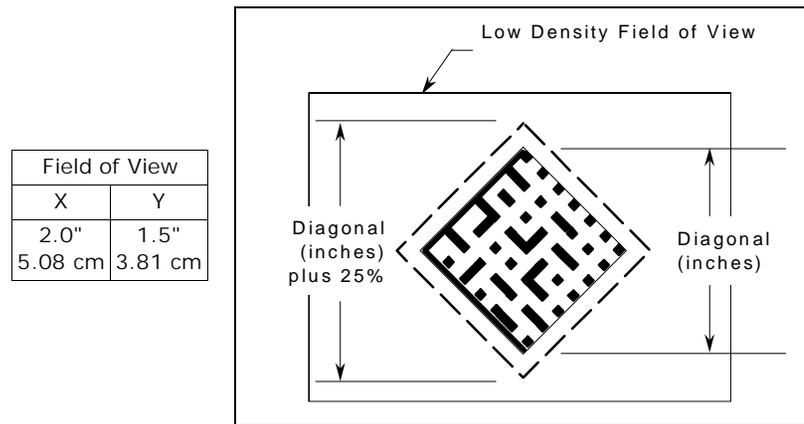


Figure A-4 Low Density Symbol Size Limitations

Table A-4 Maximum Symbol Size by Element (Low Density)

		Element				
		13 mil	15 mil	20 mil	25 mil	30 MIL
Square Symbols	Row x Col. in elements	52 x 52	44 x 44	32 x 32	26 x 26	22 x 22
	Diagonal symbol size plus 25%	1.195" 3.04 cm	1.167" 2.96 cm	1.131" 2.87 cm	1.149" 2.92 cm	1.167" 2.96 cm
Rectangular Symbols	Row x Col. in elements	16 x 48	16 x 48	16 x 16	16 x 36	6 x 12
	Diagonal symbol size plus 25%	0.822" 2.09 cm	.949" 2.41 cm	1.265" 3.21 cm	1.231" 3.13 cm	1.074" 2.73 cm

High Density Symbol Sizes

Field of View	
X	Y
1.0"	0.75"
2.54 cm	1.9 cm

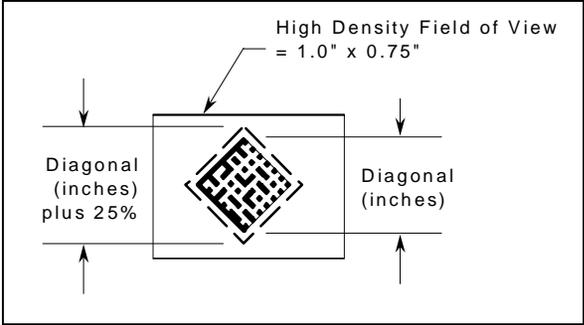


Figure A-5 High Density Size Limitations

Table A-5 Maximum Symbol Size by Element (High Density)

		Element						
		8 mil	10 mil	13 mil	15 mil	20 mil	25 mil	30 mil
Square Symbols	Row x Col. in elements	52 x 52	40 x 40	32 x 32	26 x 26	20 x 20	16 x 16	14 x 14
	Diagonal symbol size plus 25%	.735" 1.87 cm	.707" 1.80 cm	.735" 1.87 cm	.689" 1.75 cm	.707" 1.80 cm	.707" 1.80 cm	.742" 1.88 cm
Rectangular Symbols	Row x Col. in elements	16 x 48	16 x 48	16 x 36	16 x 36	12 x 26	8 x 12	8 x 12
	Diagonal symbol size plus 25%	.506" 1.29 cm	.632" 1.61 cm	.640" 1.63 cm	.739" 1.88 cm	.716" 1.82 cm	.451" 1.15 cm	.541" 1.37 cm

UHD Symbol Sizes

Field of View	
X	Y
0.65"	0.47"

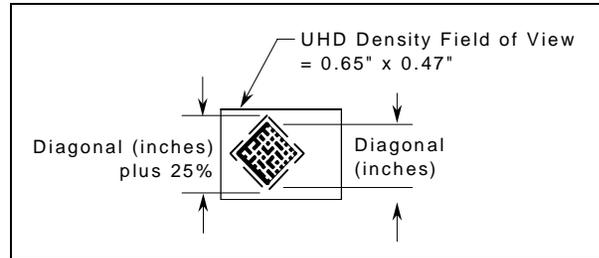


Figure A-6 *Quadrus™* UHD Symbol Size Limitations

Table A-6 Maximum Symbol Size by Element (UHD — Ultra High Density)

