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The LZ400-RF and the B78 Base Station have 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.

Shielded cables and I/O cords must be used with this equipment to comply with the relevant FCC regulations. Changes or modifications not expressly approved in writing by Worth Data may void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.

This device complies with RSS-210 of Industry Canada. Operation is subject to the following two conditions: 1) this device may not cause interference, and 2) this device must accept any interference, including interference that may cause undesired operation of the device.

The laser used is a Class II Laser Product and has a 1.2 Milliwatts Output. To operate the laser scanner, aim the scanner at the bar code, and pull the trigger. The light source will turn off, once a successful scan has occurred or 2.5 seconds has elapsed, whichever is first. Do not look directly into the laser light source with the trigger depressed; avoid direct eye contact with the laser light source.

RF Exposure Requirements

To comply with FCC exposure essential requirements, a minimum separation distance of 20cm (8 inches) is required between the Base and the body of the user or nearby persons.

Introduction

The Worth Data RF Lasers have the following features:

- 1) The **LZ400-RF Laser Scanner** for the USA and Canada. This laser has a range of 500 feet and has collision detect and retry logic built within. The LZ400-RF Laser communicates with the B78 Base Station. The Base Station communicates with a host PC through the USB port or a RS-232 Serial Port. Up to ten RF Lasers can communicate with one Base Station.
- 2) If you use the USB interface, data is transmitted as keyboard data. If you use the serial interface instead, serial data is transmitted to one of the computer's COM ports.
- 3) The USA RF Laser and Base operate in the 902MHz band. The laser and base radios operate by "frequency hopping" spread spectrum. The radios hop from one frequency to another every 400ms. The radio goes through 25 different frequencies and then repeats the sequence – all in the 902 MHz band at 15 milliwatts (10 dBm) of power. Different sequences define the channels. It is possible to have up to ten RF Lasers/Base Stations in the same area, providing each pair is on separate channels to avoid interference and general confusion. The RF Lasers can also operate in the same room as the 701 RF Terminal.
- 4) The R/F Lasers can read and discriminate between Code 39, Full ASCII Code 39, Interleaved 2 of 5, Codabar, Code 128, EAN-13, EAN-8, UPC-E, UPC-E1, UPC-A, MSI, LabelCode4, LabelCode5, Code 93 and Plessey.
- 5) The RF Lasers have a rechargeable lithium ion battery. The battery is recharged with an included 5v power supply. Recharge time on fully discharged batteries is 2 hours.

Installation

Components of RF Laser Readers

In the event the shipping box shows damage on arrival, please note the damage on the carrier's receipt log.

The supposed contents of your Reader shipment is the following:

1. An R/F Base Station with 1-10 RF Lasers.
2. A Worth Data regulated 5V power supply with each Base Station and Laser Scanner ordered. **TO PREVENT DAMAGING the Base Station or RF Laser, DON'T USE ANY OTHER BRAND OF POWER SUPPLIES.**
3. Either a serial cable (F36) or USB cable (C21), depending on which one you ordered.
4. A laminated **RF Laser Reader Setup Menu** sheet.
5. A plastic barpad for entering variable quantity information and performing the *Link Test* without data transmission.

Scanner Beeps and LEDs (what they mean)

When you scan, you will get one beep when you get a successful decode and a high-pitched beep. The data is then transmitted to the Base Station (as it is being transmitted, the LED flashes yellow). When the Laser receives the acknowledgement from the Base Station that the data has been received, the Laser emits a lower pitched beep and turns on a green LED for three seconds.

If the transmitted data fails to be acknowledged,

- 1) further scanning is prohibited. You can't pull the trigger again until the data reaches the base or until you clear the scanner.
- 2) The laser will retransmit three times, (the yellow LED will indicate retransmissions).
- 3) If it fails three times, it will emit a distinct 8 beep pattern and turn off. This is your clue to check out the Base Station.
- 4) You can pull the trigger to try transmission again. (the laser beam will not come on until the transmission is acknowledged or you hold the trigger down for 30 seconds to clear the data).

USB Installation

Before connecting to a USB port, first plug one of the Worth Data 5v regulated power supply into the Base Station. (REMEMBER, any other brand will damage the Base Station.) The Base Station will power up with 3 more flashes than the channel setting; i.e. if it is set on Channel 0, it will flash green three times. If the Channel were set to 7, it would flash green 10 times.

Now connect the USB port to the Base Station. The Base Station will be automatically sensed and the driver installation will begin. Windows can usually find the necessary driver on the hard drive under */Windows/System 32/Drivers*; occasionally you will have to insert the original Windows CD. The Mac always finds the driver. In either case, the driver used is the standard keyboard driver. No special drivers are required.

You should be connected as below:

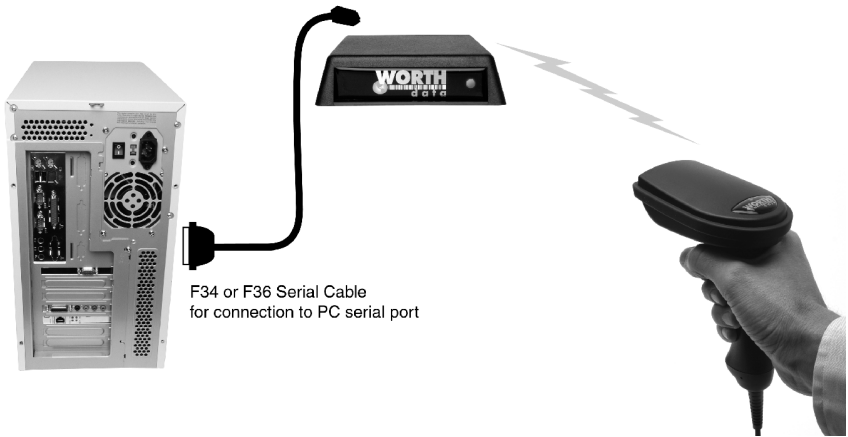


If mistakenly abort your driver installation, see the **Trouble Shooting Section** of this manual.

For testing, bring up Notepad or WordPad on your computer and scan the TEST LABEL on page 23. Now turn to page 8.

Installing the R/F Reader with a dedicated serial port

The Base Station can be directly attached to a spare serial port as shown below.



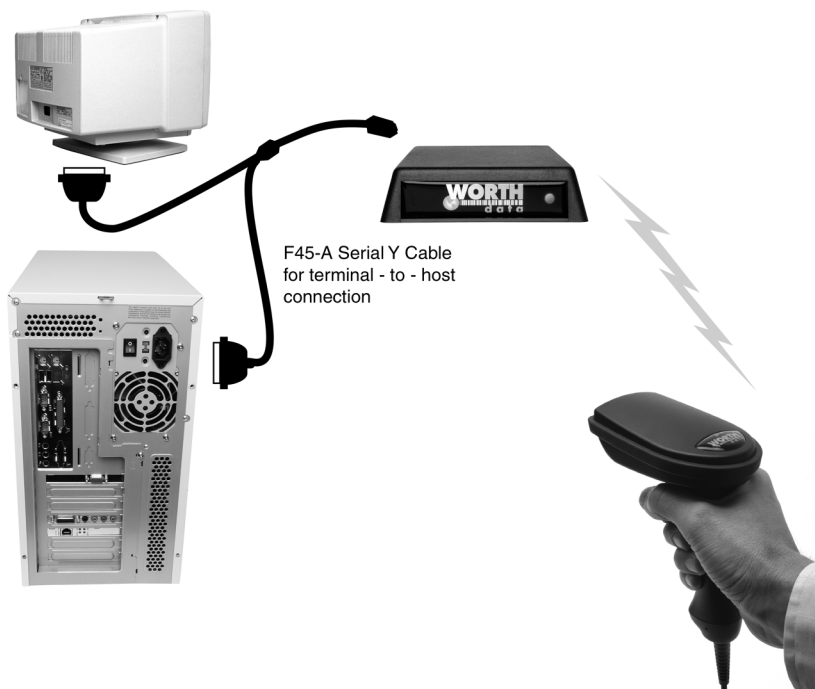
Your software will need to read the serial port as a separate device, unless you're using an IBM-compatible computer and Worth Data's PortKey software, which makes serial-port data appear as though it had been typed at the keyboard. See page 28 for a simple BASIC program to read the serial port for testing purposes.

If you specified a 25-pin null-modem cable (part number F34) or a 9-pin cable (part number F36) when you placed your order, you can cable directly from the RF/Reader's Y-Cable port to your computer's serial port. Refer to *page 8* for the details of the pin-outs of the cables.

Turn to *page 8* to configure the RF Laser Reader using the Setup Menu.

Installing the R/F Reader between a computer and terminal

If you attach the s Base between your computer and a terminal, as shown below, using Cable Selection F45-1, bar code data will be sent to the computer as if it had been typed on that terminal. Refer to *page 8* for the details of the pin-outs for each connector on the cable. You will also need to change jumpers (JP2 on the RF Base) on the board inside the case from the "S" position to the "Y" position.



Cables may require modification, depending on the genders and pin-outs of your serial ports and cables. You may require "gender changers" (available at most computer stores) for the two 25-pin connectors. Refer to *page 8* for the details of the pin-outs of the dual port serial cable.

Turn to *page 8* to configure the your reader using the **RF Laser Reader Setup Menu**.

R/F Reader Serial Model Pinouts

F34, DB25 Null Modem Cable

These are the pinouts for Cable F34, a DB25 Female, with pins 2 and 3 crossed, used for connection directly to a DB25 male host COM.

