LM520 Scanner
Integration & Programming Manual

R44-2016 (Rev. E)

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Section 1
The LM520 Bar Code Scanner

Overview

The LM520 scanner is a compact, decoded, single-line scanner for fixed position or embedded applications, such as conveyor, library, document tracking, chemical analyzers, vending machines, point-of-sale (POS) terminals, and other attended or unattended scanning applications. The LM520 is a complete scanning system, ready to plug in and scan. The LM520 presents a fast, easy and low-cost way to incorporate scanning into any application where you need to read a bar code.

A typical system using the LM520 scanner consists of the scanner itself and a host system such as a PC, POS system, or package sorting system. The host system controls the scanner and receives the decoded bar code data produced by the scanner. The laser in the LM520 scanner emits coherent visible light. When a bar code passes through the scanner's beam, light is reflected off the bar code. The scanner collects this reflected light, processes it into a digital signal and decodes it into data that can be used by the host system. In some cases the data may be processed further by the scanner before being transmitted to the host.

The LM520 has four different operational modes which can be used to scan a bar code. The four operational modes include:

- an external switch such as an output line from a Programmable Controller (also known as a PLC) can be used to enable scanning
- software commands from the host system
- continuous scanning operations, and
- a unique PSC motion detection circuitry called LaserSense™. This circuitry allows the LM520 to only scan when an object is passed in front of it.

The various modes are selected via host commands or special programming bar codes.

Unpacking the LM520

The LM520 bar code scan scanner is shipped in custom packaging. Carefully open the package, and remove the scanner from the packing material.

The LM520 standard configuration includes:

- LM520 scanner
- power supply
- mounting hardware (two bolt studs with nuts)
- interface cable - male DB9 (scanner side) [with optional beeper if ordered]
- diskette with this manual and other information

When you open the shipping carton, visually inspect the package's contents. If any parts are damaged or you need additional hardware, please contact your reseller or the PSC Customer Support Center at 1-800-547-2507.

Scanner Care

The LM520 bar code scanner contains sensitive components which require special handling. PSC Inc. may not warrant damage due to improper handling.

- Do not open the scanner's case. Doing so will void the warranty.
- Avoid touching the front window. Fingerprints will degrade the scanner's performance.
- Only clean the scan window when visual inspection reveals dirt or residue. Remove lint or foreign material be present with filtered clean air. Remove fingerprints or other residue using clean, cotton-tipped applicators dipped in isopropyl alcohol, or with soft tissues dipped in high-quality lens or eyeglass cleaner. Do not reuse cotton-tipped applicators or tissues.
- Do not scrub the window.
- Never wipe the window with a dry tissue or applicator.

Section 2
Mounting the LM520

The LM520 bar code scanner is designed to be mounted to a stand in a fixed position. This section describes the layout of the mounts for optimum scanner performance.

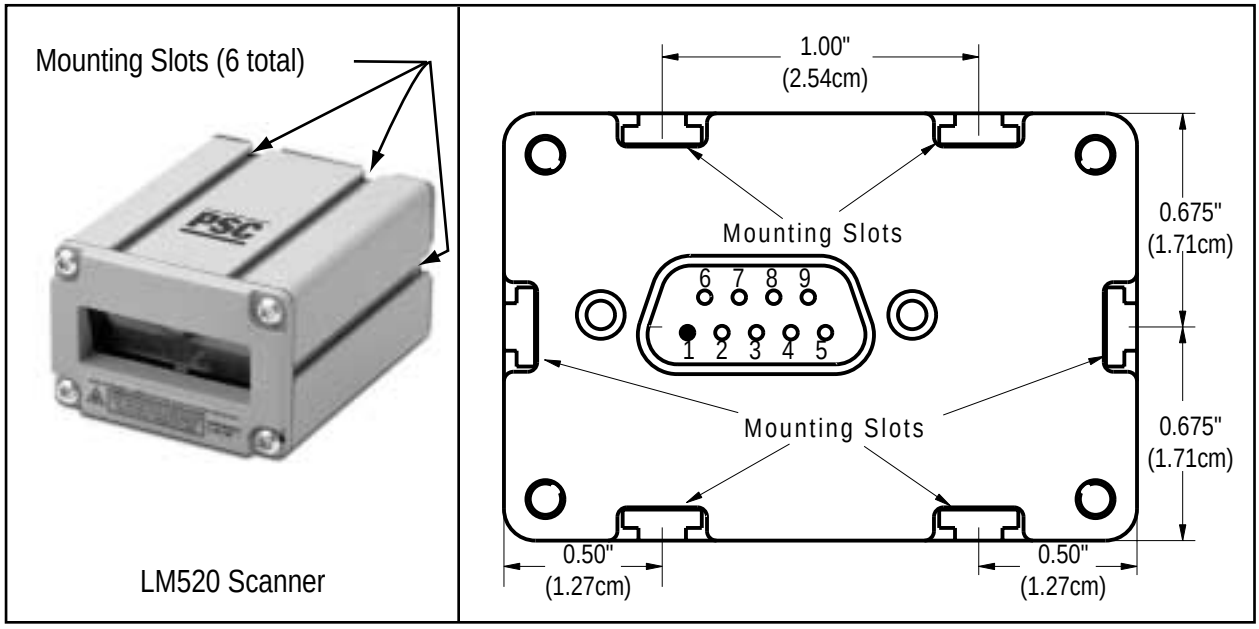
General Considerations

Although the LM520 bar code scanner has been designed to be impact-resistant, it is important to consider the effect of the environment on the scanner. In particular, the mounting scheme should minimize the possibility of foreign objects contacting the window's surface. Such contact will damage the window over time and reduce the scanner's performance. The mounting design should also take into consideration the clearance needed for the power supply and interface cables. These cables should be routed away from the operator's working area in attended applications.

Mounting

System integration is made easy with the LM520's unique mounting design. Six mounting grooves in the scanner's sealed enclosure enable mounting on any one of four sides. When looking at the back of the scanner, these slots are located as shown in Figure 1.

Figure 1. Mounting



Appendix B, *Mechanical Specifications* shows mechanical drawings of the precise position of the mounting slots relative to the scanning laser beam.

Mounting the Scanner Stand-Alone

For most instances using an adjustable mount is recommended. The position of the scan line can be fine-tuned during actual installation and the scanner's distance from the scanned object can be easily changed. The location of the operator should also be considered for attended applications. Care should be taken to position the scanner to minimize the possibility of the operator overturning the scanner, spilling liquid on the scanner, inadvertently unplugging the cables, and so on.

Integrating the Scanner to Read at the Proper Distance

When deciding how to mount the LM520, there are many criteria that must be considered. First, there are minimum and maximum distances that the bar code can be from the front of the scanner to properly read, depending on the size of the bar code. These distances, or depth of field, are specified in Appendix A, *Technical Specifications*.

Second, the scanner must be positioned so that the bar code to be read is not "square" or parallel to the front of the scanner. The scanner must have at least 3 degrees skew angle to operate properly. See Appendix B, *Mechanical Specifications* for such information as skew, pitch, and the scanner's mechanical parameters.

Third, the scanner must be positioned so that the scan line will be long enough to cover the entire bar code. The scan line should exceed the width of the bar code since only about 80% of the scan line is usable (see Figure 2). Use the following formula to calculate the expected usable line length (l) at a given distance (d):

$$l = [(d+0.88\text{in}) \times 2 \times \tan(q)] \times 0.8 \text{ (if d is measured in inches)}$$

or

$$l = [(d+2.34\text{cm}) \times 2 \times \tan(q)] \times 0.8 \text{ (if d is measured in centimeters)}$$

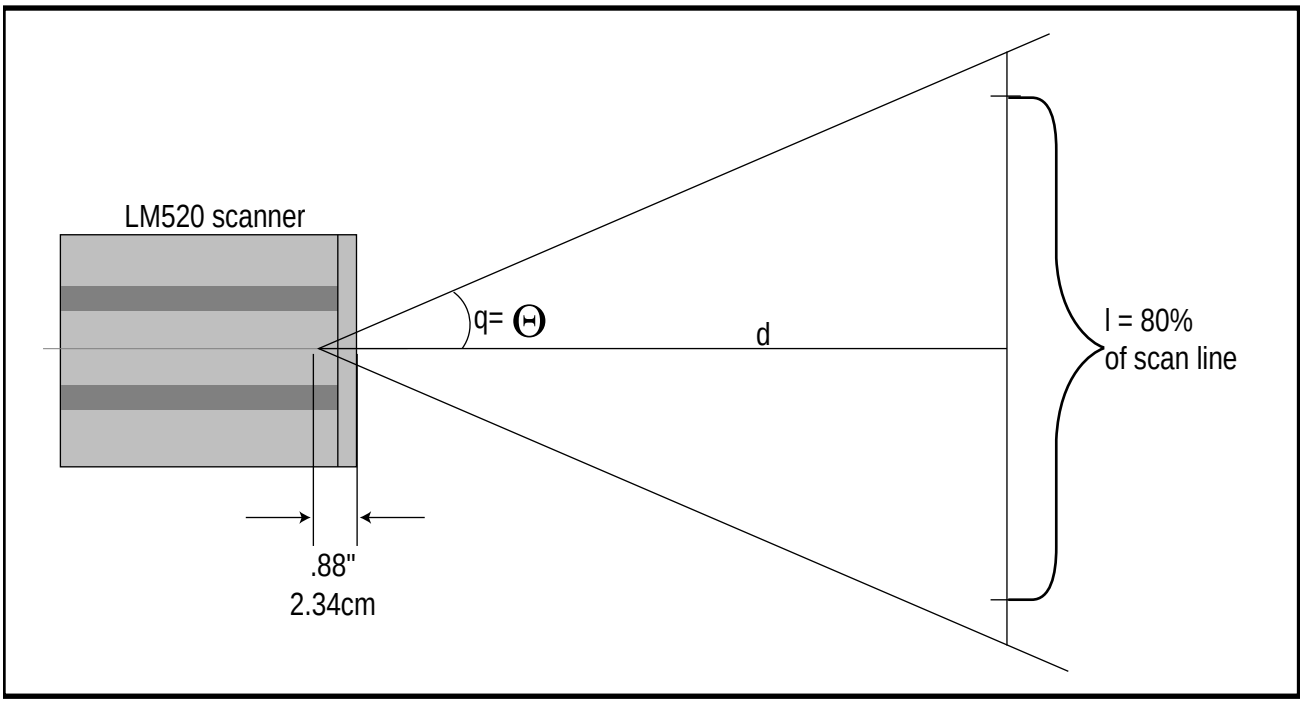
where

l = usable line length

d = distance from the front of scanner

q = half of the scan angle, (23° ± 2.0°)