		Element						
		5 mil	8 mil	10 mil	13 mil	15 mil	20 mil	25 mil
Square Symbols	Row x Col. in elements	52 x 52	26 x 26	24 x 24	18 x 18	16 x 16	12 x 12	10 x 10
	Diagonal symbol size plus 25%	.460" 1.14 cm	.368" 0.93 cm	.424" 1.08 cm	.414" 1.05 cm	.424" 1.08 cm	.424" 1.08 cm	.442" 1.12 cm
Rectangular Symbols	Row x Col. in elements	16 x 48	36 x 48	12 x 26	8 x 12	8 x 12	8 x 12	
	Diagonal symbol size plus 25%	.316" .803 cm	.394" 1.00 cm	.358" .909 cm	.234" .594 cm	.270" .686 cm	.361" 917 cm	

Appendices

Appendix E — Optional Equipment

Universal Stand

The Microscan Universal Stand is available in 4-inch, 6-inch, and 10-inch flex models.

- 4-inch, knob adjustable handle 98-200008
- 6-inch, knob adjustable head and foot 98-200007
- 10-inch flex neck, adjustable head 98-200006
- 7-1/4-inch extension kit 98-200024

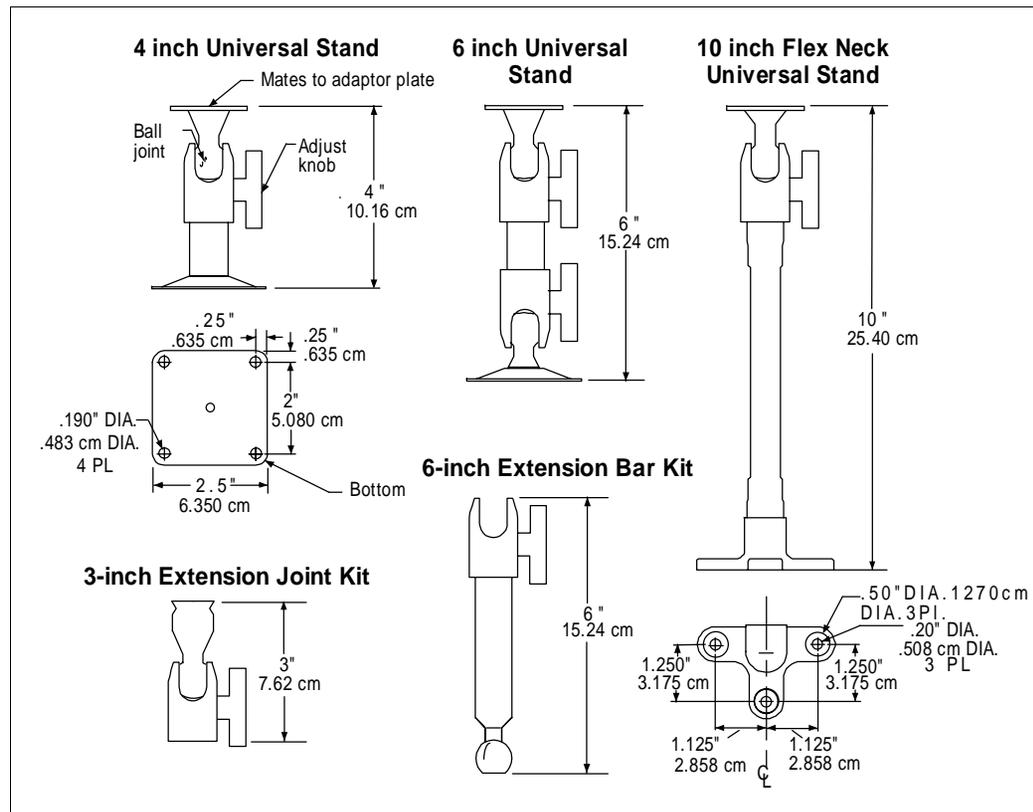


Figure A-7 Universal Stand

Adaptor Plate

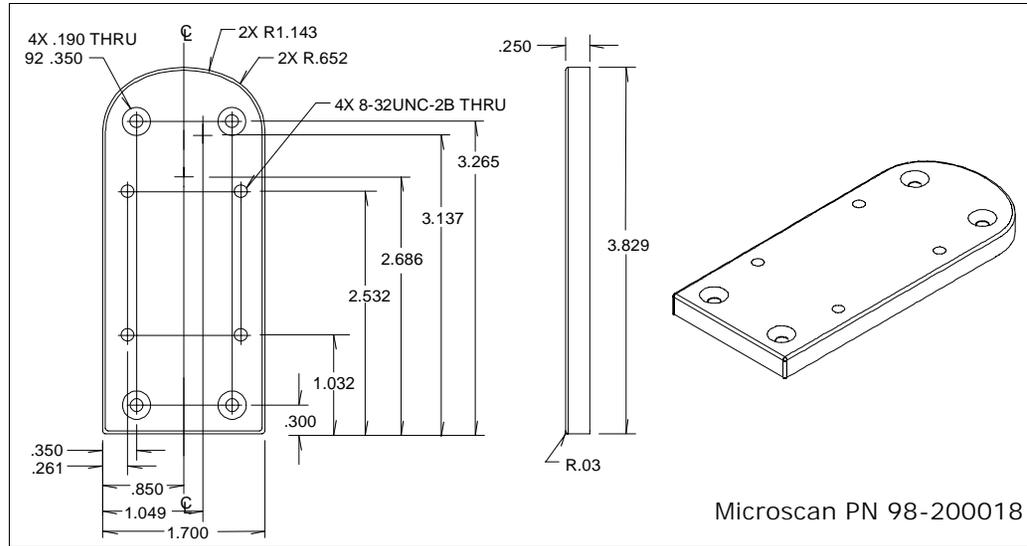


Figure A-8 Adaptor Plate -- Quadrus™ to Universal Stand

Appendices

Base Plate

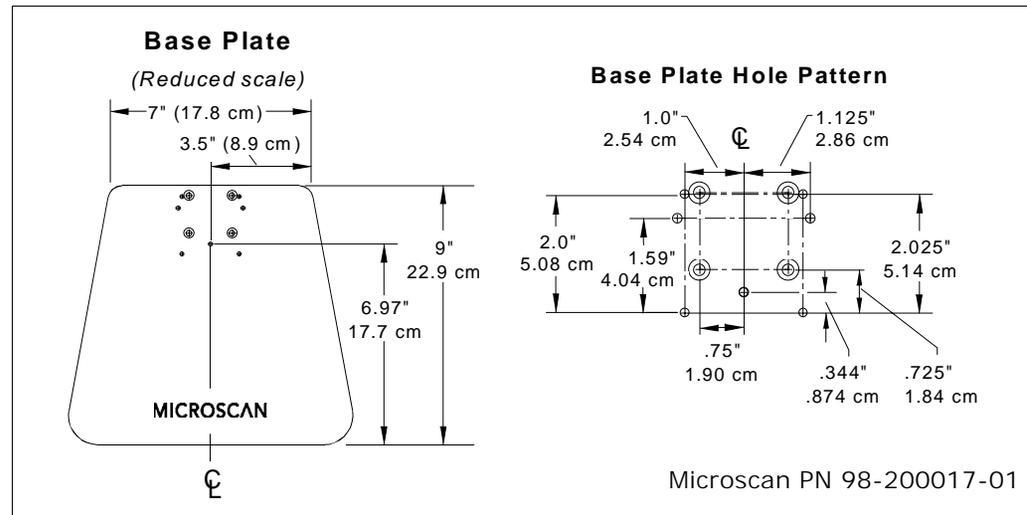


Figure A-9 Base Plate