	Mod 8	DB25F
Function	Pin	Pin
Frame Ground	1	1
Transmit Data	2	3
Receive Data	3	2
Signal Ground	4	7

F36, DB9 Straight Cable Pinouts

These are the pinouts for the DB9 Female Straight Cable, F36, used for connection of the Base directly to a DB9 Male host COM.

	Mod 8	DB9F
Function	Pin	Pin
Shell (Chassis Ground)	1	Shell
Transmit Data	2	2
Receive Data	3	3
Signal Ground	4	5

F45-1, Dual Port Serial Cable

If you want to install the Base between a serial terminal and a host computer, (as with Unix, PICK, VM, etc.), you need the Dual Port Serial Port Cable, F45-1. This cable has three connectors: 1) Host, 2) Terminal, and 3) Scanner. This cable is configured so that the Terminal End connects directly into the female main port of the Terminal; the female Host End connects into the DB25 male cable end (a cable with pins 2 and 3 crossed is assumed to have been connected between the host terminal).

Dual Port Cable's

Host Connector

Frame Ground
Transmit Data
Receive Data
RTS
CTS
DSR
Signal Ground
DTR, CD

Pin Number

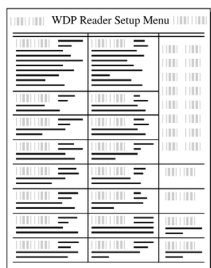
1
2
3
4
5
6
7
8,20

Dual Port Cable's

Terminal Connector

Frame Ground
Receive Data
Transmit Data
RTS
CTS
DSR
Signal Ground
CD, DTR

Configuring the RF Laser Reader for your computer and application



Find the 8 1/2 x 11" laminated ***RF Laser Reader Setup Menu*** sheet and look it over. This simple menu lets you easily configure the Radio/Freedom Reader to work with almost any computer system, and to tailor its bar code reading and data format characteristics.

Be sure to read the scanning instructions on the next page. To read *Reader Setup Menu* bar codes and configure your reader, you must know the right way to

scan bar codes.

These are the RF Laser Reader's default settings and are shipped configured to these settings; they can be reset to them at any time by scanning the **Start Setup** and **Reset** codes on the *Reader Setup Menu*.

Code 39	UPC/EAN
• Enabled • Check digit disabled • Accumulate Mode enabled • Caps Lock Off • Start/stop characters not transmitted	• Enabled • UPC supplements disabled • UPC-E Compressed / NSC of 0 • UPC-A NSC and EAN-13 1st 2 characters and check digits transmitted • UPC-E NSC and EAN-8 1st 2 characters & check digits not transmitted
2 of 5 Code	General configuration settings
• Disabled • <u>12 of 5 Code Disabled</u> • 6-digit code length • Check digit disabled	• Channel 0 • CR for Terminator Character • Data Transmission Timing of None • Medium Beep pitch • No preamble or postamble
Code 128	• USA keyboard • 9600 Baud Rate, None Parity • 8 Data Bits, 1 Stop Bit • Full Duplex Transmission • ID=0
• Enabled • UCC/EAN-128 options disabled	
Codabar	
• Disabled • CLSI Format disabled • Start/stop characters not transmitted	
MSI/Plessey	
• Disabled • Check digit(s) not transmitted	
Code 93	
• Disabled • Full ASCII disabled	

Be certain to turn off any bases with common frequencies before setting up. If you need to change any of the default settings, or would like to learn more about the Wireless scanner options, the next several pages will explain, step by step, how to set them and

Laser Scanning Instructions

Using a laser scanner is basically as simple and intuitive as "point and shoot" at a distance of 0-24", depending on the density of the bar code.

Basically, the laser scanner's beams must cross every bar and space on the bar code, without touching any other bar codes, as shown in the first example below. You'll need to hold the scanner further away to produce a wider beam for large bar codes, and closer for bar codes with bars very close together.

Even though momentary exposure to a laser's low-power, visible-light is not known to be harmful, **you should not aim the beam into anyone's eyes.**



When you scan, you will get one beep when you get a successful decode and a high-pitched beep. The data is then transmitted to the Base Station (as it is being transmitted, the LED flashes yellow). When the Laser receives the acknowledgement from the Base Station that the data has been received, the Laser emits a lower pitched beep and turns on a green LED for three seconds.

If the transmitted data fails to be acknowledged,

- 1) further scanning is prohibited. You can't pull the trigger again until the data reaches the base or until you clear the scanner.
- 2) The laser will retransmit three times, (the yellow LED will indicate retransmissions).
- 3) If it fails three times, it will emit a distinct 8-beep pattern and turn off. This is your clue to check out the Base Station.
- 4) You can pull the trigger to try transmission again. (the laser beam will not come on until the transmission is acknowledged or you hold the trigger down for 30 seconds to clear the data).

The important thing to remember about using a laser with the RF Laser Reader Setup Menu is that you need to make sure the scanner's beam covers only one bar code at a time. The laser scanner's beam is wide enough, and the configuration bar codes close together enough, that you will need to use your fingers, or the supplied Laser Setup Assist window, to "block off" bar codes adjacent to whatever configuration bar code you need to read.



For example, to read this "5" bar code on the Setup Menu, you would need to cover any adjacent bar codes with paper or a finger first, as shown.



Don't forget to take the R/F Laser Scanner of Setup Mode by scanning **End Setup**, otherwise the batteries will run down totally because the radio transmitter remains on.

Using The RF Laser Setup Menu

1. To configure your reader using the **Reader Setup Menu**, you must first scan the **Start Setup** code at the top left corner. **Do this now.** You'll hear two beeps. During Setup, nothing will be transmitted to your computer; the *Reader Setup Menu* codes are strictly for configuring the reader. If you did not hear two beeps, try scanning the code again, until you hear the two beeps. If you've never scanned bar codes before, read the scanning instructions on *page 9* before continuing.
2. Next, choose the topic you want to change an option for, and scan its code. Let's use **Beep Tone**, at the lower left corner of the menu, as an example. Scan the **Beep Tone** code now. You'll hear two beeps.
3. Then, choose the option you want to change, from the list next to the topic bar code you just scanned. For **Beep Tone**, the options range from **0** for the lowest pitch to **4** for the highest pitch. Using the "*Barpad Table*" on the right side of the Reader Setup Menu, scan the number or letter associated with the option you have selected. Let's change the beep pitch to **Highest**.
4. Now scan **End Setup** (at the top-right corner of the Reader Setup Menu to complete the setup exercise. You'll hear three beeps,. If you followed the instructions correctly and successfully changed beep tone to "highest", the

three beeps will be higher in pitch than the other beeps had been. If they aren't higher in pitch, repeat the steps on this page until you are successful at changing the beep tone.

Now that your beep tone is at the "highest" pitch, you may want to change it back to "medium" or a different setting. Repeat the steps above, selecting the option you prefer to "highest" in step 3.

When you've successfully changed the beep pitch, and are ready to configure the reader for your specific application, scan **Start Setup** again. Continue scanning topics and options until you've made all the changes you desire, and then scan **End Setup** to complete setup. For keyboard models, pay attention to *Keyboard Country*, *Computer Interface*, and *Data Transmission Timing*. For serial models, pay attention to *Baud Rate*, *Parity*, and *Data Bits*. If you are planning to use several RF Laser scanners with one base station, pay attention to the *Set ID* parameter.

The next several pages will show you all of the various Wireless Reader options. Default settings are shown in **bold** in this manual and marked with an * on the *Reader Setup Menu*.

Beep Tone

Lowest	0
Low	1
Medium	2
High	3
Highest	4
None	5

Channel

Default Channel	0
-----------------	---

- The default **Channel** is always shipped as **0**. There are 10 channels in the USA and Canada. The Channel can be set by scanning the bar coded Setup Menu.
- All Lasers and associated Base Station must be set to the same channel. If you have more than one RF Laser per Base Station, you must set a unique ID in each RF Laser. (See **SET ID**.)
- The Laser channel must match the channel on the Base station. See Appendix A for information on changing the channel on the Base from the shipped default channel of 0.

Code 3 of 9 (Code 39)

Enable Code 39	0
Disable Code 39	1
Enable Full ASCII Code 39	2
Disable Full ASCII Code 39	3
Enable Code 39 Accumulate Mode	4
Disable Code 39 Accumulate Mode	5
Enable Start/stop character transmission	6
Disable Start/Stop character transmission	7
Enable Mod 43 Check Digit	8
Disable Mod 43 Check Digit	9
Enable Check Digit Transmission	A
Disable Check Digit Transmission	B
Caps Lock ON	C
Caps Lock OFF	D

For information about Code 39 and Full ASCII Code 39, see *Appendix C*. See *page 28* for information about **Accumulate Mode** (this setting also controls Code 93 and Code 128).

Enabling Start/Stop character transmission means that the RF Laser Reader will transmit the * Start/Stop characters to your computer along with the data. For example, data of 1234 would be transmitted as ***1234***.

Enabling the Mod 43 Check Digit requires the units position of your data to match the calculation for the check digit explained in *Appendix C*.

If you've enabled the check digit, enabling Check Digit transmission causes the reader to transmit it to your computer along with the bar code data.

"Caps Lock ON" means that for all codes lower case letters read as data will be transmitted as upper case, and upper case as lower. Numbers, punctuation & control characters are not affected. This applies to Code 128 and Code 93 also.