Figure 2. Mounting the Scanner



Integrating the Scanner Behind a Window

When the LM520 scanner is integrated into a larger system, additional factors must be taken into account. The most important of these is an additional window placed between the LM520 and the bar code to be read. While an additional window provides protection for the LM520, it will also degrade the scanner's performance due to the need for the laser light to traverse two additional optical surfaces passing through to the bar codes, and the reflected light returning. Following the instructions in this section will help optimize the amount of outgoing light that reaches the bar code and the amount of reflected light that is collected by the scanner.

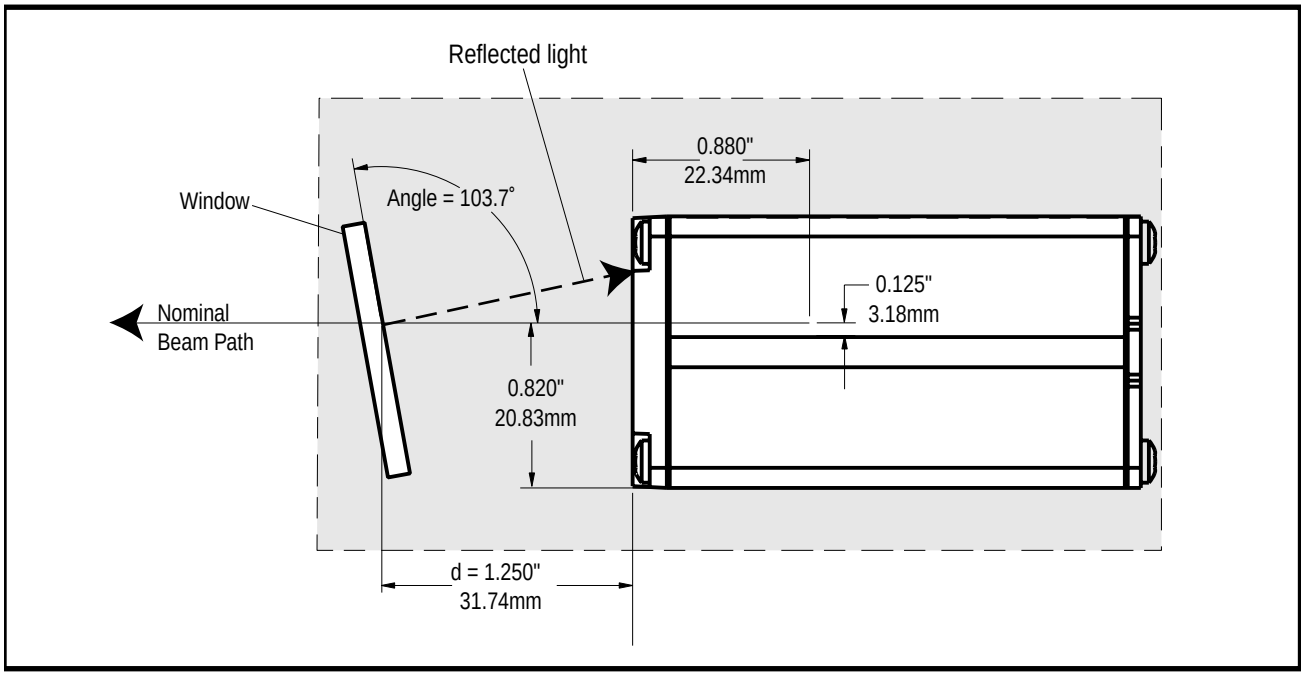
The LM520 scanner emits a laser beam in the form of a scan line. The beam's light exits the scanner's window and reflects off the bar code symbol. The reflected light returns through the window, and is collected with a photodiode. As in any optical system, any type of window causes a reduction in the amount of light that exits or enters the scanner since some of the laser light is lost due to surface reflection.

The design and placement of the window is **critical** for optimum system performance. The following issues must be considered.

- The window must not block outgoing laser light.
- The window must not block laser light reflected from the bar code. Figure 2 shows the minimum size and position of the window along the horizontal and vertical axes, respectively. **The minimum window size must increase as the distance between the scanner and the window increases. This is necessary to accommodate the width of the scan line.**
- Reflections of outgoing laser light caused by the window or other reflective surfaces should not reach the front window of the scanner.

Determine the window tilt based on your application. The tilt angle of the window (that is, its position relative to the optical axis or center-line) is important because a portion of the emitted light will always be specularly reflected from each of the two window surfaces. This reflected light must not reach the scanner's window either directly or via multiple reflections from other parts of the system.

Figure 3. Tilt Angle



$$Angle = 90 + 0.5\left[\arctan\left(\frac{0.65}{1.25}\right)\right] = 103.7$$

An example of acceptable system window inclination is shown in Figure 2. As can be seen, moving the system window closer to the scanner makes it necessary to increase the window angle with respect to vertical. Less inclination is necessary if the reflection is directed below, rather than above the scanner, since laser light is emitted near the bottom of the scanner's window and collected near the top of the scanner's window. If the light reflected from the window will be deflected above the scanner, the required window angle (from horizontal) is given by:

$$Angle = 90 + 0.5\left[\arctan\left(\frac{0.65}{d}\right)\right] \text{ if } d \text{ is measured in inches}$$

$$Angle = 90 + 0.5\left[\arctan\left(\frac{1.65}{d}\right)\right] \text{ if } d \text{ is measured in cm}$$

If the light will be deflected below the scanner, the required window angle (from horizontal) is given by:

$$Angle = 90 - 0.5\left[\arctan\left(\frac{0.2}{d}\right)\right] \text{ if } d \text{ is measured in inches}$$

$$Angle = 90 - 0.5\left[\arctan\left(\frac{0.51}{d}\right)\right] \text{ if } d \text{ is measured in cm}$$

The window material you select depends on the anticipated environment and your scanner's intended use. Appropriate window materials include glass, sapphire, and plastic. Glass, and especially sapphire, have adequate surface hardness for most applications. However, if you use any type of plastic, it should have a protective hard-coat on the exposed surface. The hard-coat will protect the plastic surface from damage if the system window needs to be cleaned.

In addition to hard-coating, some window applications may require special treatment such as antistatic or antireflection coatings. In general, do not use antiglare coatings due to undesirable polarization and diffusion effects.

Electrical Interface

The LM520 scanner communicates with the host over a standard DB-9 connector. The pinouts for the connector are shown in Table 1.

Table 1. Electrical Interface Specifications

Pin #	Direction (relative to LM520)	Signal	Function
1	Output	Beeper/ Good Read [1]	5VDC output signal used to drive an audio indicator.
2	Output	TX	Serial asynchronous RS232C level data transmitted to the host. NRZ format and user programmable for word format and baud rate. (Default: 9600 baud, 8 data bits, no parity, 1 stop bit).
3	Input	RX	Serial asynchronous RS232C level data received from the host. NRZ format and user programmable for word format and baud rate. (Default: 9600 baud, 8 data bits, no parity, 1 stop bit).
4	Output	No Read [2]	This signal is asserted at the end of a scanning cycle if no label is decoded and will remain asserted until: 1. A successful decode occurs, or 2. A user specified timeout period elapses. This may be configured in 100ms increments from 100 ms to 9900 ms (9.9 seconds). Refer to the section titled No Read Output. NOTE: If the timeout is used, the signal will be immediately deasserted if a software scan command, hardware scan trigger on pin 9 or a LaserSense scan occurs before the user specified time elapses. Setting a timeout is not available in Continuous Scan mode.
5	Input	Gnd	Power supply/signal ground.
6	Input	Vcc	Power supply input voltage (4.75 - 12.0VDC)
7	Input	CTS	RS232C Clear to send control line.
8	Output	RTS	RS232C Request to send control line.
9	Input	Scan Trigger [3]	Ground on this input initiates bar code scanning. Scanning will continue until either: (a) this line returns to high (5VDC) level, or (b) this line is disconnected, or (c) the programmed time period expires, or (d) a bar code is decoded.