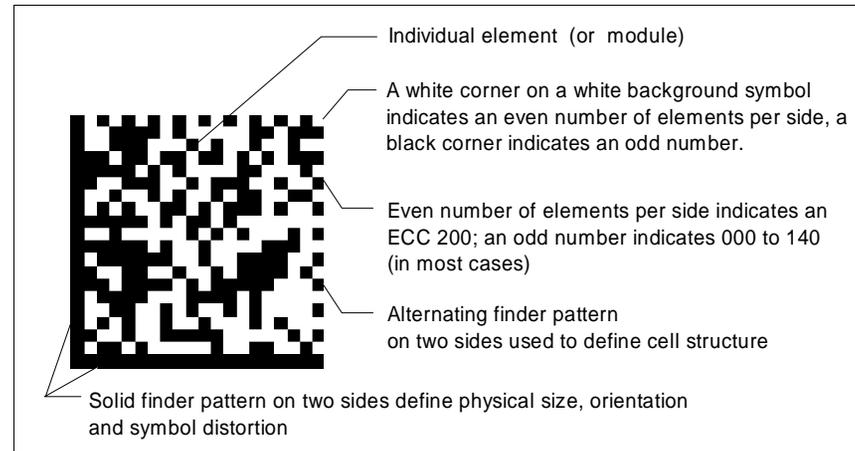
Appendix F — ASCII Table

Table A-7 ASCII Table with Control Characters

Appendices

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 G — Data Matrix Symbology¹



Appendices

Figure A-10 Data Matrix ECC 200 Symbol

Symbol Features	ECC 000 - 140	ECC 200
Number of rows and columns (including finder pattern)	Odd (except for some closed applications)	Even
Element in upper right hand corner	Dark (for light background labels)	Light (for light background labels)
Error correction routine	Convolution	Reed-Solomon
Symbol sizes (not including quiet zones)	17 to 21 sizes (squares only)	24 squares 6 rectangular
Append in structured format	No	Yes, up to 16 symbols
Subdivide code word stream into blocks for error detection	No	Yes, for symbols with more than 255 code words
Extended channel interpretation for other character sets	No	Yes, optional
Data encoded in:	Base 11, 27, 41, 37, ASCII, 8-bit Byte	ASCII, C40, text, X12, EDI-FACT, and Base 256

1. For complete specification, see *International Symbology Specification-Data Matrix*, by AIM International; <http://www.aimi.org>