"Caps Lock OFF" means that letters will be transmitted exactly as read.

UPC/EAN

Enable UPC/EAN	0
Disable UPC/EAN	1
Enable UPC/EAN Supplements	2
Disable UPC/EAN Supplements	3
Enable transmission of UPC-A NSC and EAN-13 1st 2	4
Disable transmission of UPC-A NSC and EAN-13 1 st 1 digits	5
Enable transmission of UPC-A and EAN-13 Check Digit	6
Disable transmission of UPC-A and EAN-13 Check Digit	7
Enable transmission of UPC-E NSC and EAN-8 1 st Digit	8
Disable transmission of UPC-E NSC and EAN-8 1st Digit	9
Enable transmission of UPC-E and EAN-8 Check Digit	A
Disable transmission of UPC-E and EAN-8 check Digit	B
UPC-E Compressed	C
UPC=E Expanded	D
EAN-8 observes 9 & A above	E
EAN-8 is forced to transmit 8 digits	F

For more information on UPC and EAN, see following page and *Appendix H*.

Enabling supplements allows you to read 2 and 5-digit supplemental codes used with magazines and paperbacks. **This disallows right-to-left reading of UPC codes**, to assure that the supplement doesn't get skipped.

Use setting **2** to enable reading of the 2 and 5 digit **UPC/EAN supplements** commonly found on magazines and paperback books. Use this setting to force left to right reading of UPC codes, assuring that the supplement code is not missed. This setting also allows for reading of the *UCC/EAN 128 Extended Coupon Code*. The *Extended Coupon Code* consists of a UPC code with a NSC of 5 or and EAN code with a country code of 99 along with a Code 128 supplemental code to the right. This setting allows you to read the Code 128 supplement with the UPC/EAN, providing the UPC has a NSC of 5 or the EAN code has a country code of 99. Without the correct NSC or country code, the Code 128 portion will be ignored; UPC code with an NSC of 5 or EAN codes with country code of 99 will not be read unless there is a readable Code 128 supplemental code read also.

UPC-E Compressed Format transmits UPC-E codes as is; **Expanded Format** adds zeros to make them the same length as UPC-A.

UPC-E can be used in either normal UPC-E format (implicit NSC of 0) or UPC-E1 format (NSC of 1). **UPC-E1 is enabled** by scanning 2 of 5 Code and **8** (9 disables UPC-E1). It is very easy to partially read EAN-13 as UPC-E1, so **don't enable UPC-E1 if reading EAN-13**.

If you wish to **transmit UPC-A data in EAN-13 format**, (an added leading 0 for the USA's country code), scan **Terminator Character** and **F**. Scanning **E**, the default, sets UPC back to no country code transmitted.

ISBN, International Standard Book Numbering, bar codes are EAN-13 codes with a 5 digit supplement. If the first three digits are the "Bookland" country codes of 978 for books or 977 for periodicals, then you can enable transmission of EAN-13 bar codes in the ISBN format. Suppose you scan an EAN-13 with 5-digit supplement which is a bar code of 978055337062153495. It would be transmitted in ISBN format as 0553370626 (as of Jan.1, 2006, the correct ISBN format is the EAN-13 bar code with the 5 digit supplement). 055337062 are the first nine digits of the ISBN format, and 6 is the newly calculated Mod-11 check digit.

To enable the transmission of the ISBN format, scan **Terminator Character** and **D**. Scanning **C**, the default, disables conversion to ISBN format back to regular EAN-13 format.

Code 128

Disable Code 128	0
Enable Code 128	1
Disable UCC/EAN-128	2
Enable UCC/EAN-128	3
Enable Storage Tek Tape Label Code	C
Disable Storage Tek Tape Label Code	D
Bar Code IDs transmitted	E
Bar Code IDs not transmitted	F

To enable a Bar Code ID character to be transmitted at the beginning of each bar code read, scan **E**. **The ID's are as follows:**

Codabar	a	I2of5	e	93	i	Plessey	x
Code 39	b	2of5	f	UPC-E0	n	LabelCode4	y
UPC-A	c	128	g	UPC-E1	o	LabelCode5	z
EAN-13	d	MSI	j	EAN-8	p	STK	s

To disable bar code ID characters, scan F. For information about Code 128, see *Appendix F*.

MSI and Plessey

Disable MSI	0
Enable MSI with 1 Mod 10 check digit	1
Enable MSI with 2 Mod 10 check digits	2
Enable MSI with 1 Mod 11 and 1 Mod 10 check digit	3
Transmit No Check Digits	4
Transmit 1 Check digit	5
Transmit 2 Check digits	6
Enable Plessey (mutually exclusive with MSI)	7
Enable LabelCode5	8
Enable LabelCode4	9

For more information about MSI code, see *Appendix I*.

Codabar

Enable Codabar	0
Disable Codabar	1
Enable CLSI Codabar	2
Disable CLSI Codabar	3
Enable Start/Stop Character Transmission	4
Disable Start/Stop Character Transmission	5

For information about Codabar, see *Appendix E*.

CLSI format is a form of Codabar often used by libraries.

Enabling Start/Stop character transmission means that the RF Laser will transmit start/stop characters to your computer along with data. If you're varying start/stop characters with different label types, you'll want to enable transmission.

2 of 5 Code

Enable Interleaved 2 of 5	0
Disable Interleaved 2 of 5	1
Enable Interleaved 2 of 5 Check Digit	2
Disable Interleaved 2 of 5 Check Digit	3
Enable Check Digit Transmission	4
Disable Check Digit Transmission	5
Enable Standard 2 of 5	6
Disable Standard 2 of 5	7

For information about Interleaved and Standard 2 of 5, see *Appendix G*.

Enabling the Check Digit requires the data's units position to match the calculation for the check digit explained in *Appendix F*. *If you've enabled the check digit*, enabling Check Digit transmission causes the reader to transmit it to your computer along with the bar code data.

2 of 5 Data Length

2 of 5 Code is so susceptible to interpreting partial scans as valid reads that the Radio/Freedom Reader uses fixed-length data as a safeguard. **To choose a data length**, scan it as a two-digit number using the Barpad Table. For example, to select 8-digit data length, you would scan a 0 and then an 8. **Because Interleaved 2 of 5 is required to be an even number of digits in length**, you must use an even number. If you're unsure of your bar code length, **temporarily** set the length to **00**, read a bar code, and count its digits and then set it to the actual length. **DO NOT PERMANENTLY SET THE 2 of 5 LENGTH TO 00 or you will get misreads!**

Code 93

Enable Code 93	0
Disable Code 93	1
Enable Full ASCII Code 93	2
Disable Full ASCII Code 93	3

For more information on Code 93 see *Appendix D*.

Terminator characters

Enter (carriage return)	0
None	1
HT	2
CR/LF	3

Depending on your application, you may wish your Wireless Reader to transmit bar code data to your computer with an **Enter** (carriage return), a **Tab** at the end, or with no extra terminating character at all.

If you need a terminator character other than **CR** or **HT** or **CR/LF**, you can get it by specifying **None** here and then selecting your desired terminator character(s) specified in the **Postamble** (See *Page 18*).

Preamble

A "Preamble" is a user-specified data string transmitted at the beginning of each bar code. For example, if you specify the preamble @@ and read data of **123456**, "@@123456" would be transmitted to your computer. With the 2-Way LZ2x2-RF Laser, the Preamble applies to the scanner, not the base station because there may be multiple scanners per base.

The default is no preamble. To select a preamble, scan up to 15 characters from the "FULL ASCII MENU" on the back of the *Reader Setup Menu*, and then scan **SET** when you're done. To return to the no preamble setting, scan **Clear** here instead of scanning **SET** or any characters from the FULL ASCII MENU.

You can **trim 1-15 leading characters** from bar code codes by scanning a ~ (tilde -- ASCII 126) followed by a single digit, 1 through F, as part of the Preamble. (Bar codes that are shorter than the amount-to-trim are transmitted with no trimming.) Consider the examples in the following table to understand how trimming works:

<u>Bar Code Data</u>	<u>Preamble</u>	<u>Data Transmitted</u>
123	XYZ	XYZ123
12345678	~3XYZ	XYZ45678
12345678	~9	12345678
12345	~A	12345
123456	~5	6

You can also trim selectively by bar code type. For example, you can trim 2 characters from Code 39 and a different amount from other bar code outputs. This is done by using the bar code ID character in conjunction with the tilde (~). A preamble of ~b2~c1 says trim 2 characters from the front of Code 39 output and trim 1 character from the front of UPC-A. Refer to the Code 128 parameter on page 13 for a list of the ID character associated with each bar code type.

A final use of the Preamble/Postamble is to enter a minimum/maximum length check for bar code data read. Use the Preamble or Postamble by entering |*nnmm* where "|" is ASCII 124, "*nn*" is the two digit minimum to be read and "*mm*" is the two digit maximum to be read.

Postamble

"Postamble" refers to a user-specified data string transmitted at the end of each bar code. For instance, if you specify the postamble @@ and read data of **123456**, "**123456@@**" would be transmitted to your computer.

The default is no postamble. To select a postamble, scan up to 15 characters from the "FULL ASCII MENU" on the back of the *Reader Setup Menu*, and then scan **SET** when you're done. To return to the no postamble setting, scan **CLEAR** here instead of scanning **SET** or any characters from the FULL ASCII MENU.