1 Beeper Drive/Good Read source current must be limited to 50mA with a maximum voltage of 5VDC.

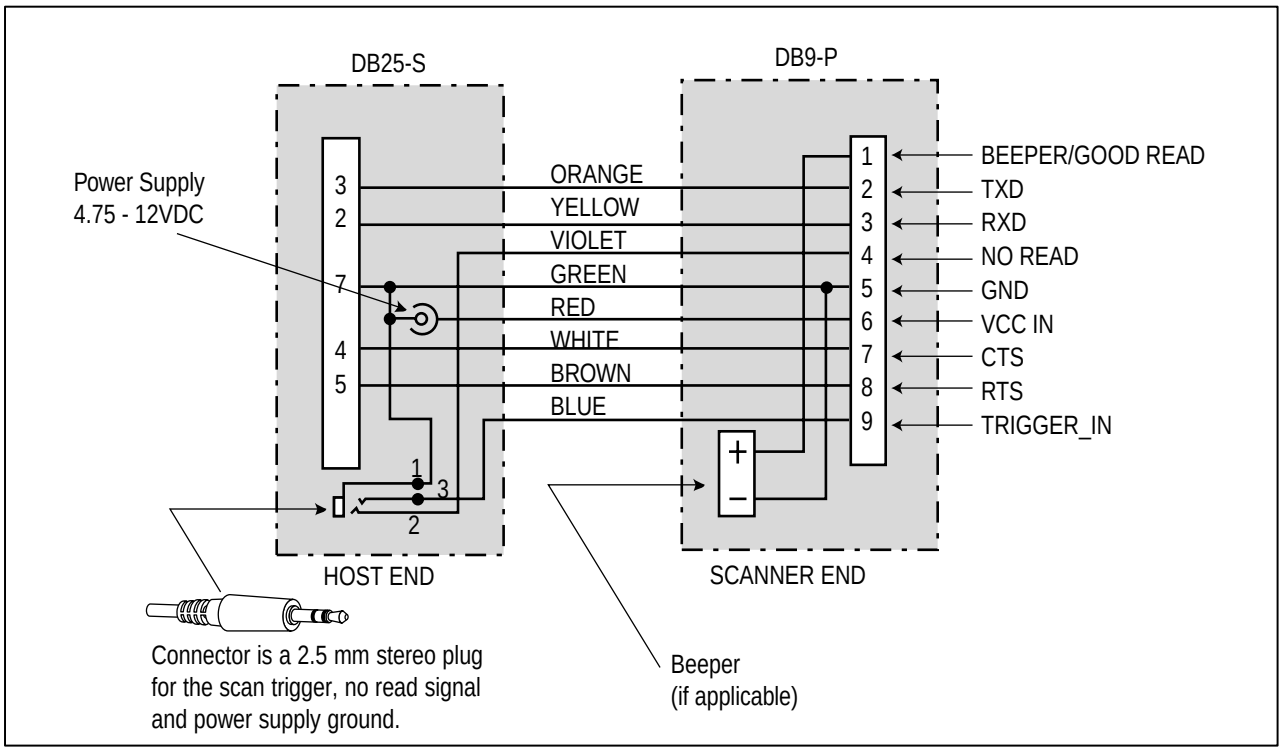
2 No Read output will source 15mA @ 5VDC. The maximum sink current must be limited to 200mA with a maximum voltage of 14VDC.

3 Scan trigger signal must be limited to a maximum input voltage of 5VDC with a maximum input current of 10mA.

Interface Cable Schematic

The drawing in Figure 4 shows a schematic view of the electrical connection between the scanner and the host.

Figure 4. Interface Cable Schematic



Section 3
LM520 Scanner Configuration

The LM520 offers a command interface which allows a wide range of customization. Commands can be combined with standard programming bar codes to develop an active configuration and a saved or factory default configuration.

Configuration Management

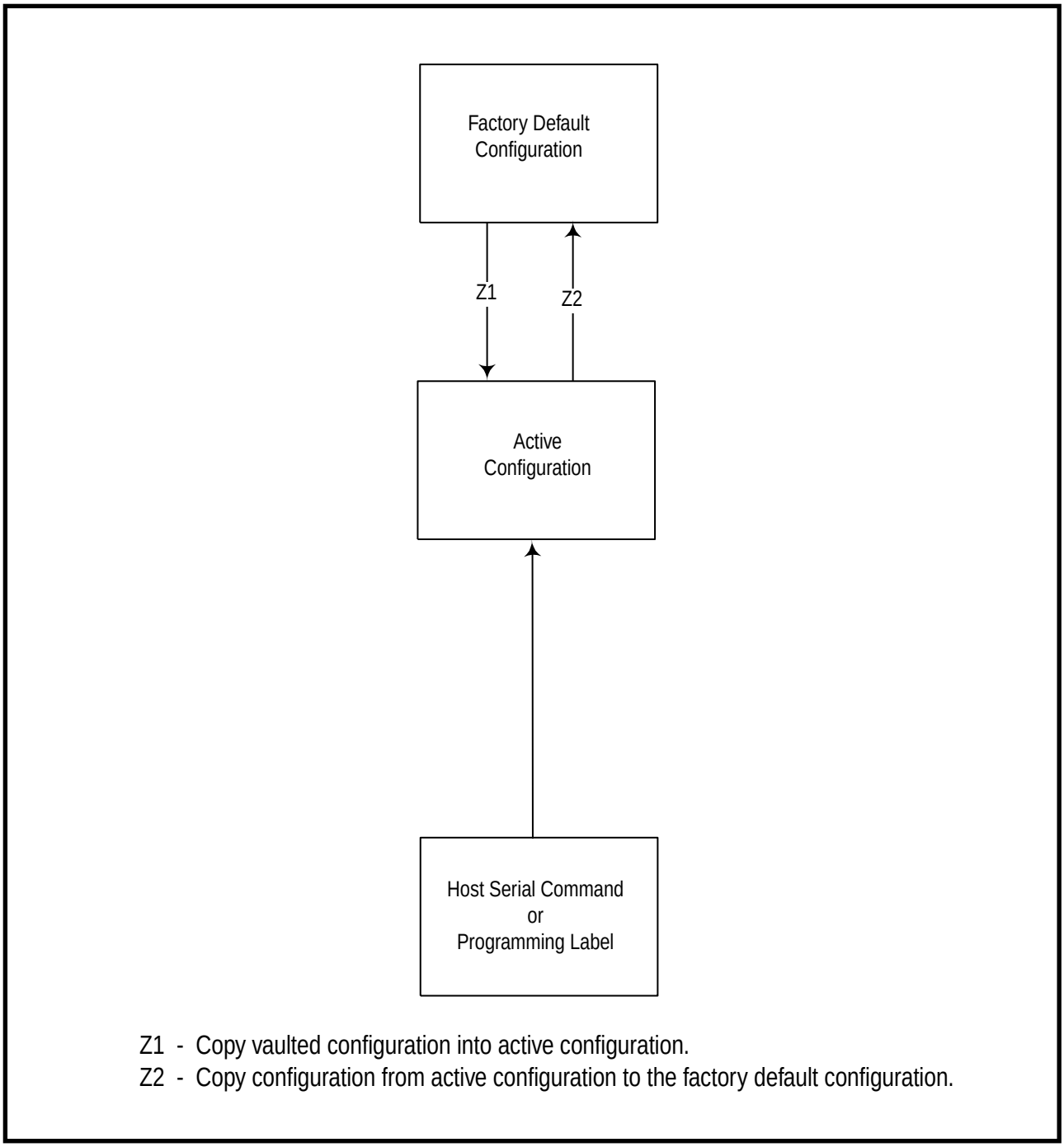
The LM520 scanner always contains two configuration sets: the **Active** configuration and the **Factory Default** configuration. Both configurations are stored in nonvolatile memory. When the scanner receives a command changing the configuration, it changes the **Active** configuration. If the scanner is reset to the **Factory Default** configuration, the factory defaults are copied to the **Active** configuration. See Appendix C, *Factory Default Configuration* for a concise list of the factory defaults.

The LM520 offers the ability to change and save a new Factory Default configuration. To overwrite the Factory Default configuration as shipped from PSC, first make changes to the Active Configuration, then store the Active Configuration as the Factory Default. The previous Factory Default will be overwritten. Figure 5 illustrates this process. Table 2 describes the commands for changing the default configuration.

Table 2. Configuration Commands

Command	Setting
Z1	Reset active configuration to factory defaults. **The active configuration will be overwritten.**
Z2	Store the active configuration as Factory Default. **The contents of the Factory Default will be overwritten.**

Figure 5. Configuration Management



Z1 - Copy vaulted configuration into active configuration.
Z2 - Copy configuration from active configuration to the factory default configuration.

Programming Methods

The LM520 scanner may be programmed either by sending commands from a host over the serial interface or by the using bar codes containing programmable commands. Typically, the scanner is programmed over the serial interface when it is integrated into a system.

Appendix D, *LM520 Programming Labels*, contains a minimal set of programming bar codes and the section titled, *Programming with Bar Codes*, on page13, describes how to create programming bar codes.

Programming through the Serial Interface

The easiest and most common way to program the LM520 is by sending ASCII commands through the serial interface. Each command transmission must begin with the STX (0x02 hex) and ESC (0x1B hex) characters. Next, the command itself is transmitted, followed by any necessary parameters. The command transmission ends with an ETX (0x03 hex). A complete serial command transmission, therefore, consists of:

STX-ESC-[command]-[parameters]-ETX

The scanner uses an ACK / NAK protocol to communicate with the host. The scanner does not echo received data back to the host, and will not acknowledge transmissions which do not begin with STX-ESC and end with ETX. Upon receipt of a valid command sequence, the scanner responds in one of two ways:

- All commands that are valid (both commands and parameters) take the requested action and then transmit an ACK to the host.
- If the command is invalid, the scanner responds with an ASCII NAK (0x15 hex).

All valid commands return an ACK. Otherwise, a NAK is returned if the command is not valid. If the command is not formatted properly (missing the STX, ESC, or ETX), the scanner does not respond. Each command recognized by the scanner consists of two ASCII characters, followed by any required parameters.

Programming with Bar Codes

The LM520 scanner can also be programmed by scanning bar codes which contain commands. This method allows users to easily adjust scanner parameters.