Pixels and Elements

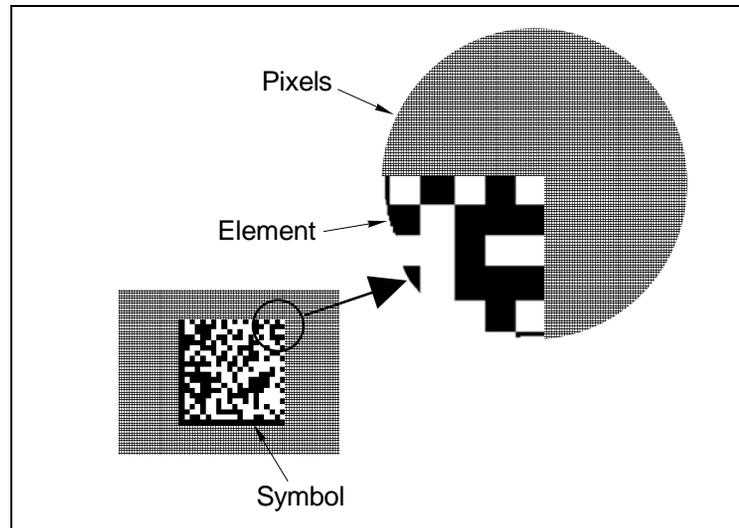


Figure A-11 Pixel/Element Relationship

Figure A-11 shows the relationship between pixels and an ECC 200 symbol. Each reader density model (UHD, High Density, and Low Density) has a minimum pixel to element ratio For successful decoding, which depends on illumination, orientation, and quality of printing.

Symbol Sizes

Since symbols are positioned an exact distance from the front of the Quadrus™, it is possible to calculate the limits to the size of symbols for each density model. Tables A-4, A-5, and A-6 show precise sizes per element size for EEC 200 symbols. These are calculated for the worse case scenario; each symbol is rotated diagonal to the shorter Y (height) dimension of the reader's field of view and 25 percent additional space is added on to this to allow for quiet zones.

Appendix H — Histograms

To generate a histogram, place the tip of your cursor on the red or green border line of the object, and double click. The resulting histogram can be seen in [figure A-12](#).