You can **trim 1-15 trailing characters** from bar code codes by scanning a ~ (tilde -- ASCII 126) followed by a single hex digit, 1 through F. (Bar codes which are shorter than the amount-to-trim are transmitted without trimming.) Consider the examples in the following table to understand the options of the Postamble:

<u>Bar Code Data</u>	<u>Postamble</u>	<u>Data Transmitted</u>
123	XYZ	123XYZ
12345678	~3XYZ	12345XYZ
12345678	~9	12345678
12345	~A	12345
123456	~5	1

Bar codes that are shorter than the sum of the Postamble trimming and Preamble trimming will be transmitted without trimming. Selective trimming and min/max bar code data is also supported through Postamble specifications, (See **Preamble** above for complete details).

Characters

This setup option allows you to output ASCII characters different from the ones scanned. (Don't use this option to configure the Radio/Freedom Reader for your non-US keyboard -- instead, use the Keyboard Country option described below.)

For example: Suppose you want the Radio/Freedom Reader to output a hex 92 character every time you scan a 1 (hex 31); you want to remap hex 31 to hex 92, (If you're using 8 data bits, output of 80-F8 codes is possible.)

- 1) Scan the **Start Setup** Bar Code
- 2) Scan the **Characters** Bar Code on the Setup Sheet.
- 3) Scan **3 1** and **9 2** to output hex 92 when reading a "1".
- 4) Scan up to 7 other pairs of character reassignments.
- 5) Scan **Set** when complete.
- 6) Scan **End Setup** to exit setup mode.

Hex values for each character code are shown on the **Full ASCII Menu**, (the back of **Wireless Setup Menu**). The equivalent decimal values are also shown for each character.

You can also eliminate characters by reassigning hex codes to FF. For example, to strip all \$ (dollar sign) characters from transmission, you would follow the above instructions and scan **2 4 F F** in step 3.

Keyboard country

This option configures the Radio/Freedom Reader for your choice of 15 keyboard country settings, such as USA (the default), UK, French, German, etc.

Scan the keyboard country bar code and then the two-digit code for your keyboard country (listed on the Reader Setup Menu), such as **14** for UK.

Set ID Character

The ID is used to differentiate between multiple RF Lasers attached to the same Base Station.

Multiple scanners on one base station require each scanner to be set to a unique ID of **0,1,2,3.....9**. Scan **Set ID Character** and then scan **0-9** for each scanner, giving each a different ID of 0-9.

Link Test Code

This is a code to test the transmission link between the Wireless Scanner and its Base Station, without transmitting data. You can use this to be sure you are in range and able to hear the base station beeping. No data is transmitted. **Do not enter the Setup Mode when performing the link test.** This code is the same as the "**Clear Buffer**" code on the *Barpad Menu*.

Reset

Once you are in the Setup Mode, don't scan **Reset** unless you're sure you want to restore the Wireless Reader to its default settings (as described on *page 9*), erasing all changes you've made.

DIFFICULT CODE SETUP OPTIONS

Aiming Laser Dot: Sometimes it is difficult to see the laser beam and know you are on the bar code, especially if you are attempting to read outdoors in direct sunlight. The laser can be outputted as a brighter dot for a few seconds, allowing the user to place the dot in the middle of the bar code; then the laser beam starts sweeping for the read. As shipped, the laser beam never forms an aiming dot, but you can program a number of seconds that you wish the aiming dot to appear before the sweeping beam by scanning the following:

Scan **Start Setup**

Scan **Protocol**

Scan **3** to select a 1 second aiming dot, or
4 to select a 2 second aiming dot, or
5 to select a 3 second aiming dot, or
6 to select a 4 second aiming dot, or
7 to select a 5 second aiming dot, or
2, the default, to eliminate an aiming dot.

Scan **End Setup**

4-second beam: Another option with problem reading conditions is to increase the length of the time the scanner attempts to read, from the default 2-second beam to a 4-second beam. To select the 4-second beam:

Scan **Start Setup**

Scan **2 of 5**

Scan **F** to select the 4-second beam

Scan **End Setup**

To return to the default 2-second beam, scan **E** instead of **F**.

Automobile VIN READING:

There is special support for reading automobile Vehicle Identification Numbers, VIN, remotely from the computer. (CCDs will not read through a windshield, only laser scanners.) You may want to use the aiming dot above too.

"Delayed Transmission": is a feature which allows the user to leave the computer, (perhaps being operated by someone else), go to the location of the car, scan the VIN with the first trigger pull, return to the computer, be certain that the screen and cursor are properly positioned, and then pull the trigger again for transmission. The first trigger pull scans and stores the bar code. The second trigger pull transmits the data, permitting the user to be sure the cursor is properly positioned. To change the reader to "Delayed Transmission":

Scan **Start Setup**

Scan **Terminator**

Scan **B** to select "delayed transmission"

Scan **End Setup**

To disable "delayed transmission", repeat the above substituting **A** for **B**.

"Difficult Code 39 Reading": This feature facilitates reading of the VIN number on automobiles, which is often a difficult-to-read bar code, especially reading through a windshield. VIN numbers are long, often weathered, often dirty, and challenging to read.

To enable the more aggressive Code 39 algorithms necessary to read windshield VINs:

Scan **Start Setup**

Scan **2 of 5 Code**

Scan **D** for windshield reading

Scan **End Setup**

To return to the default Code 39 decode algorithms, scan **B** instead of **D**.

"Double-scan checking": When reading a VIN, you will also want to disable double scan checking. The reader's default is to not output or beep until it has two successive identical decodes. This is an acceptable safeguard with most codes, but with VIN numbers read through a windshield, you will have to deactivate double scan checking to get timely reads.

Scan **Start Setup**

Scan **Code 39**

Scan **F** to disable doubles scans.

Scan **End Setup**

To enable double scan checking, scan **E** instead of **F**.

Don't forget the common sense things you can do to facilitate reading the VIN:

- 1) Be sure the window on the laser scanner is clean.
- 2) Be sure the windshield is wiped before of reading.

The following parameters apply base station attached serially.

Baud rate

300	0
600	1
1200	2
2400	3
4800	4
9600	5
19,200	6

Data bits

7 Bits	0
8 Bits	1

Set the data bits ("word length") to the same setting your terminal is using, or you want to use with your serial port.

Parity

None	0
Even	1
Odd	2

Set parity to the same setting your terminal is using, or the one you want to use with your serial port. None is usually used in conjunction with 8 data bits, Even or Odd with seven data bits.

Stop bits

1 Bit	0
2 Bits	1

Set the stop bits to the same setting your terminal is using, or you want to use with your serial port.

Transmission mode

Full Duplex	0
Half Duplex	1

This applies to use of the "F45-1 Serial Y Cable" only. "Full Duplex" means that the R/F Reader will transmit data only through the HOST connector. With "Half Duplex", data is transmitted through the HOST and TERM connectors. Full Duplex should be used in almost all cases, but Half Duplex. 0 is useful for testing pin-out reversal.

Protocol

This parameter only applies to serial operation of a Base Station.

None	0
Host Controlled Acknowledge	1

"None" means that Base Station will immediately transmit an acknowledgement to the RF Laser from which it has just received transmitted data, (without waiting for a response from the host computer program.)

If you want the host computer program to analyze the data and to send back different beep patterns to the laser scanner, enable *Host Controlled Acknowledge*. With this parameter enabled, the data is passed to the computer and no acknowledgement is sent to the scanner until the host computer replies to the base station with one of three possible ASCII codes: ACK (ASCII 06), BEL (ASCII 07), DC2 (ASCII 18). Upon receipt of these codes from the host computer, the base sends a signal back to the transmitting laser scanner that causes it to emit beeps as follows:

- ACK - one short beep in laser
- BEL - two longer low pitched beeps
- DC2 - three longer low pitched beeps

This allows the host computer program to give limited feedback to the scanner operator.

Please refer to *Host Response Delay* to determine if you need to compensate for slow host program response by slowing down the retry time when failing to get a response from the base station.

Test the Reader with your computer

If you are connected by usb interface, or if you have a serial reader and are using PortKey with an IBM compatible, you should be able to scan the bar code on the next page, hear a beep (2 beeps on 2-way laser), and see data displayed on the computer's screen. First get your computer to some program where you can type and see it on the screen, (i.e. Notepad). Now scan the TEST LABEL below. Your screen should show:

TEST LABEL

If you can't read the TEST LABEL, see the *Scanning Techniques* back on page 10. If you don't get a beep, try moving closer to the Base Station and moving the scanner closer or farther away from the bar code. If you get a beep (two beeps with 2-way laser scanner), but no data displayed:

If you still have trouble, see the **Troubleshooting** section of this manual.

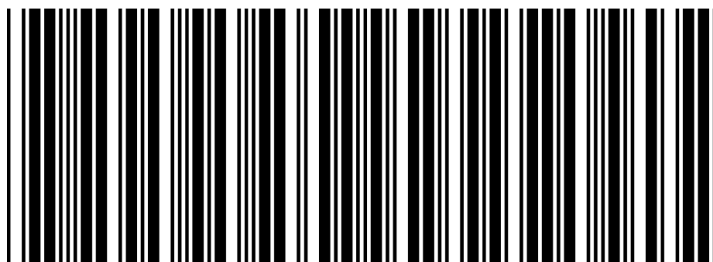
If you are connected to serial port and aren't using *PortKey*, you will need to use a communications program; or use the *WDR Serial Test Program* distributed on the enclosed with your serial reader. The program is for Windows only.