Bar codes used for programming must be Code 128, with a Function Code 3 (FNC3) as the first character. The command following the FNC3 character configures the scanner in exactly the same way as if it had received the command over the serial line, *except* that the scanner will not acknowledge the command on the serial line. Each bar code may contain only one command. All parameters for the command must be included in the label with the command characters. For example, the label to limit the minimum number of Code 39 to 5 characters would be.

<FNC3>OH05

The scanner can be programmed not to accept programming bar codes by using the **Disable Programming Bar Codes** command (@Y). If you disable the programming with bar codes feature, the scanner will still accept programming commands through the serial port. The **Enable Programming** (@Z) bar code commands will **always** be accepted by the scanner, and cannot be disabled.

If **Disable Programming Bar Codes** (@Y) is set, all programming bar codes except **Enable Programming Bar Codes** (@Z) will be treated as standard Code 128 bar codes.

Conventions

The remainder of this manual presents the valid commands in a tabular format. These tables contain two or three columns.

- First column – Bar Code **Command**, contains the two-letter ASCII string which the scanner accepts as programming commands through the serial port or in a programming label. See Appendix D, *LM520 Programming Labels*, for instructions on how to create bar code programming labels.
- Second column – Bar Code **Parameters**, may be present. If an entry appears in this column, a parameter setting is required to complete the command.
- Last column – **Setting**, describes the effect of the command and its associated parameters.
- Default Entries – The factory default settings for the scanner are shaded and denoted by asterisk.

A concise list of these defaults is presented in *Appendix C, Factory Default Configuration*.

Setting Serial Communication Parameters

The first step in the integration process is establishing communications between the scanner and the host. This is done by matching the scanner's communications parameters to the serial communication requirements of the host. The Baud Rate, Data Format and Flow Control communication settings of the scanner must match the serial communications requirements of the host. For example, if the scanner is sending data at the wrong baud rate, the host will not be able to interpret the data that is being sent. The following section outlines the RS-232 communication settings.

Baud Rate

Use one of the commands shown in Table 3 to set the LM520 baud rate. Note that the scanner and the host **must** communicate at the same rate for communication to be successful. An ACK command will be sent by the scanner at the new baud rate, indicating that the command has been received and understood.

Table 3. Baud Rate

Command	Setting
DA	Baud = 300
DB	Baud = 600
DC	Baud = 1200
DD	Baud = 2400
DE	Baud = 4800
DF *	Baud = 9600
DG	Baud = 19200
DH	Baud = 38400

* Asterisk and shading denotes the Factory Default Setting.

Data Format

These parameters control the data format in which the LM520 will communicate with the host. Note that the scanner and host **must** communicate in the same format for communication to be successful. An ACK command will be sent by the scanner in the new format indicating that the command has been received and understood. Table 4 lists the commands for the data format options.

Table 4. Data Format

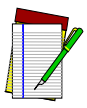
Command	Setting
EC	7 data bits, 1 stop bit, even parity
ED	7 data bits, 1 stop bit, odd parity
EK	8 data bits, 1 stop bit, even parity
EL	8 data bits, 1 stop bit, odd parity
EM *	8 data bits, 1 stop bit, no parity
EN	8 data bits, 2 stop bits, no parity

Flow Control

As shown in Table 5, the LM520 scanner supports standard flow control protocols, including XOn / XOff (software flow control) and CTS / RTS (hardware flow control). If CTS / RTS is being used, first send the HA command before sending a new Flow Control command (HB - HN). If the CTS and RTS lines are not used for flow control, they can be used to monitor and control the scanner. The default setting is no flow control: CTS = none; RTS = low when scanning in process and Xon / Xoff disabled. To return to this configuration send the HA command followed by the HN command.

Table 5. Flow Control

Command	Setting
HA *	No Flow Control Xon/Xoff disabled CTS mode = none RTS mode = RTS low when ready to receive
HB	Xon/Xoff Enabled CTS mode = none
HC	CTS mode = Low to transmit Xon/Xoff disabled
HD	CTS mode = High to transmit Xon/Xoff disabled
HE	CTS mode = Low to begin scanning Xon/Xoff state unchanged
HF	CTS mode = High to begin scanning Xon/Xoff state unchanged
HG	RTS = Always Low
HH	RTS = Always High
HI	RTS = Low when scanner is ready to receive commands
HJ	RTS = High when scanner is ready to receive commands
HK	RTS = High when scanner has data to send
HL	RTS = Low when scanner has data to send
HM	RTS = High when scanning is in progress
HN *	RTS = Low when scanning is in progress



NOTE

If Xon/Xoff is enabled, then RTS = low when scanning and CTS = none
If Xon/Xoff is disabled, then RTS = low when ready to scan and CTS = none
Low = Mark signal (negative voltage)
High = Space signal (positive voltage)

Controlling Scanning Through Host Commands

Triggering Scanning Using Software Switch

A host can instruct the scanner to begin scanning by sending the Scan Now command. Table 6 shows that the number of scanning passes is user programmable.

Table 6. Software Switch Control

Command	Parameter	Setting
ZD	XX (01-99)	Scan Now. Begin scanning immediately. Scan until a bar code is decoded, or for a maximum of XX scans. NOTE: The LM520 scans approximately 42 times per second.
ZD	00	Scan Now. Begin scanning immediately. Scan until a bar code is decoded, or until the scanning timeout expires. See BH command in Table 30.

NOTE

The ZD command returns ACK immediately followed by the bar code data when a bar code is decoded.

Except for terminating after the requested number of scans if no bar code is read, scanning initiated through this command performs identically to scanning initiated by pressing the trigger (assertion on the Scan Trigger line, pin 9).

Triggering Scanning Using Hardware Switch

Using a hardware switch can also be configured to respond to the CTS line rather than the Scan Trigger line using the commands below.

Table 7. Hardware Switch Control

Command	Setting
HE	CTS mode = High signal triggers scanning (Other serial options unchanged)
HF	CTS mode = Low signal triggers scanning (Other serial options unchanged)

Scanning initiated in response to a CTS signal performs identically to scanning initiated by pressing the trigger (assertion on the Scan Trigger line, pin 9). To disable scanning in response to a CTS signal, set the CTS mode to a non-scanning mode (HA, HB, HC or HD) as described in *Setting Serial Communication Parameters* on page 14.

Hardware scanning continues until either the Scan Trigger is deasserted or until the scanner timeout expires. See BH command in Table 30.

Continuous Scanning Mode

The LM520 may also be set for Continuous Scanning mode through host commands.

Table 8. Continuous Scanning Mode

Command	Parameter	Setting
NC		Continuous scanning on.
ND*		Continuous scanning off – only for use when programming with bar codes. (Also, see Canceling Software Triggered Scanning.)

LaserSense Scanning Mode

LaserSense is a significant technology breakthrough. LaserSense technology has two key advantages over other automatic triggering methods.

- It detects movement at a user configurable range from the scanner. This eliminates false triggers from movement in the general area and clearly identifies where the bar code should be placed with a stable marker point.
- It is integral to the scanner. There are no additional components to fail or add-on components that are not well integrated.

Using a background color that contrasts with the object being detected will enhance performance.

Table 9. LaserSense Mode

Command	Parameter	Setting
NA *		**Enable LaserSense. When an object is detected, scanning occurs until the scanning timeout expires. See the BH command in Table 30.**
NB		**Disable LaserSense – only for use when programming with bar codes.(Also see Canceling Software Triggered Scanning.)**
NG	**XX (45 - 70)**	**Set range for LaserSense. Higher values increases the effective range. A value that is too large will result in false triggers and continuous scanning. A value too low will result in no triggering. Tolerance = ±20%**

Default: NG60
Range = 45 - 70
NG45 = 4.5” (minimum)
NG60 = 10” (default)
NG70 = 23” (maximum)

Canceling Software Triggered Scanning

A scan triggered by software, such as software trigger (ZD), LaserSense scanning (NA), or continuous scanning (NC) can be canceled using the ASCII DC4 command from the host, or by scanning the ND or NB labels. The ASCII DC4 command is a single byte (0x14 hex) and should **not** be sent with a STX-ESC preceding it. When the LM520 receives this single character, it will respond with an ACK, turn active scanning off and be ready to receive additional programming commands. Sending this DC4 command is sufficient and does not require the host to send the Continuous Scanning Off (ND) or Disable LaserSense (NB) commands.

Setting Symbology Parameters

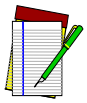
The LM520 is able to decode UPC-A, UPC-E, EAN-8, EAN-13, Code 39, Code 128, Code 93, Codabar, Interleaved 2 of 5, and Standard 2 of 5 symbologies. The decoder will actively attempt to match bar code data against all symbologies which are enabled. Thus, performance is enhanced by disabling symbologies which are not used in a particular environment. The possibility of misreads due to symbology overlap will also decrease by disabling unused symbologies.

Enabling All Symbologies

It is possible to enable all symbologies at once. This command is typically used for diagnostic or demonstration purposes. For best performance in actual use, only those symbologies which are needed should be enabled.

Table 10. Symbologies

Command	Setting
QM	Enable all symbologies.



NOTE

This command does not enable either ISBT 128 or UPC/EAN supplementals.

EAN

Table 11. EAN

Command	Parameter	Setting
RA		Disable EAN-13
RB		Enable 2 and 5 digit supplementals for EAN-13 and EAN-8.
RC *		Enable EAN-13
RN		Disable EAN-8
RP *		Enable EAN-8
RS		Disable all EAN 2 and 5 digit supplementals (EAN-8, EAN-13).
QY	xx (01-99)	Enable number of scans to try to build EAN/UPC 2 and 5 digit supplementals. Maximum number of scans is 99, the default is 15[1]

[1] The higher the number of tries to build the supplemental portion of the code, the longer it takes EAN/UPC labels without supplemental code to decode.