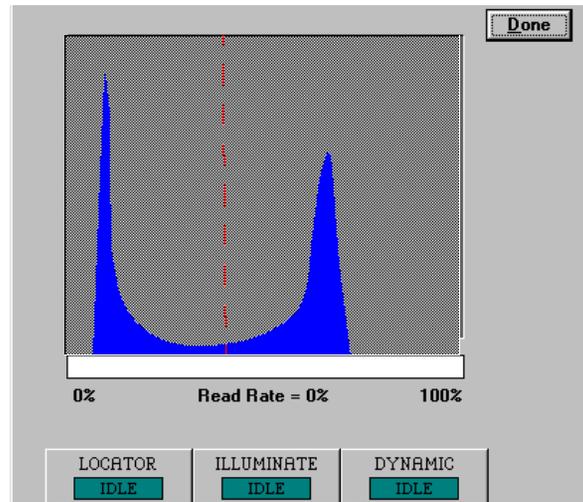


Figure A-12 Histogram 1

Histogram

A histogram is a graphical presentation of the numeric count of the occurrence of each intensity (grey level) in an image. The horizontal axis is the values of grey levels and the vertical axis is the number of pixels for each grey level.

The vertical dashed red line is the threshold that separates pixels interpreted as black from those designated as white, those to the left being black and those to the right being white. Good Image contrast usually has a bimodal histogram with its low and high peaks as far apart as possible.

To see statistical information of the histogram click the Statistics button ([figure A-13](#)).

- To move the peaks further apart, increase the contrast. For example, changing Contrast to 190 produces a wider histogram as seen in [figure A-14](#).

Since Auto Threshold Adjust is enabled, Threshold has changed from 100 to 126. This keeps the red line centered between the peaks.

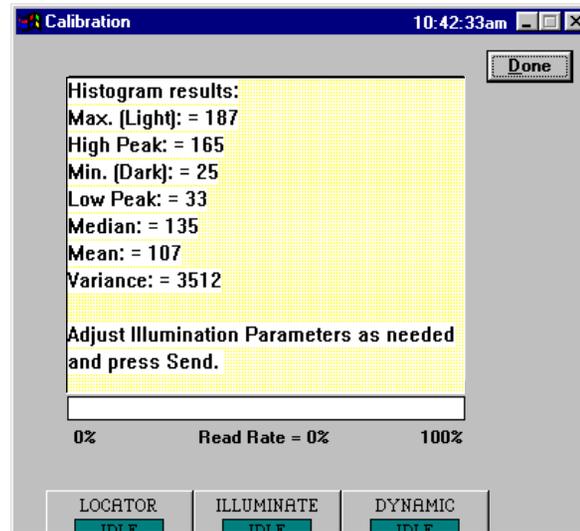


Figure A-13 Statistics for Histogram 1

As shown in [figure A-14](#), the histogram peaks have moved apart.

- Now, if you reduce the offset and further increase the Contrast, you will get an even better histogram.
- Test by clicking the Image and Statistics buttons.

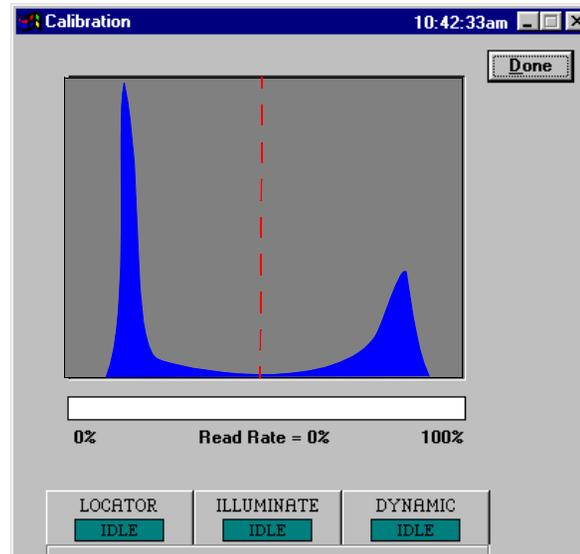


Figure A-14 Histogram 2

Appendix I — Multidrop Communications

This appendix describes the rules for setting up a concentrator or controller to communicate with a Quadrus™ in standard Multidrop protocol, as presented in “Protocol Menu,” on page 2-9.

Figure A-15 shows a typical Multidrop network in which 1 to 50 readers can communicate with a host via an intermediary device, a concentrator or a controller.

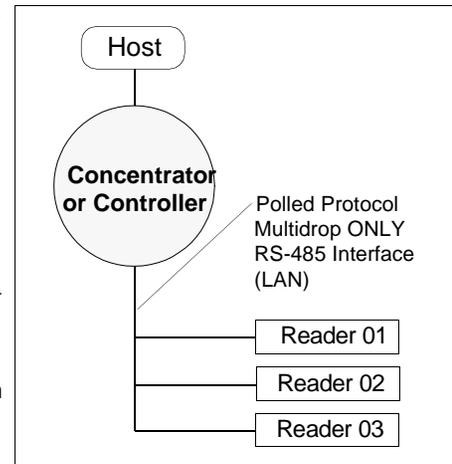


Figure A-15 Typical Multidrop Network

Multidrop Addresses

- No two readers in the Multidrop Network can have the same address.
- Each reader in the network must have an address (from 01 to 50) assigned in its configuration program.