If you are using the WDR Serial Test Program, follow these guidelines:

- Make sure the serial parameters on your Base Station match those used by your computer.
- Make sure you are connected to a valid serial port.

If you still are having problems, see the **Troubleshooting Section**.

TEST LABEL



Radio Considerations

Operating Instructions

Operational Details

The RF Laser:

1. **chirps** on a "good read" or successful scan while turning off the scanner beam, and
2. **beeps** loudly when it gets the acknowledgement back from the Base Station that it has received the data.

The yellow light on the back of the scanner indicates that it is transmitting. You will see up to four transmission attempts before the unit goes to sleep and waits for you to pull the trigger again. The green light indicates that it has received the acknowledgement from the Base Station. After four unsuccessful tries of transmitting to the base without an acknowledgement, the scanner chirps 8 times and goes to sleep waiting on the operator to move closer to the base station and pull the trigger again for a transmission retry. After going to sleep on an unsuccessful read, when the trigger is pulled again, the scanner beam doesn't turn on for reading; instead, the unit beeps three times to indicate is re-transmitting and just transmits again. This sleep and retransmission cycle is repeated until the acknowledgement is received or the buffer is deliberately cleared. In this way, no scanned data is lost, even though you have wandered out of range of the Base Station. Until the pending data acknowledgment has been received, pulling the trigger will only retransmit and not activate the scanning laser beam for additional reading.

If you are out of range and want to clear data in the scanner's buffer waiting to be transmitted again, by pulling the trigger and holding it down for 30 seconds, the buffer will be cleared and the scanner will emit 3 low pitched beeps.

Range

The operational range of 500 feet is far greater than is practical to operate blind from the PC. However, unless the unit becomes defective, you should experience excellent transmissions in almost any environment.

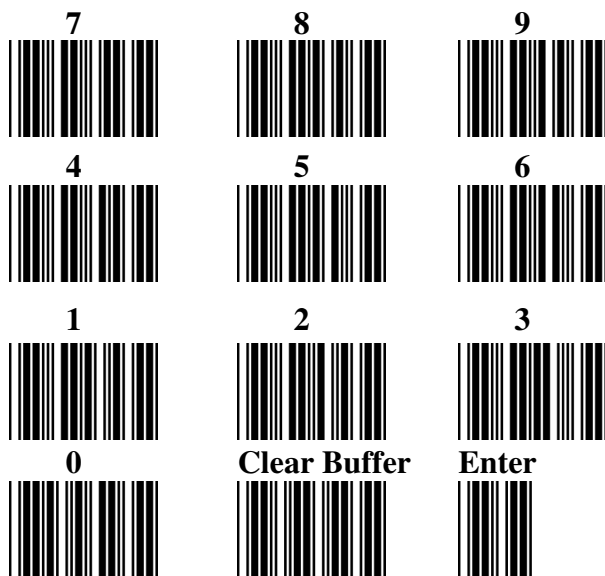
Avoid locating the Base Station next to a 900 MHz phone. Raise the Base if you are having any range issues.

Accumulate Mode

Accumulate Mode is an option (which can be enabled or disabled using the Reader Setup Menu's Code 39 section) allowing the reader to accumulate multiple bar codes in its buffer, then transmit them to the computer as if they had been a single bar code. This is useful for entering quantities and other variable data. A small laminated *barpad* card is provided with each reader ordered to aid in entering variable quantities.

It works with Code 39 only, and can't be used with a check digit. When the reader reads a bar code with a leading space, it beeps and buffers the data without transmission. It continues to read and buffer bar codes (up to 40 characters) until it reads a bar code without a leading space. Then the entire buffer (including that last code) is transmitted as one long bar code. A bar code of a double minus (--) sign clears the buffer. Scanning a backspace code (\$H) backspaces in Full ASCII mode. A handy code for **Enter** (as seen on the "Barpad" below) is a Start/Stop only. (No data.) The code to use for testing the transmission link between the RF Laser Scanner and the RF Base Station is the CLEAR BUFFER code (the same bar code as titled Link Test on the Setup Menu. It will cause beeps to be heard, but no data will be transmitted to the computer -- testing blind with no computer consequence.

This numeric "Barpad" illustrates Accumulate Mode. Scan **5, 3, 8**, and **Enter**. The reader transmits a single message of **538**.



Function/Control Key Support

The RF Scanner can also transmit key sequences for function, control, alt (command and option keys on Macs), cursor and shift keys, for ease of use with the many software packages using these keys for menus or commands. You can include these codes in other bar codes, or you can scan these “keystrokes” into your Preamble or Postamble in order to add them to every scan from your reader. You must have Full ASCII Code 39 enabled on your reader (this is the default setting). Scan the corresponding bar code (or pairs of codes for Pg Up, Pg Dn, Home, etc) from the Full ASCII menu to emulate the chosen key.

PC Key	Full ASCII Menu Bar Code
F1	SOH (f1)
F2	STX (f2)
F3	ETX (f3)
F4	EOT (f4)
F5	ENQ (f5)
F6	ACK (f6)
F7	BEL (f7)
F8	SO (f8)
Numpad 5*	Null 5
Enter	CR
F9	SI (f9)
F10	DLE (f10)
Del	Null .
Insert	Null 0
Left Arrow*	Null 4
Rt Arrow*	Null 6
Dn Arrow*	Null 2
Up Arrow*	Null 8
Pg Up*	Null 9
Pg Dn*	Null 3
Home*	Null 7
End*	Null 1
Shift ON	EM (Shift ON)
Shift OFF	SUB (Shift OFF)
Control On	FS (Ctrl ON)
Control Off	GS (Ctrl OFF)
Alt On	RS (Alt ON)
Alt Off	US (Alt OFF)

* refers to the keys on the Number pad on the far right side of a PC keyboard. To emulate any of the keys above, scan the appropriate bar code from the FULL ASCII MENU. For example, to emulate the f5 key, scan the ENQ bar code.

Simply scan the correct bar code(s) from the FULL ASCII MENU. For example, if the WDP reads the bar code SOH (ASCII 001 -- a control-A) from the FULL ASCII MENU, it will transmit an F1 key.

Shift, Ctrl and Alt keys require three sequences:

- 1) The ON code generated when the Shift, Ctrl or Alt key is pressed.
- 2) The other key to be used in conjunction with the Shift, Ctrl or Alt key.
- 3) OFF code generated when the Shift, Ctrl or Alt key is released.

(For example, to create a Control C bar code: use Control ON, C, and Control OFF. To put Control C in a Preamble or Postamble, scan from the Full ASCII Menu: Control ON, C, and Control OFF).

Function keys F11 and F12

Function keys F11 and F12 require two bar codes to be scanned to make these functions keys. The F11 key is created by combining the Null and SOH. The F12 key is created by combining the Null and the STX.

Windows Key

The Windows key on a Windows keyboard is transmitted by scanning 4 bar codes - NULL and C for Windows On (pressing down) and NULL and D for Windows Off (releasing the key).

Command and Option Keys on Mac USB Keyboards

When you have a WDP Reader attached to a Macintosh Computer's USB port, to emulate the Command key, use the Windows key ON/OFF bar codes NULL, C (Command ON) and NULL, D (Command OFF) For the Option Key ON/OFF use RS (Option On) and US (Option Off).

Transmitting any ASCII character using its 3-digit ASCII code

You can also transmit any ASCII character from 000 to 255 by emulating the PC technique of typing a character's ASCII number on the numeric pad while holding down the Alt key. For example, to transmit ASCII 250, you would scan the bar codes for:

Keystroke	Full ASCII Menu Bar Code
Alt ON	RS
Ins (0 on the numeric pad)	DC2
Down Arrow (2 on the numeric pad)	NAK
Numpad 5	LF
Ins (0 on the numeric pad)	DC2
Alt OFF	US

Troubleshooting

All Models Troubleshooting

The beam won't stay on, or I just get a narrow beam when I pull the trigger, or The scanner won't turn on when I pull the trigger and I get 3 beeps

- All of the above problems are an indication that your BATTERIES ARE TOO LOW. With any of the above symptoms, recharge the battery in the RF Laser before assuming you have some other kind of problem.

The reader won't beep when reading bar codes

- Recheck all the connections. Get close to the Base Station. Try reading the *Link Test* bar code, following the steps for scanning on page 10.
- If you hear two beeps, but see nothing on the screen, and you are reading the pocket card, you must read the ENTER bar code to have anything transmitted. Any Code 39 or 128 bar code with leading spaces (such as the Barpad on *page 25*) will not be transmitted to your computer until you read a bar code without a leading space. Try reading the Test Label on *page 23* as an example of a known good label without a leading space. If you have bar codes with leading spaces in them, and you want them transmitted, you must disable *Accumulate Mode* using the *Setup Menu*.
- Reread the configuration section and make sure you properly enabled the bar code types you're trying to read.

Extra characters at the beginning or end of your bar code data

- Clear the Preamble and Postamble.

Poor read rate

- Get close to the Base Station and try reading the test label on *page 24* (following the scanning instructions on *page 9*) as an example of a known good bar code. Examine your bar codes to make sure they have dark bars, clearly defined bars and white spaces, and a "quiet zone" of at least 1/4 inch to the left and right. If the bars are gray, or so dark that they "bleed" into the white spaces, the person or organization printing them will need to adjust the printer or get a new ribbon or toner cartridge for it.