UPC

Table 12. UPC

Command	Parameter	Setting
QA		Disable UPC-A (If EAN-13 = enabled, UPC-A labels will decode as EAN-13).
QB		Enable 2 and 5 digit supplementals for UPC-A and UPC-E
QC *		Enable UPC-A
QH *		Disable expansion of UPC-E to UPC-A
QI		Enable expansion of UPC-E to UPC-A
QL *		Enable UPC-E
QV		Disable UPC-E
QX		Disable all UPC 2 and 5 digit supplementals (UPC-A UPC-E)
QY	xx (01-99)	Enable number of scans to try to build EAN/UPC 2 and 5 digit supplementals. Maximum number of scans is 99, the default is 15[1]

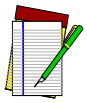
[1] The higher the number of tries to build the supplemental portion of the code, the longer it takes EAN/UPC labels without supplemental code to decode.

Code 128

Reads variable length bar codes 1 to 50 characters.

Table 13. Code 128

Command	Setting
TA	Disable Code 128
TC *	Enable Code 128
TD	Enable function code transmission
TE *	Disable function code transmission
TF	Enable UCC 128 Emulation



NOTE

Code 128 function codes are transmitted as follows:
FNC1 = 80h, FNC2 = 81h, FNC3 = 82, FNC4 = 83h
FNC3 = in the first data position of a Code 128 bar code is reserved for programming labels and no data will be transmitted to the host from a programming label.

Code ISBT 128

ISBT 128 is a bar code symbology for labeling of whole blood and blood components adopted by the International Council for Commonality in Blood Banking Automation. (ICCBBA). Implementation of ISBT 128 requires the payment of a registration fee and an annual license fee thereafter. Contact the ICCBBA in Durham, NC USA. Their web address is: (http://www.ICCBBA.inter.net)

The ISBT 128 standard allows two bar codes to be read as if they were a single bar code, known as concatenation. The physical placement of labels that can be concatenated is done so that a laser beam can pass completely through both labels. The information for both bar codes is transmitted to a host computer at the same time. There are 19 different code types in the ISBT symbology.

Table 14. ISBT Symbology

ISBT 128 Single label codes	
Donation Collection Date Donation Collection Date and Time Manufacturer's Identity and Container Information Manufacture's Lot Number Nationally-specified Special Testing National use Staff Member Identification Number Date of Production Date and Time of Production Donor Identification Number Special Concatenation Programming Label	
ISBT 128 Concatenation label codes[1]	
Blood Groups	Data ids are '=' and '%', label length is 6 data characters including data ids.
Nationally-specified Confidential Unit Exclusion Status.	Data ids are '&' and '!', variable length, nationally defined
Donation Identification Number	Data ids are '=' and x (where x is A-Z or 0-9), label length is 16 data characters including data ids.
Nationally-specified Donor Identification Number	Data ids are '&' and ';', variable length, nationally defined
Expiration Date	Data ids are '=' and '>', label length is 8 data characters including data ids.
Expiration Date and Time	Data ids are '&' and '>', label length is 12 data characters including data ids.
Product Code	Data ids are '=' and '<', label length is 10 data characters including data ids.
Nationally-specified Product Code	Data ids are '&' and '<', label length is, label length is 10 data characters including data ids).

[1] Of these, 8 types may be concatenated together in seven legal ways (see the Concatention Pairs table on following page).

Table 15. Concatenation Pairs

Normal Concatenation Pairs
Donation Identification Number & Blood Groups
Donation Identification Number & Nationally-specified Donor Identification Number
Donation Identification Number & Nationally-specified Confidential Unit Exclusion Status
Product Code & Expiration Date
Nationally-specified Product Code & Expiration Date
Product Code & Expiration Date and Time
Nationally-specified Product Code & Expiration Date and Time

The other 11 types that are not normally concatenated may be specially programmed to be concatenated. See the specification for ISBT 128 from ICCBBA for creating specially programmed concatenated bar codes.

Table 16. ISBT Commands

Command	Setting
TQ	Enables single label mode ISBT 128, disables concatenated label mode ISBT 128. The single label mode will read all 19 ISBT 128 labels as single labels only (no concatenation is done). To read single label ISBT 128, both Code 128 must be enabled (TC) and single ISBT 128 must be enabled (TQ). Standard Code 128 will not read while single ISBT 128 is enabled. To disable ISBT 128, use TA command.
TR	Enables concatenated mode ISBT 128, disables single ISBT 128. The concatenation mode will only read the 8 types of ISBT 128 labels that are used in concatenation. See Table 14 for the 8 types of concatenation labels and Table 15 for their legal combinations with other concatenation types. The other 11 types of ISBT labels that are not normally used in concatenation will still read as single labels. However, with the use of a special programming label, the other 11 types of ISBT128 labels that are not normally concatenated may be concatenated. If they are specially programmed, they will not read as single labels. Only one special concatenation of these other 11 type labels can be programmed at a time. To read concatenated ISBT 128, both Code 128 must be enabled (TC) and concatenated ISBT 128 must be enabled (TR). Standard Code 128 will not read while concatenated ISBT 128 is enabled. To disable ISBT 128, use TA command.
TS	Disables the specially programmed concatenated ISBT 128 labels, if defined. To again read specially programmed concatenated ISBT 128 labels, use TR command followed by the special programming label. See the specification for ISBT 128 from ICCBBA for creating specially programmed concatenated bar codes.

Code 93

When Code 93 is enabled, the bar code length defaults are set to zero which allows the scanner to read Code 93 bar codes of varying lengths up to 50 characters. If the scanner will be used for specific fixed length bar codes, use the UE and UF commands to enable these fixed lengths.

Table 17. Code 93

Command	Parameter	Setting
UA *		Disable Code 93
UB		Enabled Code 93
UE	XX (00 - 50)	Set minimum length for Code 93 to XX. If 00 is selected, the scanner ignores the min. and max settings.
UF	XX (00 -50)	Set maximum length for Code 93 to XX.

Codabar

When Codabar is enabled, the bar code length defaults is set to zero which allows the scanner to read Codabar bar codes of varying lengths up to 50 characters. If the scanner will be used for specific fixed length bar codes, use the VE and VF commands to enable these fixed lengths.

Table 18. Codabar

Command	Parameter	Setting
VA *		Disable Codabar
VB		Enable Codabar
VC *		Disable transmission of start/stop characters
VD		Enable transmission of start/stop as upper-case characters
VE	XX (00 - 50)	Set minimum length for Codabar to XX characters. Includes start/stop and check characters, if transmitted. If 00 is selected, the scanner ignores the min. and max settings.
VF	XX (00 - 50)	Set maximum length for Codabar to XX characters. Includes start/stop and check characters, if transmitted.
VG		Enable transmission of start/stop as lower-case characters

Code 39

When Code 39 is enabled, the bar code length defaults is set to zero which allows the scanner to read Code 39 bar codes of varying lengths up to 46 characters. If the scanner will be used for specific fixed length bar codes, use the OH and OI commands to enable these fixed lengths.

Table 19. Code 39

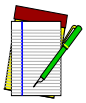
Command	Parameters	Setting
OA		Disable Code 39
OB *		Enable standard Code 39
OC		Enable full ASCII Code 39
OD *		Disable Modulo 43 check character
OE		Enable Modulo 43 check character
OF *		Disable transmission of the start/stop characters
OG		Enable transmission of the start/stop characters
OH	XX (00 - 46)	Set minimum data characters to XX characters. Includes start/stop characters and check characters, if transmitted. If set to 00, the scanner ignores the min/max settings.
OI	XX (00 -46)	Set maximum data characters to XX characters. Includes start/stop characters and check characters, if transmitted.
OJ		Enable transmission of the check character
OK *		Disable transmission of the check character

Interleaved 2 of 5

When Interleaved 2 of 5 is enabled, the default bar code length is fixed at 14 characters (PD14 & PE14).

Table 20. Interleaved 2 of 5

Command	Parameters	Setting
PA *		Disable Interleaved 2 of 5.
PB		Enable Interleaved 2 of 5 without a check digit.
PC		Enable Interleaved 2 of 5 with a check digit.
PD	XX (04 - 50)	Set minimum number of data characters for Interleaved 2 of 5 to XX characters. Add check digit, if transmitted.
PE	XX (04 - 50)	Set maximum number of data characters for Interleaved 2 of 5 to XX characters. Add check digit, if transmitted.
PO *		Disable transmission of Interleaved 2 of 5 check digit.
PP		Enable transmission of Interleaved 2 of 5 check digit.



NOTE

The total number of characters must be even. If the Check Digit is included, the number of data characters must be odd.

Standard 2 of 5

When Standard 2 of 5 is enabled, the default bar code length is fixed at 14 characters (PT14 & PU14).

Table 21. Standard 2 of 5

Command	Parameter	Setting
PQ *		Disable Standard 2 of 5.
PR		Enable Standard 2 of 5 without a check digit.
PS		Enable Standard 2 of 5 with a check digit.
PT	XX (04 - 48)	Set minimum length for Standard 2 of 5 to XX characters.
PU	XX (04 - 48)	Set maximum length for Standard 2 of 5 to XX characters.
PV *		Disable transmission of Standard 2 of 5 check digit.
PW		Enable transmission of Standard 2 of 5 check digit.

Formatting Bar Code Data

Bar code data can be returned to the host as raw bar code data or additional characters may be appended before or after the bar code data, or the bar code data may be truncated and reformatted to meet the needs of the host. Formatting can be set to occur regardless of the symbology of the bar code scanned or it can be specific to the symbology by applying different filters to different types of bar codes. Formatting will occur on the bar code data if it is a single bar code, if it is a bar code with additional supplementals added (UPC/EAN), or if it is two codes concatenated together (ISBT=128). The data returned to the host can take the form of a Preamble, Filtered Data, and Postamble. Both the Preamble and the Postamble apply to all bar codes regardless of symbology, and one or both can be omitted if not required by the host.