Each address has its own separate poll and select address (from 1C to 7F hex as shown in table A-8 on page A-19).

For example, during a polling sequence, Reader 03 expects a 20 hex (“SP” ASCII poll character) from the concentrator. And during a select command, it looks for a select value 21 hex (“!” ASCII select character).

Polling Sequence

Data that is transmitted to the host (bar code data, noread messages, counters, etc.) via concentrators is solicited by poll requests from the host.

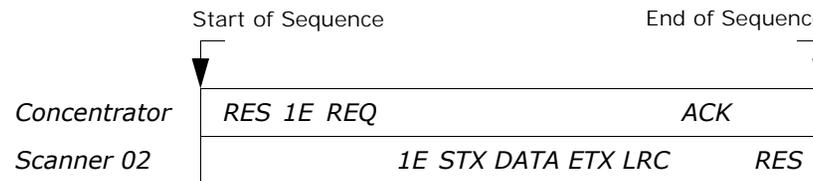


Figure A-16 Polling Sequence

The polling sequence example in figure A-16 begins with a RES (reset) from the concentrator followed by poll address 1E (ASCII hex value for Reader 02) and a REQ (request). The reader responds by first transmitting its own address, 1E, followed by a STX (start of text) character, and then the data. Next it transmits an ETX (end of

text) character and an LRC (longitudinal redundancy check) character.

If the concentrator (or controller) receives the data from the reader and is able to validate it with an LRC calculation, it responds with an ACK (acknowledgment). If the reader in turn sends the ACK, the reader ends this successful exchange with a RES (reset).

Polling Reset

- If the reader has no information, it responds to a poll request by transmitting a RES (reset).
- If the reader receives a NAK instead of the ACK after transmitting its data string, it will transmit the data string again up to three times. If the reader still does not receive an ACK, it will transmit a RES (reset) and discard the data in its buffers.
- If the READER transmits data to the concentrator and the concentrator responds with an ACK or NAK, but the reader doesn't receive the concentrator's response, the reader will timeout and transmit a REQ to the concentrator and request another response. If after three retries (the number of times it transmits a REQ to the concentrator) the reader receives no response, it ends the transmission with a RES (reset).

Select Sequence

Unlike poll requests, select commands always originate from the host and consist of serial configuration or operation commands to devices that are configured in Multi-drop. The reader complies with the command when it is polled during the cycle.

Figure A-17 is an example of a select sequence.

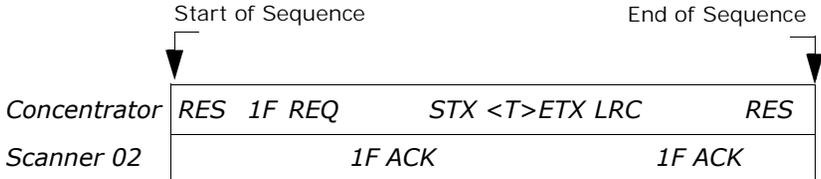


Figure A-17 Select Sequence

A RES (reset) is the first command in the select sequence. The 1F hex is the select address associated with Reader 02 address (see table A-8 on page A-19). It is followed by a REQ (request). The reader responds with its own select address, 1F hex, and an ACK (acknowledge). The concentrator then transmits an STX (start of text), the data (in this case a <T>), an ETX (end of text), and an LRC character.

The reader replies by transmitting its own address, followed by an ACK, acknowledging receipt of the command. Upon receipt of an ACK, the concentrator concludes the successful exchange with a RES.

In the example above, the reader only acknowledges a trigger counter request from the concentrator. It does not respond to the trigger counter request until a subsequent poll. For example, if the reader's trigger count was 12 at the time the trigger

counter request was received, on a subsequent poll it would transmit 02T/00012. (The 02 at the beginning of the string is the reader's address.)