I get six beeps when the RF Laser powers up or six flashes or the Base Station flashes and turns Red or Orange.

- The unit needs repair. Call for an RMA.

The Orange light stays on the RF Laser Scanner

- You are in Setup Mode. Scan End Setup on the Wireless Setup Menu.

USB Trouble Shooting

The Base Station's light flashes in Red cycles when the USB cable is connected.

- The Base Station cannot enumerate. The driver is probably not installed correctly.

Occasionally the user will be unaware that he aborted his driver installation. Once the process has started, it should finish successfully. If it doesn't, you will not see any data on the screen when scanning.

To resolve a driver installation problem follow the applicable instructions below:

Windows XP:

1. Go to the *Start* menu.
2. Select *Control Panel*.
3. Switch to "*Classic View*" if in "*Category View*"
4. Select "*System*".
5. Select "*Hardware*" tab.
6. Select "*Device Manager*"
7. Double Click on the "*Human Interface Devices*"
8. Locate the USB Human Interface Device with a "!" in the icon.
9. Click on *Update Driver*
10. Follow instructions. If XP fails to find the driver on the computer's hard disk, you may have to insert and point to the original Windows XP CD to complete the installation.
11. Click "*Finish*"

Win98/ME:

1. Go to the "*Start*" menu.
2. Go to "*Settings*".
3. Select "*Control Panel*".
4. Go to "*System*".
5. Click on the "*Device Manager*" tab.
6. Double Click on the "*USB Human Interface Devices*" (it may be titled *TriCoder HID Keyboard* instead).
7. Now click on the "*Reinstall Driver*" button.
8. Follow directions. If the installer cannot find the right driver file on your hard disk, you may have to insert the original Windows 98 CD and point to it to complete the installation.
9. Click "*Finish*".

Win2000:

1. Log on as *Administrator* and open the “*Administrative Tools*” folder in your *Control Panel*.
2. Run the “*Computer Management*” utility.
3. Select the “*Tree*” tab on the left panel
4. Find the “*Device Manager*” entry under “*System Tools*” and click on it. The right panel will display current devices.
5. Problem devices will be identified with an “!” icon. Find either the “*HID Keyboard Device*” under Keyboards or the “*USB Human Interface Device*” under Human Interface Devices and double-click on one of those entries.
6. Now select the “*Driver*” tab at the top of the window and click on the “*Update Driver*” button. Follow the prompts to re-install the HID driver.

Serial Troubleshooting

The reader beeps on reads, but nothing appears on your screen using PortKey OR nothing appears to your own software.

- Recheck the installation instructions beginning on *page 2* to make sure all cables are properly connected.
- If you're trying to read Code 39 bar codes with leading spaces (such as the Barpad on *page 25*) and have enabled *Accumulate Mode*, those bar codes will **not** be transmitted to your computer until you read a bar code *without* a leading space. Try reading the Test Label on *page 23* as an example of a known good label.
- If you're using **PortKey** on an IBM-compatible, verify that the readers matches the program's COM port, baud rate, data bits, stop bits, and parity
- If you're using your own software to read the serial port, verify that the problem is not in your software. Run the **WDR Serial Test Program** that shipped with your reader and see if it gets any data on the screen when you read a bar code.
- Use a "null modem" connector to test switching pins 2 and 3 on one or more serial cables, or use a breakout box to modify your cable(s).

The reader doesn't beep when you try to read your bar codes.

- Make sure the power adapter is plugged in.
- Try reading a known good bar code -- the test label on *page 23*, following the steps for proper scanning technique on *page 9*.
- Read the instructions beginning on *page 9* on configuring the Reader for different bar code types and formats, and make sure you properly enabled the bar code types you're trying to read.

Data characters are garbled or missing.

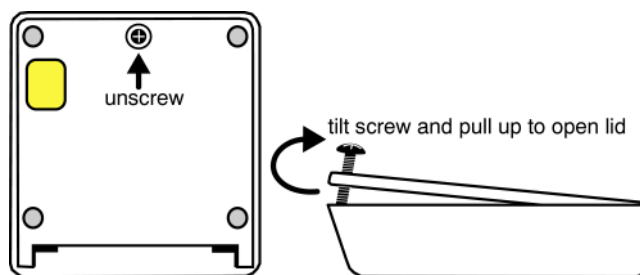
- Make sure you've set the reader to the same baud rate, parity, data bits and stop bits as your serial port.
- If Code 39 bar codes are transmitting in the wrong case (upper and lower transposed), set **Caps Lock Off** on the Setup Menu.
- If you're getting occasional extraneous characters, try cutting the jumper between pins 8/20 in the serial Y-Cable's DB25 connectors. *See page 7.*

Appendix A

Changing Jumpers and Channels

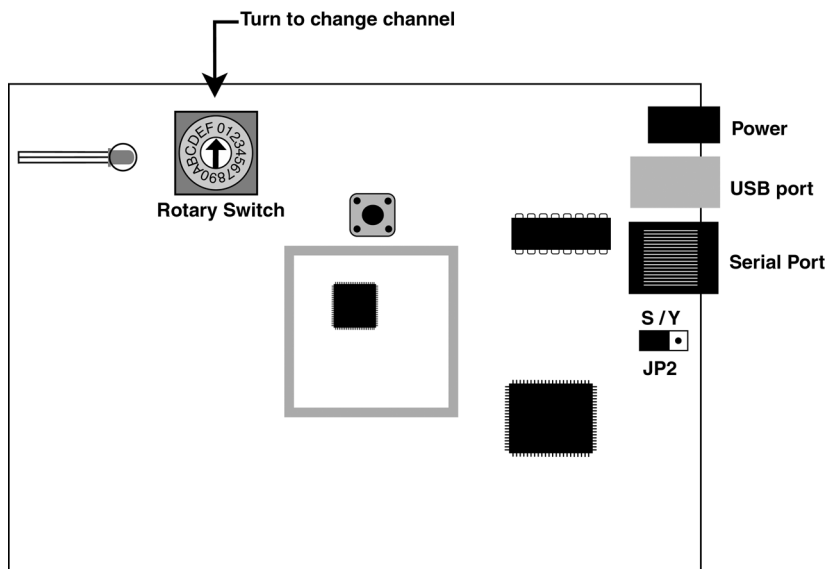
You may want to change the channel on the Base Station or you may want to set the unit to use a Serial Y Cable. To do so, open up the case.

Turn your Base unit upside-down and unscrew its single Phillips screw. If you don't completely remove the screw you can use it as a lever to pull up on the cover, otherwise insert a fingernail, credit card edge or small screwdriver blade into the gap between the base and side of the case. Gently use it as a lever to lift up the edge of the base, then grasp the edge of the base and open it outward like a door.



This exposes the reader's circuit board, as shown on the next page. When you've finished examining or changing jumper settings, put the reader case back together by reversing the steps illustrated on this page.

To change the Channel (0-9 for USA and Canada), unplug the power supply and use a small flat head screw driver to move the rotary switch shown below to the number of the channel you desire. Now simply put the case back together and plug in the power supply. You should see channel number set+ 3 green flashes on the base's LED; i.e. channel 0 setting will flash 3 times -- channel 6 setting will flash 9 times.



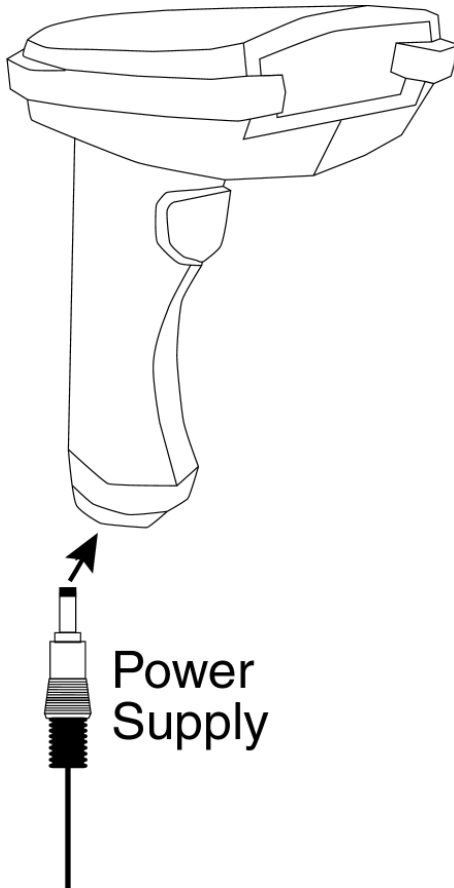
Serial Users, if you are going to use the Serial Y Cable (F45-1), you will need to change the JP2 (Jumper 2) from S to Y. This permits Half Duplex transmissions and interface between a host and terminal.

Appendix B

Recharging the Batteries

The LZ400-RF Laser and LZ403-RF Laser have a rechargeable lithium ion battery built-in.

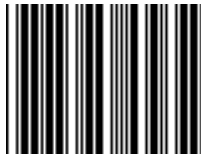
When not in use, the RF Laser should be plugged into the supplied, regulated Worth Data 5V power adapter, (**DON'T USE ANY Supply Except Worth Data**). That way it will always be recharged. The built-in recharger is a smart charger, so you can't overcharge the battery and ruin it.