Preamble

A preamble may be added to the beginning of bar code data transmissions to provide a standard start-of-transmission character. It may also be set for up to twenty ASCII characters. Note that the characters set as the preamble will be added to every bar code transmission for all symbologies.

Table 22. Preamble

Command	Parameter	Setting
KA *		No preamble
KB	(Up to 20 characters)	Add the characters specified to the beginning of every data transmission.

Postamble

A Postamble may be added to the end of bar code data transmissions. This is commonly used to provide a standard end-of-transmission character, but may be set to up to twenty ASCII characters. Note that the characters set as the Postamble will be added to every bar code transmission for all symbologies.

Table 23. Postamble

Command	Parameter	Setting
LA		No postamble
LB *	(Up to 20 characters)	Add the characters specified to the end of every data transmission. The default is CR, LF (0x0D hex, 0x0A hex)

Filters

After the bar code is decoded, the LM520 scanner may apply a filter on the decoded data before transmitting the data to the host. A filter is maintained for each symbology the scanner supports. All bar codes using a given symbology are processed using the filter for that symbology. Table 24 shows examples of filters that include fill characters, edit functions and two types of "literals," pre-literals and post-literals.

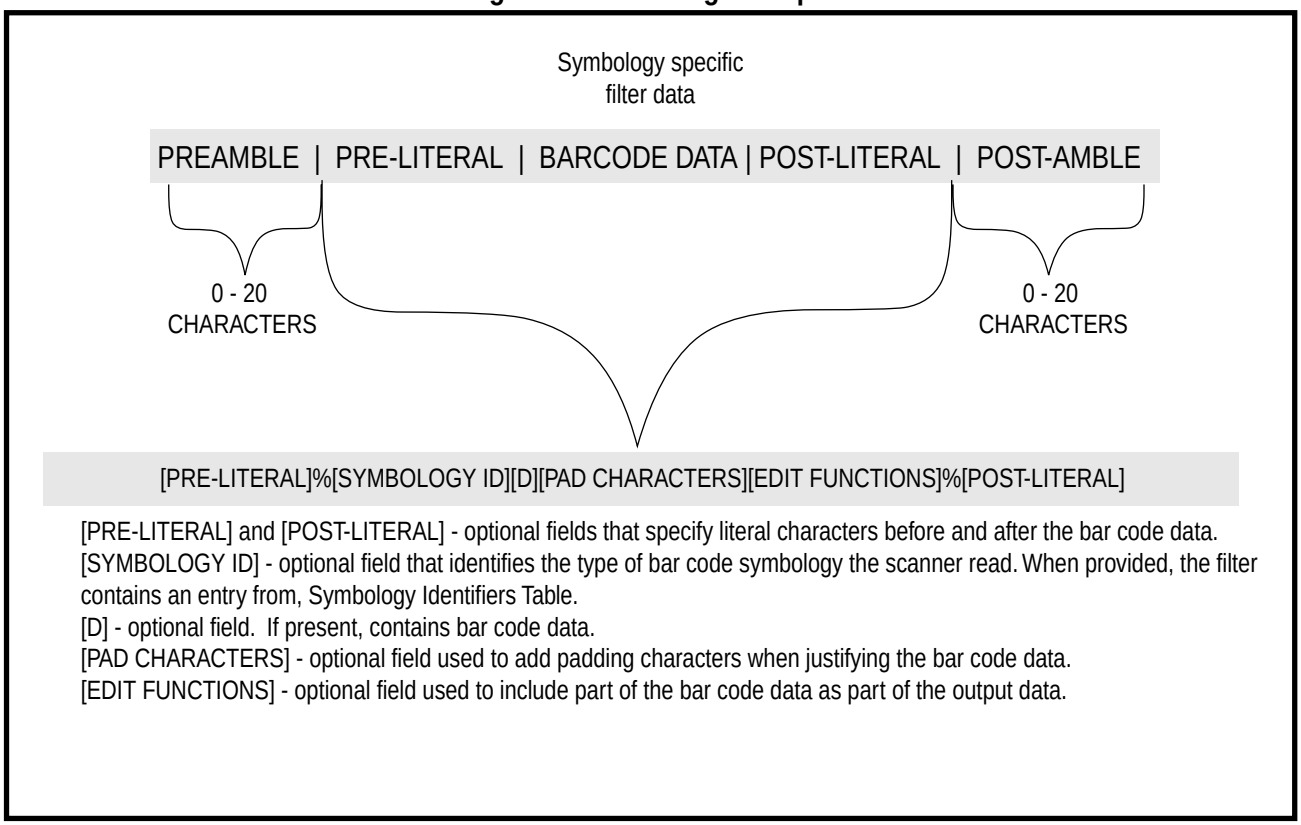
In the following examples the bar code data contain five numeric characters: "12345."

Table 24. Filter Examples

Filter	Output	Comment
%DZL7%	'12345000'	Return left-most seven characters. Zeroes are added to to the right of the label data to bring the total number of characters to seven.
%DSR7%	' 12345'	Return right-most seven characters. Spaces are added to the left of the label data to bring the total number of characters to seven.
%DL3%	'123'	Return left-most three characters of the label.
%DR4%	'2345'	Return right-most four characters of the label.
%DM2,3%	'234'	Return three characters of the label, starting at the second character.
%DZLM2,3,7%	'2340000'	1. Inner-most edit functions (M2,3): return three characters of the label, starting at the second character. Provide this data ('234') as input to the next inner-most edit function. 2. Outer-most edit functions (L7): return the left-most seven characters of the input string ('234'). Zeroes are added to the right of the label data to bring the total number of characters to seven.
%DSRM2,3,7%	' 234'	1. Inner-most edit functions (M2,3): return three characters of the label, starting at the second character. Provide this data ('234') as input to the next inner-most edit function. 2. Outer-most edit functions (R7): return the right-most seven characters of the input string ('234'). Spaces are added to the left of the label data to bring the total number of characters to seven.
SCAN%D%END	'SCAN12345END'	Return the pre-literal 'SCAN', the label data, and the post-literal 'END'.

Figure 6 shows an example of fully appended bar code data that would be sent from the scanner to the host. To set a filter for a particular symbology, use the command below. Note that the filter must be provided as a parameter. If no filter is provided, the scanner will return no data. To return only the bar code data a filter of %D% may be set. Reference Table 25 for Symbology Identifiers.

Figure 6. Formatting Example



Field Descriptions

[Pre-literal] and [Post-literal] - Optional fields that specify literal characters before and after the bar code data. These are different from a Preamble or Postamble in that they only apply to the symbology that the filter is defined. When a filter is applied to all symbologies, pre- and post-literals serve the same function as a Preamble and Postamble. For example, if the following was defined: Preamble = “123”, Postamble = “789”, Pre-literal = “ABC”, and Post-literal = “XYZ” the data returned to the host would take the format of “123ABC[bar code data]789XYZ”.

NOTE

Filters must be bracketed by the ‘%’ character as shown in this example: %[id]D[*Pad Character*][*Edit Function*]%

The **[D]** parameter is an optional field containing the ASCII character D (0x44 hex). If the D is present, bar code data (including supplemental and concatenated bar code data) will be returned in it's place (edited or unedited – see Edit Functions below.) If a 'D' is not present in the filter, no bar code data will be sent, but any pre- or post-literal data will be sent for that symbology.

The **[symbology id]** parameter is optional. When provided, the filter will output a single character indicating the symbology of the bar code. When a symbology identifier is used, it precedes the bar code data and informs the host of the data type that follows. For example: If the filter for Code 39 is set to '%idD%', a Code 39 bar code containing the data '12345' will be transmitted to the host as 'a12345'. The following table lists the symbology identifiers.

The **[pad character]** field is optional. It designates a character to be used as padding when justifying the code data.

The **[edit functions]** parameter is an optional field that can divide the bar code data into pieces by taking the right-most characters, left-most characters, or middle characters.

Table 25. Symbology Identifiers

Symbology	Identifier
UPC-A	'd'
UPC-E	'd'
EAN-13	'd'
EAN-8	'd'
Code 39	'a'
ITF	'b'
STF	'c'
Codabar	'h'
Code 93	'g'
Code 128	'f'
Code ISBT128	'f'

Pad Character

Valid pad characters are N, S and Z as shown below.

Table 26. Pad Characters

N	Do not fill
S	Pad with spaces
Z	Pad with zeroes

Edit Function

Edit functions may be one of:

Table 27. Edit Functions

R[s,](n)	Include the last 'n' characters of the output from filter 's' or the label if 's' is not present.
L[s,](n)	Include the first 'n' characters of the output from filter 's', or the label if 's' is not present.
M[s,](p,n)	Include 'n' characters starting at position 'p' of the output from filter 's' or the label if 's' is not present.

If *n* is larger than the number of characters in the bar code, then pad characters are added to the output. The bar code data will be justified in the same position in which it appeared in the bar code.

Edit functions may also be nested. When nested, the innermost function is processed first, taking the bar code data as input. The output of the innermost function is passed to the next most-embedded function as input. However, only the outermost function will pad data using the pad character(s).

Examples of edit strings, including nesting and the use of pad characters, are shown in Table 26.

Setting the Bar Code Format

To set the bar code format for a particular symbology, use the following commands. Note that the filter **must** be provided as a parameter. If no filter is provided, the scanner will return **no** data. To return only the bar code data (including supplemental and concatenated bar code data), a filter of %D% may be set.

