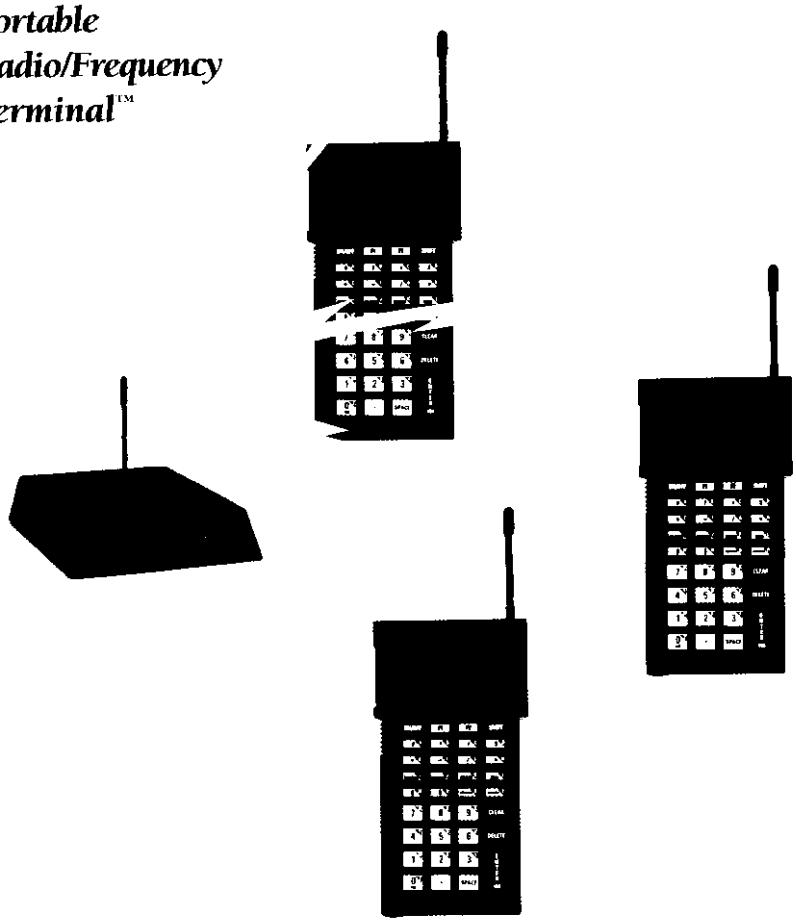
Portable
Radio/Frequency
Terminal™



Owner's Guide

WORTHINGTON
DATA SOLUTIONS

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

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

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 Worthington Data Solutions 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 RF Terminal has been approved for use in the United States and Canada as a low power narrow band radio operating in the unlicensed 902 MHz frequency range. As of this printing, approval is pending for the UK at 458MHz and France and Germany at 434MHz

The LT7x models of this product have a laser scanner integrated with the Terminal as one unit. The laser used is a Class II Laser Product and has a 1.0 Milliwatt Maximum Output.

To operate the laser scanner, aim the top of the case at a bar code, (the light source comes out at a 30 degree angle), and press the long green key on the keyboard of the R/F Terminal. 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 "Scan Key" depressed; avoid direct eye contact with the laser light source.

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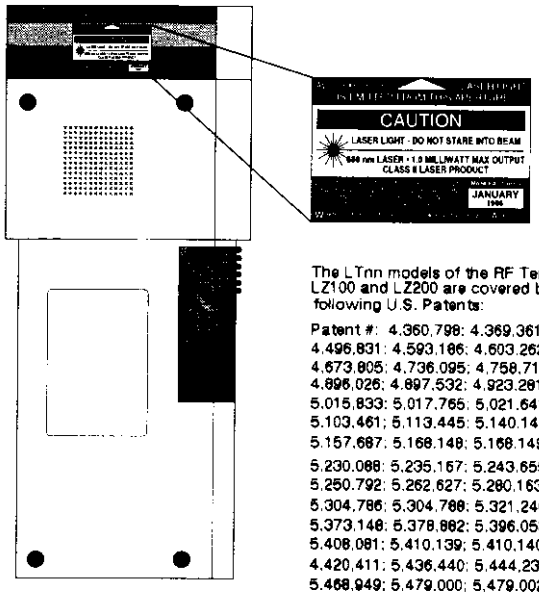
Warning labels to AVOID DIRECT EYE EXPOSURE, DANGER are located according to the below diagram:



The LTnn models of the RF Terminal as well as the LZ100 and LZ200 are covered by one or more of the following U.S. Patents:

Patent #: 4,360,798; 4,369,361; 4,387,297; 4,460,120; 4,496,831; 4,593,186; 4,603,262; 4,607,156; 4,652,750; 4,673,805; 4,736,095; 4,758,717; 4,816,660; 4,845,350; 4,896,026; 4,897,532; 4,923,281; 4,933,538; 4,992,717; 5,015,833; 5,017,765; 5,021,641; 5,029,183; 5,047,617; 5,103,461; 5,113,445; 5,140,144; 5,142,550; 5,149,950; 5,157,687; 5,168,148; 5,168,149; 5,180,904; 5,229,591; 5,230,088; 5,235,167; 5,243,655; 5,247,162; 5,250,791; 5,250,792; 5,262,627; 5,280,163; 5,280,164; 5,280,498; 5,304,786; 5,304,788; 5,321,246; 5,377,361; 5,387,151; 5,373,148; 5,378,882; 5,396,053; 5,396,055; 5,399,846; 5,408,081; 5,410,139; 5,410,140; 5,412,198; 5,418,812; 4,420,411; 5,436,440; 5,444,231; 5,449,891; 5,449,893; 5,468,949; 5,479,000; 5,479,002; 5,479,441; 5,504,322; 5,528,621; 5,532,469; 5,543,610; 5,545,889; 5,552,592; 5,578,810; 5,589,680; 5,612,531

There are no user adjustments or maintenance operations to be performed on the integrated laser scanner. **Caution - use of controls or adjustments or performance of procedures other than those specified herein many result in hazardous laser light exposure.**

Introduction

Worthington Data Solutions' **R/F Terminal**™ is a narrow band radio terminal to allow remote communication from a PC or Macintosh. Applications suitable include order picking, put-aways, receiving, shipping, stock taking, shelf price verification, re-labeling merchandise or shelves, time and attendance, job costing, labor distribution, patient dispensing, tape library management, etc. -- any application where an on-line computer leading or checking through a remote RF Terminal can aid in efficiency. Features of the R/F Terminal include:

- Data input on the R/F Terminal via the 35 key keyboard plus your choice of a wand, CCD, or laser bar code scanner. A scanner is not necessary.
- Voice prompts and error messages on the R/F Terminal which are triggered by the host program's control.
- Up to 16 Terminals can be attached to one base station.
- Up to 16 frequencies are user selectable on the R/F Terminal, Base Station, and Relay Stations. This allows you to change frequencies as conflicts arise with additional RF equipment installed in the same area, as well as have several Terminal/Base Station networks operating in the same area without interference and providing very fast response time.
- The R/F Terminal™ automatically reads and discriminates between Code 39, Full ASCII Code 39, 2 of 5, Interleaved 2 of 5, Codabar, Code 128, EAN-13, EAN-8, UCC/EAN-128, UPC-E, UPC-E1, UPC-A, Code 93, MSI, LabelCode4&5, and Plessey. Only Code 39 and UPC/EAN are enabled when shipped.
- The R/F Terminal™ is easily configured by simply scanning the RF Terminal Setup Menu or by keyboard entry while in the SETUP MODE.
- Easy host programming with simple commands to the serial port, to which the Base Station is attached. These commands control the display of data on the screen, where data is to be keyed or scanned, broadcast of voice messages, and passing data to the R/F Terminals serial port to an attached printer.
- The R/F Terminal™ can operate from battery power for roaming operations, or it can operate from wall power.
- The R/F Terminal can operate in the normal 2-way data communication with a HOST computer, but in addition, there are two other modes provided for hostless demonstrations, one-way dumb scanning, and site testing of the communication links. The site testing mode can be useful for determining the optimal location of a base station and the total cost of a potential network including relays.

Installation

Components of R/F Terminal

In the event the shipping box shows damage on arrival, *please* note the damage on the carrier's receipt log. Be sure to save your shipping box to facilitate safe reshipping for repair, return, or transfer.

Your R/F Terminal shipment should contain the following:

1) An R/F Terminal (with keyboard and display). If an LT71, with an integrated laser scanner built-in. An Integrated Laser Scanner model does not have a cable to plug in -- it is connected under the covers.

2) A scanner (Laser, Wand, or CCD) which plugs into the Scanner Port on the R/F Terminal (not necessarily required for operation).

3) A scanner holder (if scanner was ordered).

4) An 8 1/2"x11" laminated Setup Menu.

5) A manual on the R/F Terminal.

Optionally, you will receive with the R/F Terminal one or more Base Stations which include:

1) A Base Station or Relay Station with Power Supply for each.

2) If a Base Station, a serial cable (F34 for DB25, or F36 for DB9).

3) If multiple Relay Stations, 422 Y cables (F44).

You are expected to furnish the twisted pair cabling connecting the Base Station to any Relay stations. (We recommend you use Ethernet rated twisted pair cable or Belden 9502 wire).