Select Reset

- If the reader receives bad data from the concentrator, it transmits a SEL (its select address) and a NAK to the concentrator. The concentrator transmits the data up to three times. The concentrator will end the sequence with a RES (reset) if no ACK is received.¹

Table A-8 Multidrop Address Characters

Multidrop Address	Poll Character		Select Character		Multidrop Address	Poll Character		Select Character	
	ASCII	HEX	ASCII	HEX		ASCII	HEX	ASCII	HEX
01	^\ 	1C	^] 	1D	26	N	4E	O	4F
02	^^ 	1E	^- 	1F	27	P	50	Q	51
03	SP 	20	! 	21	28	R	52	S	53
04	" 	22	# 	23	29	T	54	U	55
05	\$ 	24	% 	25	30	V	56	W	57
06	& 	26	' 	27	31	X	58	Y	59
07	(	28	)	29	32	Z	5A	[	5B
08	* 	2A	+ 	2B	33	\	5C	]	5D
09	, 	2C	- 	2D	34	^	5E	_	5F
10	. 	2E	/ 	2F	35	`	60	a	61
11	0 	30	1 	31	36	b	62	c	63
12	2 	32	3 	33	37	d	64	e	65
13	4 	34	5 	35	38	f	66	g	67
14	6 	36	7 	37	39	h	68	i	69
15	8 	38	9 	39	40	j	6A	k	6B
16	: 	3A	; 	3B	41	l	6C	m	6D
17	< 	3C	= 	3D	42	n	6E	o	6F
18	> 	3E	? 	3F	43	p	70	q	71
19	@ 	40	A 	41	44	r	72	s	73
20	B 	42	C 	43	45	t	74	u	75
21	D 	44	E 	45	46	v	76	w	77
22	F 	46	G 	47	47	x	78	y	79
23	H 	48	I 	49	48	z	7A	{	7B
24	J 	4A	K 	4B	49	|	7C	}	7D
25	L 	4C	M 	4D	50	~	7E	Δ	7F

1. For additional information on Multidrop, see the MS-5000 Multidrop Concentrator User's Manual.

Appendix J — Glossary of Terms

Adaptive. Routine in Quadrus™ code that sets threshold from data acquired from the current read only. (See Fixed.)

Bandwidth. Range of frequencies (energy transitions) that are allowed to pass through bandpass filters during signal processing.

Baud Rate. The term used to describe the number of discrete signal events per second. In RS-232 and RS-422/485 systems, baud rate is the same as bits per second (bps).

Bimodal. Relating to a histogram. Two peaks showing definite separation between light and dark values.

Bin. An individual stack of pixels at a given grey scale value on a histogram.

Capture. A single frame, shot, or picture. The total CCD image acquired by the Quadrus™ and held in its buffer for analysis and decoding.

CCD Array. The grid of CCDs (literally, “charged-coupled devices”) in a linear or 2D reader that senses light.

Configuration. The method used to change factory default settings for operational features to match a specific application. Configuration can be done through the ESP™ menus or with serial commands.

Connector. Physical device (plug or socket) on unit or cable to provide in/ out connectivity for various circuits and pins.

Convolution. Error correction scheme used by ECC 000 - 140.

Counter. Memory space provided to keep track of read cycle events.

CRC. Cyclical Redundancy Check. A 32 bit string of the length value and binary data file received.

Data Matrix. Two-dimensional code type characterized by arrays of square elements and a finder pattern.

Decode Rate. The number of good reads per second decoded by the reader.

Default. The original factory settings.

Defaulting. Act of resetting the reader to the original factory settings.

Dynamic Setup. Testing and configuration done with symbols in motion.

ECC 000 to 140. Two-dimensional Data Matrix symbols characterized by an odd number of elements, except for some closed applications.

ECC 200. Two-dimensional Data Matrix symbol characterized by an even number of elements.

Edge. External Triggering mode in which a detected object is recognized by a single edge pulse.

Element. Smallest square-shaped component of a 2D symbol in light or dark contrasting shades.

End of Read Cycle. The time at which the reader stops expecting label information to decode. This can be caused by a timeout, a trigger event, or a good read.

EPROM. Erasable, programmable, read only memory.

Error Correction. Scheme to check accuracy of data.

Fixed. The dividing line between dark and light pixels is represented in Quadrus™ histograms as a vertical dashed line

Flash Memory. Non-volatile random access memory.

Exposure Time. The duration of time the Quadrus™ CCD array is available to capture an image. See Illumination Time.