Table 28. Bar Code Format

Command	Parameter	Setting
FA *		Set filters for all symbologies to %D% (bar code data only)
FB		Set filters for all symbologies that have not been specifically set with a filter to %idD% (symbology identifier and bar code data)
FC	*Filter*	Set filter for UPC-A bar codes
FD	*Filter*	Set filter for UPC-E bar codes
FE	*Filter*	Set filter for EAN-13 bar codes
FF	*Filter*	Set filter for EAN-8 bar codes
FG	*Filter*	Set filter for Code 39 bar codes
FH	*Filter*	Set filter for Interleaved 2 of 5 bar codes
FI	*Filter*	Set filter for Codabar bar codes
FJ	*Filter*	Set filter for Code 93 bar codes
FK	*Filter*	Set filter for Code 128 and ISBT 128 bar codes
FM	*Filter*	Set filter for Standard 2 of 5 bar codes

For example, a complete command to set the bar code filter to return the literal ‘12’, the bar code data, then the literal ‘34’ for UPC-A bar codes is:

FC12%D%34

The command to set the same filter for UPC-E bar codes is:

FD12%D%34

Additional Commands

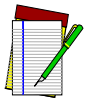
The commands in this section customize the scanner's operation to meet your specific system requirements.

Good Read Beeper Duration

This command controls the length of time the scanner will produce a signal on the Beeper / Good Read line (pin 1) when a bar code is successfully decoded.

Table 29. Beeper Duration

Command	Parameter	Setting
AE	XX (00 - 99)	Set Beeper duration to (XX * 45)ms. The default is 135ms (XX = 03).



NOTE

Setting AE = 00 disables the Good Read Beeper.

Laser Timeout

If a bar code is not read and decoded successfully within a certain period of time, the LM520 will stop scanning. The length of time the scanner remains active before timing out can be set to between 0.1 and 9.9 seconds. This command affects hardware, software and LaserSense triggering modes.

Table 30. Laser Timeouts

Command	Parameter	Setting
BH	XX (00 - 99)	Set scanning timeout to (XX * 100)ms. +/-10%. (Default is 6 seconds XX = 60)

NOTE

A duration of zero implies infinite duration. The scanner continues to scan until:

a. a bar code is decoded
b. cancel command, DC4 (0x14 hex) is sent if using software or LaserSense triggering
c. hardware triggering is released or deasserted on the scan trigger line using hardware trigger.

Double Read Timeout

After a bar code has been successfully read, the scanner will wait for the amount of time set using this command before it will read a bar code that contains the same bar code data. Setting this parameter effects the scanner's internal timing and produces no external I/O response.

Table 31. Double Read Timeout

Command	Parameter	Setting
NH *	XX (00-99)	Default is NH24 (timeout = 600ms). Set double read prevention to XX * 25ms. After a successful decode, the scanner will ignore a label containing identical data for XX * 25ms. If set to 00, scanner returns to default timeout = 600 ms.

Read Verification

When the Read Verification feature is used, the LM520 will not consider a bar code to be successfully decoded until it has obtained the same results from scanning the bar code on multiple attempts. This feature is particularly useful for reading poorly printed bar codes. Since there is a small performance penalty when this feature is enabled, it should be left disabled unless it is needed to prevent misreads of poorly printed bar codes.

Table 32. Read Verification

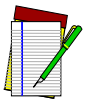
Command	Setting
BC *	Read verification disabled
BD	Read verification set to two decodes
BE	Read verification set to four decodes

No Read Message

When no read message is enabled, the ASCII character string 'No Read' will be transmitted to the host when scanning is completed without a bar code being successfully decoded.

Table 33. No Read Message

Command	Setting
NX	No read message enabled.
NY *	No read message disabled.



NOTE

The No Read message is not available if Continuous Scanning mode is enabled.

No Read Output Signal

The LM520 No Read signal is output on pin 4 of the 9 pin DSUB connector. This signal is an active low signal (0 V) input to a PLC (Programmable Logic Controller). The normal signal is high (5VDC). Care must be taken no to exceed the electrical limits of this output (see Electrical Interface). The signal is asserted (0V) when a scan results in no bar code being decoded. There are two modes of operation available.

No Read Output Signal Mode 1

When a scanning timeout occurs or the trigger is released and no bar code was decoded, the signal is set active (0V) and remains active until a label is successfully decoded.

No Read Output Signal Mode 2

When a scanning timeout occurs or the trigger is released and no bar code was decoded, the signal is set active (0V) and remains active until a duration set by the timeout argument of the enable command NKxx. After the timeout, the signal returns to 5V.

The two digit argument for NK has a valid range of 1-99 (0.1 – 9.9 sec.) In the event of another scanning timeout occurring during the active period of the signal, the timer is reset to 0, which extends the active period of the No Read Output Signal for the period xx.

NOTE

The No Read Output Signal is deactivated and remains at 5VDC when the command is given to disable this function.

This Function is not available in Continuous Scan mode.

Table 34. No Read Output Mode

Command	Parameter	Setting
NI		Enable No Read Timeout Mode 1 and forces disable of No Read Timeout Mode 2 [if a laser timeout occurs, the No Read Timeout signal (pin 4) is asserted (0.0VDC) until a decode occurs].
NJ *		Disable No Read Timeout Mode 1. Returns signal to +5VDC.
NKxx	XX = 01 - 99	Enables No Read Timeout Mode 2 and forces disable of No Read Timeout Mode 1. The XX arguments following the command characters are the length of time in approximately 100 ms that the No Read Timeout signal will remain 0.0VDC.
NL *		Disable No Read Timeout Mode 2. Returns signal to +5VDC

Diagnostic Commands

The LM520 scanner provides commands which allow testing of the scanner, and provide information about the firmware in the scanner.

Table 35. Diagnostic Commands

Command	Settings
ZC	Display operational software version. Scanner sends ACK followed by the data.
AG	Activate the Beeper/Good Read line (pin 1) for a single Good Read beep (as configured by Beeper Duration: AE command).
AH	Activate the internal Good Read LED for the amount of time specified by Good Read LED duration (AF command).

Good Read LED Duration

This command controls the length of time the scanner will light the Good Read LED when a bar code is successfully decoded.

Table 36. Good Read LED Duration

Command	Parameter	Setting
AF	XX (00-99)	Set Good Read LED duration to XX * 45ms. The default is 135ms (XX = 03).

Appendix A:Technical Specifications

Table A-1. Performance Specifications

Parameter	Specification	
Scan Rate	42 scans/second ± 10% (bi-directional)	
Scan Angle	46° nominal, ±2.0°	
Vertical Beam Pointing	0° nominal, ±2.0° (relative to mounting surface)	
Horizontal Beam Pointing	88.3° nominal, ±4° (toward right from engine perspective, relative to engine front face)	
Vertical Beam Exit Position	See Appendix B	
Horizontal Beam Exit Position	See Appendix B	
Usable Scan Line Length	l = [(d+0.88 inches) x 2 x tan q]0.8 or l = [(d+2.34 cm) x 2 x tan q]0.8 where l = usable line length d = distance from the front of scanner q = half of the scan angle, (23° +/- 2°)	
Depth of Field	The minimum depth of field over which a print quality UPCA label (10 mil, 13 mil) or C39 label (all others) with given minimum element width can be read.	
	Code Size	Depth of Field
	5 mils	2.5 – 4.25“
	7.5 mils	2.0 – 7.25“
	10 mils	1.5 – 10.25“
	13 mils	1.5 – 14.25“
	20 mils*	* -- 20.0“
	55 mils*	* -- 36.0“
Start-Up Time	100ms from power on (mirror at rest) to >90% of full deflection scanning.	
Skew Tolerance	< ± 55° from normal. Measured 7” (127 mm) from the front of the module on 20 mil paper code.	
Pitch Angle	< ± 65° from normal. Measured 7” (127 mm) from the front of the module on 20 mil paper code.	
Specular Dead Zone	< ±3°	
Wavelength	650nm visible laser diode standard	
***The near point reading capability is limited by resolution of the module, and is also limited by the symbol length on lower density codes.**		

Table A-2. Power Requirements

Supply Voltage Range		4.75 – 12.0V DC			
Supply Current		Triggered	Continuous Scan	LaserSense	Host-Activated Scanning
	Operating	130mA (typical) 165mA (end of laser life)			
	Surge	200mA for 2ms during initial power-up			
	Standby	60mA max	N/A	90mA max	60mA max
Ripple		Maximum allowable ripple & noise on the power source is 100mv, peak to peak			

.