Appendix C

Specifications for Code 39

Code 39 (or Code 3 of 9) is the de facto standard of non-retail American industry. It is widely used in the automotive industry (AIAG specifications) as well as in government and military applications (LOGMARS specifications). Code 39 is flexible, features a large character set, variable data length and density, and bi-directional readability. Code 39 is extremely accurate; substitution errors are almost nonexistent. Its character set consists of numbers **0** through **9**, upper case **A-Z**, and characters *Space*, **\$**, **%**, **/** **+** and **-**.



C39

The name "Code 39" comes from both the fact that its character set originally contained 39 characters (it now has 43) and from its structure. Each character is formed of three wide and six narrow elements, made up of five bars and four spaces. Code 39's density can vary from a low of .75 characters per inch (cpi) to a high of 9.4 cpi. There should be a 1/4" "*quiet zone*" (white space) to the left and right of the bar code.

Code 39 uses an asterisk (*) as a start and stop character. This character must precede and follow the data in the bar code. The Wireless Readers give you the option of transmitting or not transmitting these characters when the bar code is read.

Exact specifications for Code 39 and other bar code symbologies can be obtained from ANSI at the address below:

**American National Standards Institute
Customer Service
11 West 42nd St., 13th Floor
New York, NY 10036
212-642-4900
<http://www.ansi.org>**

document ANSI/AIM BC1-1995

Code 39 has several advanced features and functions that are discussed further in this appendix.

Code 39 Advanced Features and Functions

Mod 43 Check Character

Standard Code 39 can be printed with a "Mod 43 Check Character". This Mod 43 check character *cannot* be used with **Full ASCII Code 39**. The check character is derived by assigning a value to each character in the data to be bar coded from the table as follows:

Char	value	Char	value	Char	value	Char	value
0	0	B	11	M	22	X	33
1	1	C	12	N	23	Y	34
2	2	D	13	O	24	Z	35
3	3	E	14	P	25	-	36
4	4	F	15	Q	26	.	37
5	5	G	16	R	27	space	38
6	6	H	17	S	28	\$	39
7	7	I	18	T	29	/	40
8	8	J	19	U	30	+	41
9	9	K	20	V	31	%	42
A	10	L	21	W	32		

Table C-1. Mod 43 Check character calculation for Code 39

Here is an example to illustrate how the check character is calculated for bar code data of **123XYZ**:

1. Take the sum of the values assigned to each character:

$$\begin{array}{cccccc} \mathbf{1} & + & \mathbf{2} & + & \mathbf{3} & + & \mathbf{33} & + & \mathbf{34} & + & \mathbf{35} & = & \mathbf{108} \\ \mathbf{I} & & \mathbf{2} & & \mathbf{3} & & \mathbf{X} & & \mathbf{Y} & & \mathbf{Z} & & \end{array}$$

2. Divide the sum by **43**: (thus the name modulus 43)

$$\mathbf{108/43 = 2 \text{ with a Remainder of } 22}$$

3. Find the character corresponding with the remainder.

M (value 22) is the CHECK CHARACTER

The data becomes **123XYZM**, with **M** added as the Mod-43 check character.

Full ASCII Extension to Code 39

"Full-ASCII Code 39" expands the Code 39 character set to include all 128 ASCII characters. Symbols 0-9, A-Z and punctuation characters, and - are identical to their Code 39 representations. Lower-case letters, additional punctuation characters and control characters are represented by sequences of *two Code 39* characters.

This table depicts the Full ASCII character set as a function of Code 39 characters:

ASCII	Code 39	ASCII	Code 39	ASCII	Code 39	ASCII	Code 39
NUL	%U	SP	Space	@	%V	'	%W
SOH	\$A	!	/A	A	A	a	+A
STX	\$B	"	/B	B	B	b	+B
ETX	\$C	#	/C	C	C	c	+C
EOT	\$D	\$	/D	D	D	d	+D
ENQ	\$E	%	/E	E	E	e	+E
ACK	\$F	&	/F	F	F	f	+F
BEL	\$G	'	/G	G	G	g	+G
BS	\$H	(	/H	H	H	h	+H
HT	\$I	)	/I	I	I	i	+I
LF	\$J	*	/J	J	J	j	+J
VT	\$K	+	/K	K	K	k	+K
FF	\$L	,	/L	L	L	l	+L
CR*	\$M	-	-	M	M	m	+M
SO	\$N	.	.	N	N	n	+N
SI	\$O	/	/O	O	O	o	+O
DLE	\$P	0	0	P	P	p	+P
DC1	\$Q	1	1	Q	Q	q	+Q
DC2	\$R	2	2	R	R	r	+R
DC3	\$S	3	3	S	S	s	+S
DC4	\$T	4	4	T	T	t	+T
NAK	\$U	5	5	U	U	u	+U
SYN	\$V	6	6	V	V	v	+V
ETB	\$W	7	7	W	W	w	+W
CAN	\$X	8	8	X	X	x	+X
EM	\$Y	9	9	Y	Y	y	+Y
SUB	\$Z	:	/Z	Z	Z	z	+Z
ESC	%A	;	%F	[	%K	{	%P
FS	%B	<	%G	\	%L		%Q
GS	%C	=	%H	]	%M	}	%R
RS	%D	>	%I	^	%N	~	%S
US	%E	?	%J	_	%O	DEL	%T, %X

Table C-2. Full ASCII Table

Appendix D

Code 93 Specifications

Code 93 is variable length, continuous, bi-directional, compact code. Code 93 is an alphanumeric bar code, which consists of *43 data characters (0-9,A-Z, \$/+%. - and Space)*, *4 control characters*, and a *unique start/stop character*. The entire set of 128 ASCII characters is represented in Code 93 using combinations of *control characters* and *data characters*.

The control characters are , , , and . Full ASCII 93 is created by pairing these control characters with normal data characters. It is almost identical to the pairings for Code 39; Code 39 uses \$M to produce a Carriage Return (ASCII 13) character -- Code 93 uses M to produce the Carriage Return.

Code 93's two built-in check digits greatly minimize the possibility of reader substitution errors. These check digits are never transmitted by the bar code reader. Code 93's Start and Stop characters are also never transmitted.

If you have not decided which bar code type to use for your application and are considering using Code 93, while we agree that Code 93 is an excellent code, we believe that Code 128 is generally preferable because:

1. Code 93 **does not** have the numeric compression capability that 128 does, and
2. Code 93 requires pairings to make all Full ASCII characters while 128 does not.

Appendix E

Codabar Specifications

Codabar is widely used in libraries, blood banks, the cotton industry and transportation industries. Its' character set consists of numbers **0** through **9**, and punctuation characters **+**, **.**, **-**, **/**, **:** and **\$**. Symbols **a**, **b**, **c**, **d**, **t**, **n**, ***** and **e** are used as start and stop characters. Characters are constructed of four bars and three spaces.



Codabar is a numeric-only code, but different combinations of start and stop characters can be used to identify different types of labels. Codabar's variable data length and extremely low error rate make for a versatile bar code.

Codabar start/stop transmission

The Codabar section on the *Wireless Reader Setup Menu* lets you determine whether Codabar start/stop characters are transmitted or not. If you are varying start/stop characters with different types of labels, you'll want to **"Enable Stop/Start character Transmission"**. Start/stop character transmission can also be helpful if you want your program to differentiate between data coming from the Wireless Reader and data coming from the keyboard. If neither situation applies, you'll probably want to disable it.

Appendix F

Code 128 Specifications

Code 128 is a very powerful bar code, combining an extensive character set and variable length with compactness and error checking. The character set contains all 128 ASCII characters with each character made up of three bars and three spaces. Each element (bar or space) varies from one to four units in width, totaling 11 units of width per character. Code 128 contains two levels of error checking:

- Each character is checked for internal parity, **and**
- The last character is a checksum.



Code 128 has three subsets, A, B and C. Subset A contains alphanumeric characters and unprintable control characters, subset B contains alphanumeric characters plus printable control characters and subset C contains only numeric characters and uses a 2-character encoding scheme to create a more compact bar code.

Code 128 uses an internal Mod 103 check character that is not displayed by the bar code reader. Code 128 bar codes can be made up of only one subset or may be a combination of several.

The Code 39 features of **Accumulate Mode**, **Caps Lock ON** and **Caps lock OFF** also apply to Code 128.

UCC-128/ EAN-128

UCC-128/EAN-128 Code is a subset of Code 128 adopted by the UCC and EAN council's for use as a shipping label symbology. UCC/EAN-128 bar codes always start with a Function Code 1 character. In addition, all variable length fields are terminated by a Function Code 1 character unless they are the last field in the bar code.

The Wireless Reader outputs the following for the special function codes and start sequences:

```
]C1 Start C/Function Code 1  
^] (GS) Function Code 1 as a variable string terminator
```

If **UCC/EAN 128** is *enabled*, the reader looks for the Start C/Function Code 1 to indicate a UCC/EAN 128 bar code.

The **UCC Serial Shipping Container Code** specification calls for a 19 digit UCC/EAN 128 code with an additional Mod 10 Check digit (20 digits in all).

The Mod 10 Check digit is calculated the same as the *Interleaved 2 of 5* example in **Appendix G**. It is the data length as well as the MOD 10 check digit that distinguishes the **UCC Serial Shipping Container Code** from other UCC /EAN 128 bar codes.

UCC/EAN 128 is enabled by scanning the appropriate bar codes on the *Wireless Reader Setup Menu*. If UCC/EAN 128 is **enabled**, you will be able to read both standard Code 128 bar codes as well as the UCC/EAN 128 bar codes with the *Function 1* character and the Mod 10 check character.