Frame. A single capture, shot, or picture. The total CCD image received by the Quadrus™ and held in its buffer for analysis and decoding.

Focal Length. The distance measured from the reader to the center of the depth of field, or focal point.

FOV. Field of View. The rectangular pattern in which a label can be read by the CCD array.

Good Match. The event occurring when a scanned label matches the master label information that is stored in the memory of the reader.

Good Read. The event that occurs when a label's data is accurately scanned and decoded.

Histogram. A visual representation of the frequency of various intensities of light (grey levels) in an image.

Illumination. The light, external or internal, flashed over a symbol sufficient to enable the reader to detect each element within a given symbol.

Illumination Time. The duration in which the LED's are held on during image capture. See Exposure Time.

Label Speed. The rate in inches or centimeters per second at which a label moves through the scan beam.

LED Illumination. Internal Quadrus™ light source.

Level. The period of time between the arrival and departure of an object is referred to as "level," a reference to the horizontal signal that is displayed on an oscilloscope.

Line Scan. Graphical representation of the grey scale levels of a selected slice of the image.

Master Label. A label or label data that is stored in the reader's memory and is compared with subsequently scanned labels.

Match Code. The ability to compare data matrix labels being scanned against a master label that is stored in the memory of the reader.

Matrix Symbology. Grid of rectangular elements (or modules) in a regular pattern to represent data for retrieval by a vision scanning system.

Menu Configuration. The process of changing factory default settings via a sequence of menus displayed on a terminal monitor.

Mil. One thousandths of an inch or 0.0254 mm. In bar-coding, a measurement that identifies a data matrix label by the width of its narrowest element.

Mismatch. An event that occurs when the scanned data matrix label does not match the master label that is stored in the memory of the reader.

Module. Another name for Element. See Element.

Noread. A non-read. A condition that occurs when the reader is set up to decode labels, and no labels are scanned during the read cycle.

Null. A non-printed character that acts as a space-holder.

Number of Scans Calculation. The number of times a data matrix label is scanned by the reader during one pass.

Object Detector. A photo electric device used to sense the presence or absence of an object.

One Shot. Single frame or capture.

Operational Commands. Serial commands from the host to the reader that control current operating parameters, counters, master label operations, and program management that are not stored in non-volatile RAM.

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.

Pitch. Label (or reader) rotation around the center of a line parallel to the label's line of travel.

Point-to-Point. A protocol consisting of a single communications event, typically used to connect a data matrix reader to a terminal or host computer.

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

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

Quiet Zones. Specified "clear" (nonprinted) areas between data matrix symbols and other image objects. The quiet zone is greater than one element in width, and should have the opposite reflectance value of the finder pattern.

Read Cycle. A programmed period of time or condition during which the reader will accept data matrix label input.

Read Range. The distances in which a label can be reliably read, as measured from the front of the reader. See "Depth of Field."

Reed-Solomon Error Correction Code. A linear, error correcting block code used

by ECC 200, suited to the correction of character errors which could be, in bar or matrix codes, the obliteration or removal of part of the symbol.

ROM. Read Only Memory. Memory that cannot be changed.

Reader. A scanning device that is comprised of a scan head and a decoder integrated in one package.

Serial Commands. Online data strings (including configuration and operations) from a host or other terminal to the reader, that are always preceded by a < left angle bracket symbol and followed by a > right angle bracket symbol.

Serial Configuration (Host Configuration). Serial command specifically for changing configuration and distinguished from operational command by the fact that they modify the non-volatile for power up configuration. Most of these commands begin with the upper case K character immediately following the left angle bracket symbol, as in <Kg3>.

Single Shot. Single frame or capture.

Skew. Label (or reader) rotation around the center of the skew axis, a line perpendicular to the label's direction of travel and the center of the reader's beam.

Specular Reflection. The direct, mirror-like reflection of light back to the reader, causing saturation.

Static Setup. Menu driven interface to allow testing and adjustment of stationary symbols.

Strobe Pulse. An reader output pulse synchronized to allow external strobe illumination.

Strobe Rate. Number of strobes per second that the reader projects.

Symbology. A set of Data Matrix symbols, such as Data Matrix, that have special rules to define the elements and patterns to represent specific numeric or alphanumeric information.

Tilt. Label (or reader) rotation around the centerline of the FOV. For 2D code, this is 360°.

Timeout. A user-selected period of time that ends a reader's read cycle.

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