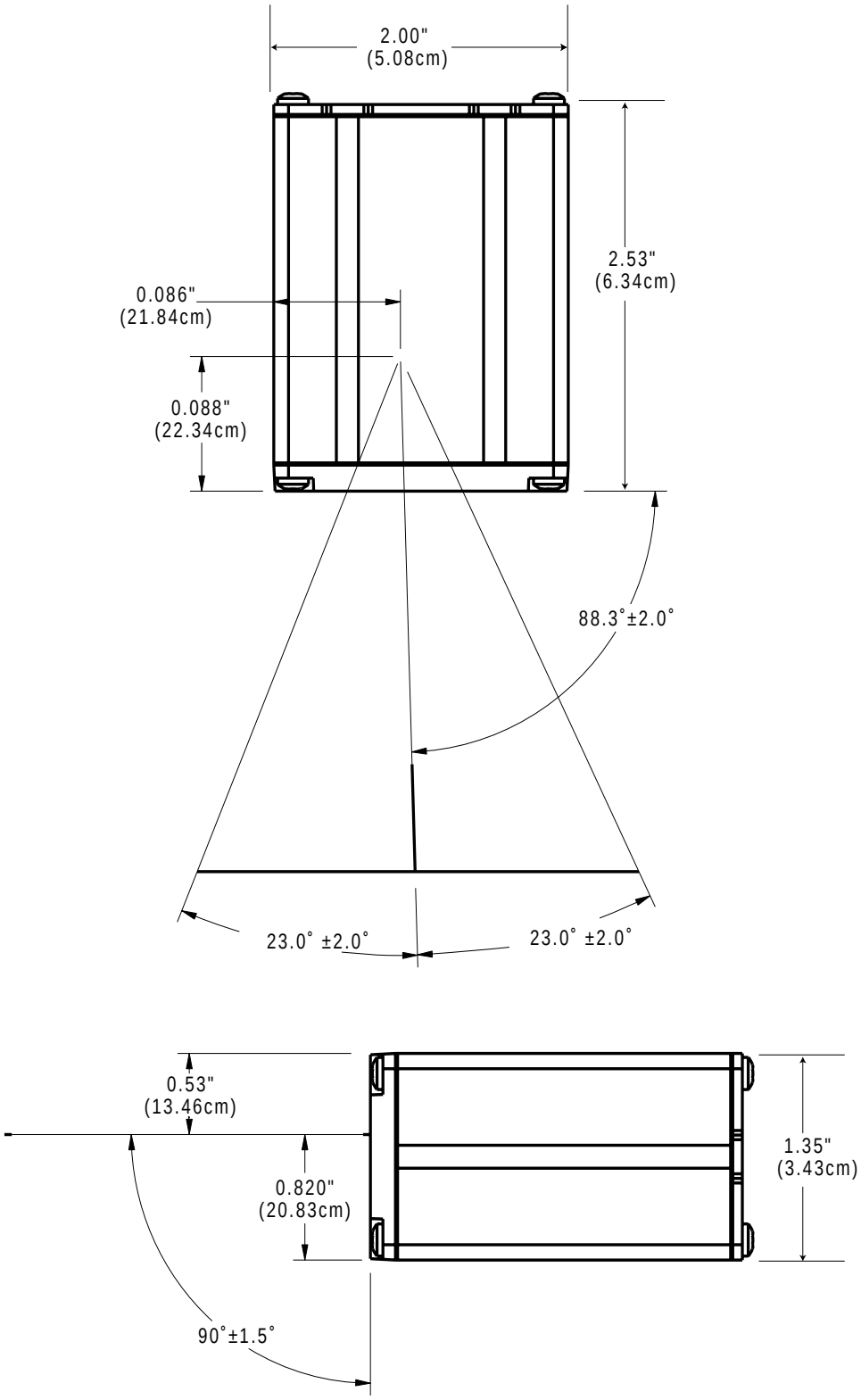
Table A-3. Physical and Environmental Specifications

Parameter	**Specification**	
Dimensions	Height	1.35 " (3.43 cm)
	Width	2.0 " (5.08 cm)
	Length	2.52 " (6.40)
Volume		6.80 cubic inches (111.43 cubic cms)
Weight		0.30 lbs. (136.1 grams)
Temperature	Operating	-20º C to +40º C (normal mode) -20º C to +30º C (operating in continuous scanning mode at 12 VDC)
	Storage	-40º C to +70º C
Relative Humidity		5% - 95%
Ambient Light		2153 lux max.
Radiated Emissions Susceptibility		IEC 1000-3-3
Mechanical Shock		1500G (all axes)
ESD		20 kV
Rain and Dust		IP54

Table A-4. Agency Approvals

Laser Output Power	1.26 mW ±6%
Laser Safety	CDRH Class II, IEC 825 Class 2
EMI/RFI	FCC-A, EN55022-B, UCCI-B, AS/NZ 3450
Safety Conformity	UL, TÜV, CUL, GOST-R

Appendix B: Mechanical Specifications



Appendix C: Factory Default Configuration

Table C-1. Factory Default Configuration

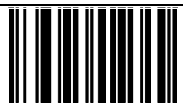
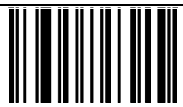
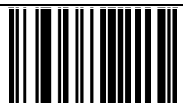
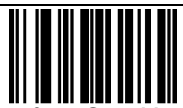
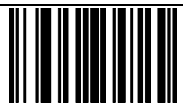
Cmd	Description
@Z	Enable Scanning of Programming Labels
AE03	Beeper/Good Read duration = 135ms
AF03	Good Read LED = 135ms
BC	DisableRead Verification
BH60	Laser time-out = six seconds
DF	Select 9600 baud
EM	Set serial data word to 8 bits, one stop bit and no parity
FA	Clear Label Formats to Default (%D%)
HA	Disable all Flow Control Protocols. Xon/Xoff is off, CTS mode is None. RTS mode is forced to RTS high ready to receive (default for CTS)
HN	RTS High Indicates Scanning in Progress (default for RTS)
KA	Disable Preamble
LB	Postamble = CR, LF (0x0D 0x0A)
NA	Enable LaserSense mode
ND	Disable Continuous Scanning mode
NH24	Double Read timeout = 600ms
NJ/NL	Disable No Read timeout
NY	Disable No Read message.
OB	Enable standard Code 39
OD	Disable Code 39 check character
OF	Disable transmit of the Code 39 start/stop characters
OK	Disable transmission of the Code 39 check character
PA	Disable Interleaved two of five
PO	Disable transmission of Interleaved 2 of 5 check digit
PQ	Disable Standard two of five (STF)
PV	Disable transmission of STF check digit

Cmd	Description
QC	Enable UPC-A
QH	Disable expansion of UPC-E
QL	Enable UPC-E
QX	Disable all UPC 2 and 5 digits supplementals (UPC-A, UPC-E)
QY15	Number of scanning retries to build UPC/EAN supplementals = 15
RC	Enable EAN-13
RP	Enable EAN-8
RS	Disable all EAN 2 and 5 digit supplementals (EAN 8, EAN13)
TC	Enable Code 128
TE	Disable transmission of Code 128 function codes
UA	Disable Code 93
VA	Disable Codabar
VC	Disable transmission of Codabar start/stop characters

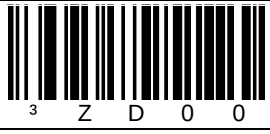
Appendix D: LM520 Programming Labels

The most common method of configuring the LM520 scanner is by sending commands from the host. (see *Configuration of the LM520*). The bar codes contained in this table are a limited set of the programmable options.

Table D-1. Programming Labels

Feature	Code	Bar Code
Reset Factory Defaults	Z1	
Baud rate - 9600	DF	
Data Format - 8 data bits, 1 stop bit, no parity	EM	
Enable no flow control	HA	
Enable software flow control	HB	
Enable hardware flow control	HL	
Enable all symbologies	QM	
Turn beeper off	AE00	
Enable label programming	@Z	
Disable label programming	@Y	

Programming Labels (continued)

Feature	Code	Bar Code
Set beeper duration to 135ms	AE03	
Set scanner timeout to 6.0 seconds	BH60	
Set scanner timeout to 9.9 seconds	BH99	
Set scanner to no timeout until bar code is decoded	BH00	
Scan now, until timeout	ZD00	
Continuous scan ON	NC	
Continuous scan OFF	ND	
LaserSense ON	NA	
LaserSense OFF	NB	
LaserSense Range (Default)	NG60	
LaserSense Range Min.	NG45	
LaserSense Range Max.	NG70	

Appendix E: ASCII Conversion Table

Table E-1. ASCII Conversion Table

CHAR	DEC	HEX	CHAR	DEC	HEX	CHAR	DEC	HEX
NULL	0	00	0	48	30	[	91	5B
SOH	1	01	1	49	31	\	92	5C
STX	2	02	2	50	32	]	93	5D
ETX	3	03	3	51	33	^	94	5E
EOT	4	04	4	52	34	_	95	5F
ENQ	5	05	5	53	35	`	96	60
ACK	6	06	6	54	36	a	97	61
BEL	7	07	7	55	37	b	98	62
BS	8	08	8	56	38	c	99	63
HT	9	09	9	57	39	d	100	64
LF	10	0A	:	58	3A	e	101	65
VT	11	0B	;	59	3B	f	102	66
FF	12	0C	<	60	3C	g	103	67
CR	13	0D	=	61	3D	h	104	68
SO	14	0E	>	62	3E	i	105	69
SI	15	0F	?	63	3F	j	106	6A
DLE	16	10	@	64	40	k	107	6B
DC1	17	11	A	65	41	l	108	6C
DC2	18	12	B	66	42	m	109	6D
DC3	19	13	C	67	43	n	110	6E
DC4	20	14	D	68	44	o	111	6F
NAK	21	15	E	69	45	p	112	70
SYN	22	16	F	70	46	q	113	71
ETB	23	17	G	71	47	r	114	72
CAN	24	18	H	72	48	s	115	73
EM	25	19	I	73	49	t	116	74
SUB	26	1A	J	74	4A	u	117	75
ESC	27	1B	K	75	4B	v	118	76
FS	28	1C	L	76	4C	w	119	77
GS	29	1D	M	77	4D	x	120	78
RS	30	1E	N	78	4E	y	121	79
US	31	1F	O	79	4F	z	122	7A
SP	32	20	P	80	50	{	123	7B
!	33	21	Q	81	51	|	124	7C
“	34	22	R	82	52	}	125	7D
#	35	23	S	83	53	~	126	7E
$	36	24	T	84	54	DEL	127	7F
%	37	25	U	85	55			
&	38	26	V	86	56			
*	39	27	W	87	57			
(	40	28	X	88	58			
)	41	29	Y	89	59			
*	42	2A	Z	90	5A			
+	43	2B						
‘	44	2C						
-	45	2D						
.	46	2E						
/	47	2F						