UCC 128 Shipping Container Code

The UCC 128 specification is used extensively by the retail industry. If you have a requirement for a **UCC 128 Serial Shipping Container** bar code, be sure to follow the specification as closely as possible as many vendors will impose fines for non-conformance. For more information on UCC/EAN 128, contact the Uniform Code Council at:

Uniform Code Council, Inc.
7887 Washington Village Drive, Suite 300
Dayton, OH 45459
937-435-3870
937-435-7317
info@uc-council.org
8:00 a.m. to 6 p.m. EST

Many of the specifications are available online at:

<http://www.uc-council.org>

Interleaved 2 of 5 Code

Interleaved 2 of 5 Code is a numeric-only, even-number-of-digits bar code. It is widely used in warehouse and industrial applications. A combination of five elements, two wide and three narrow represent each character. Odd-number position digits are encoded in the bars, even-number positions in the spaces.



123456

Interleaved 2 of 5 Code is so susceptible to partial scans being interpreted as valid reads that we recommend at least one of the following safeguards:

- **Use one length of I 2 of 5 code.** Using one length of data allows you to tell the Wireless Reader to look for one length of I 2 of 5 code only. By default, the Wireless Reader is set to look for a 6 digit I 2 of 5 code but you can set the length to something different using the *Wireless Reader Setup Menu*. Setting the length to **00** digits allows variable length bar codes scanning but also dramatically increases your chance of a mis-read.
- **Use a check digit.** Worth Data's **LabelRIGHT** printing program automatically calculates and prints a check digit upon request using the method below:

Interleaved 2 of 5 Mod 10 check digit calculation

1. Assume that the bar code data is **1987**.
2. Starting with the least significant digit (in this case, a 7), label the digits alternatively even and odd.

7 - even

8 - odd

9 - even

1 - odd

3. Take the sum of the odd digits:

$$8 + 1 = 9$$

4. Multiply the sum of the even digits by 3:

$$(7 + 9) \times 3 = 48$$

5. Add the results of steps 3 and 4:

$$9 + 48 = 57$$

6. Subtract the result of step 5 from the next highest multiple of 10:

$$60 - 57 = 3$$

7. The checksum becomes the low-order digit:

$$19873$$

8. Because the data now has an odd length, a leading zero is added, for the final result of

$$019873$$

UPC Specifications



UPC symbols are found on almost all grocery products and many other retail items. The UPC code most people are familiar with (UPC-A) is a fixed-length (12 digits) numeric only code, with the first digit controlled by UPC coding assignments and the last digit a checksum. UPC-E and UPC-E1 are variations of the standard UPC-A code. Each digit is constructed of two bars and two spaces. UPC has very precise standards of code size, structure, and numbers to be used.



EAN is an international superset of UPC. EAN-13 has 13 digits, with the first two digits representing a country code. The final digit is, as with UPC, a check digit. EAN-8 is a shorter version on the EAN-13 code containing seven data digits and ending again with a checksum.

The exact UPC/EAN symbol specifications are available from:

Uniform Code Council, Inc.
7887 Washington Village Drive, Suite 300
Dayton, OH 45459
937-435-3870
937-435-7317
info@uc-council.org
8:00 a.m. to 6 p.m. EST

Specifications are also available via the Internet at:

<http://www.uc-council.org>

Keep the following guidelines in mind when printing UPC bar codes:

- If you plan to use a "supermarket-type" in-counter scanner to read the codes, specify a bar code height of at least .9" for an optimal first read rate.
- Make it an early practice to observe the numbering conventions of the UPC Council. Do not label unmarked merchandise with a bar code whose numbers may conflict with those already assigned. If products with these numbers are not in your store now, they are likely to be in the future, causing conflicts in your inventory system.

- The leading **Number System Character**, (the first number of the 11 digits to be entered) should conform to these UPC assignments:

0,6,7,8 *Regular UPC 12 digit codes with numbers assigned by the UPC Council. (Do not use 0 as the leading number for in-store marking).*

- 2** Store-marked random weight items of meat and produce.
- 3** Reserved for National Drug Code and Health Related Items.
- 4** Use this leading digit for in-store marking of non-food items.
- 5** Reserved for coupons. Do not use this today, or you will not be able to process coupons through your system tomorrow.

UPC 2 and 5-character supplemental codes



The UPC standards include the addition of a 2 or 5-character supplemental code used with magazines and paperback books. To read the supplements, you must first enable them using the *Wireless Reader Setup Menu*.

NOTE: *Enabling the supplements disallows the reading of UPC codes from right to left to assure that the supplement does not get missed.*

ISBN Specifications

ISBN (International Standard Book Numbering) bar codes are essentially EAN-13 with a 5-digit supplement, where the first 3 digits are the Bookland country codes of **978** for books and **977** for periodicals. Although the bar code contains 18 characters, the ISBN format uses only 9 of them, along with a newly calculated Mod-11 check digit. For example, a bar code containing the numbers 978055337062153495 would transmit as 0553370626 in the ISBN format. The Wireless Reader has the option of transmitting in the ISBN format.



ISBN specifications are available from:

American National Standards Institute (ANSI)
11 West 42nd Street, 13th Fl.
New York, New York 10036
Tel. 212.642.4900
www.ansi.org

document ISO 2108:1992

The UPC/EAN checksum character

The last character in a UPC-A, UPC-E, UPC-E1, EAN-13 or EAN-8 bar code is the checksum. For reference, these are the methods of calculation:

Checksum calculation for UPC-A, EAN-13 and EAN-8

Use Worth Data's phone number (it's not a real UPC-A code) as sample data:

18314589938

Assign even and odd positions, starting at the right and moving left:

8	3	9	9	8	5	4	1	3	8	1
odd	even	odd	even	odd	even	odd	even	odd	even	odd

1. Starting with the leading digit, 8, take the sum of all the characters in the odd positions.

$$8 + 9 + 8 + 4 + 3 + 1 = 33$$

2. Multiply the result of step 1 by 3.

$$33 \times 3 = 99$$

3. Now take the sum of all the even-position characters.

$$3 + 9 + 5 + 1 + 8 = 26$$

4. Add the result in Step 2 to the result in Step 3.

$$99 + 26 = 125$$

5. Subtract the result from the next higher multiple of 10.

$$\text{Next higher multiple of 10 over 125} = 130$$

$$130 - 125 = 5$$

5 is the *Modulo-10* check character. The data to be printed becomes:

183145899385.

This same formula is used for EAN-13 (using the 1-12 digits) and EAN-8 (using the 1-7 digits).

UPC-E Checksum Calculation

Use the sample data of 123456 to demonstrate the UPC-E checksum calculation:

1. The 6 digit UPC-E code is converted to a 10-digit code, using an expansion scheme based on the sixth digit:

If the code ends in:	UPC-E Data	Insertion Digits	Insertion Position	10 digit code
0	abcde 0	00000	3	Ab 00000 cde
1	abcde 1	10000	3	Ab 10000 cde
2	abcde 2	20000	3	Ab 20000 cde
3	abcde 3	00000	4	Abc 00000 de
4	abcde 4	00000	5	Abcd 00000 e
5	abcde 5	0000	6	Abcde 0000 5
6	abcde 6	0000	6	Abcde 0000 6
7	abcde 7	0000	6	Abcde 0000 7
8	abcde 8	0000	6	Abcde 0000 8
9	abcde 9	0000	6	Abcde 0000 9

Because the sample UPC-E code ends in a **6**, the insertion digits **0000** are inserted at the **sixth digit** (insertion position 6):

1234500006

2. Add the Number System Character of 0 to the sample data:

01234500006

3. Use the UPC-A check digit calculation described in the previous section to produce a check digit as if it were a UPC-A code. The check digit for the sample data is:

5

4. The complete 8 digit code consists of the *Number System Character*, the *original 6 digit code* and the *check digit*:

01234565

Appendix I

MSI/Plessey Specifications

Plessey is a variable length numeric only bar code. **MSI Bar Code** is a variable length, numeric-only code with an automatically appended Modulus 10 check digit. MSI is sometimes called ***Modified Plessey Code***. If the user specifies an additional check digit, the MSI code can be 14 digits long, otherwise it has a maximum length of 13 characters. This is how the MSI check digit(s) are calculated:

The MSI **Mod 10** check digit is calculated as follows:

The example bar code data is:

82345

1. Form a number from the odd positions, starting in the units position.

835

2. Multiply the new number by 2

(835) x 2 = 1670

3. Add the digits of product

1 + 6 + 7 + 0 = 14

4. Add the even digits of the original number to the result in 3

2 + 4 + 14 = 20

5. Subtract the result from the next highest multiple of 10

20 - 20 = 0

6. New Check Digit

0

7. Data with check digit is:

823450

The MSI **Mod 11** check digit is calculated as follows:

The example bar code data is:

943457842

1. Assign a checking factor to each number, starting with the units position of the number (in this example, the **2**) up to the highest order position (the **9**). Use checking factors of:

2,3,4,5,6,7,2,3,4,5,6,7...

2. Multiply the checking factor with its assigned number and add the products:

$$4 + 12 + 32 + 35 + 30 + 28 + 6 + 12 + 36 = 195$$

3. Divide the sum by 11

$$195/11 = 17 \text{ remainder } 8$$

4. Subtract remainder from 11

$$11 - 8 = 3$$

5. New Check Digit

3

(If the remainder is 10, no check digit is added.)

6. Data with check digit is:

9434578

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