There are only four modes of operation for the R/F Terminal:

SIGNED ON	data transmission to host
SETUP MODE	to setup Terminal and Base
ONE-WAY	for dumb scanning & hostless demo
SITE TESTING	for evaluation of sites

When turning on the R/F Terminal, you will see the messages:

```
R/F TERMINAL S9nnn          (Firmware Rev=9nnn)
TERM ID:0     RELAY=NO
USA FREQUENCY: 0            (Frequency=0)
HIT ANY KEY
```

The top line gives the firmware revision number. The Terminal ID is necessary for multi-terminals/base distinction; each Terminal in a network must have a unique ID. The country and frequency are displayed on the third line. Remember, the frequencies of any terminals and base stations within a network must match.

Summary of installation steps

The procedure for installation is:

1) Set the frequency for the base, relays, and R/F Terminals to the frequency desired. If this is your first Base/Terminal system, and you do not have other base stations operating in the same area already, you can skip the frequency settings and use the default setting which is frequency 0. There are 16 frequencies selectable, 0-F, all within the 915 MHz range. The R/F Terminal's frequency setting is displayed on the first screen when powering up the R/F Terminal. See Page 8-9 for how to set the R/F Terminal's frequency and see page 54 for how to set the frequency on the Base and Relay Station.

2) Assign the *Terminal ID* and *Relay IDs*. Unless you have multiple R/F Terminals, you will be able to use the default *Terminal ID* 0. You can see the *Terminal ID* assigned to the R/F Terminal when you turn on the unit. See Page 8 for HOW TO set IDs on the Terminal and Page 54 for Relays.

3) Connect the Base Station to a serial port. See Page 4 for how to connect the Base. The DEMO.BAS program uses the default shipped settings for serial communications: 9600bps, No parity, 8 Data Bits, 1 Stop Bit, and No protocol. If you want to use something different than these settings, you will have to modify the Base Station Setup. See Page 23 for the Base Station Setup.

4) Plug the power adapter into the Base Station (if not done).

5) At this point, you can either run one of the demo programs on the found on the Utilities disk for DOS (SHOW.BAS) or the Visual Basic Windows program on the host computer, or you can run the built-in *ONE-WAY Mode* which doesn't require a host to demonstrate. See Page 29 for how to run the *ONE-WAY Mode* testing, or see page 43 for how to run the BASIC DEMO.BAS two way testing program.

6) Now press the R/F Terminal's ON key and respond with the YES key to the SIGN ON? prompt.

You can now begin entering and transmitting data using the *ONE-WAY Mode* or the DEMO.BAS program to which you should respond to all prompts.

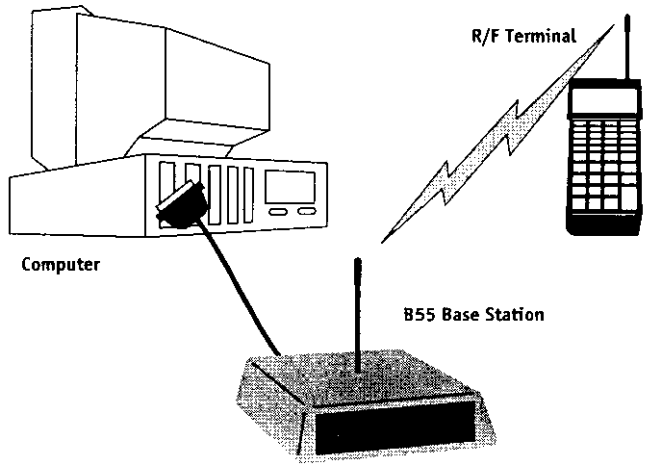
There is also a *Site Testing* option to allow you to test the range of the R/F Terminal with a percentage of First try transmissions reported. As you move about the site, you press the ENTER key, and the R/F Terminal will send a message 50 times to the Base Station, reporting back to you what percentage of the messages were received on a first attempt basis -- giving you a measure of how good the RF link is from a particular location back to a Base Station in another location. This will help you decide where to relocate the Base Station and if you need Relay stations. See page 30 for a discussion on how to perform *Site Testing*.

The next few pages go on with the full installation instructions.

Connecting the R/F Base Station to a dedicated serial port

The R/F Terminal(s) communicate with a Base Station. The Base Station communicates via the **COMPUTER** serial port to a host computer program.

The Radio/Freedom Base Station can be directly attached to a spare serial port as shown below. Your software will need to read and write the serial port as a separate device, See page 42-43 for a simple BASIC program to read and write to two R/F Terminals through the serial port, (this program is also on the R/F Terminal utilities diskette distributed with each Base Station ordered.) You may want to install the R/F Base Station more than 3 feet away from the computer. If so, you should be careful to use cable that is shielded with foil wrap and a bare wire touching the foil wrap connected to pin 1 for proper shielding from signal interference from electrical noise.



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 **COMPUTER** port to your computer's serial port. Refer to *Appendix B* for the cable pinouts.

If you are not connecting to a PC, refer to Appendix B for serial pinouts.

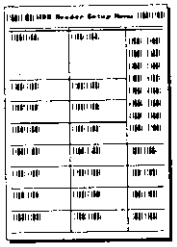
After you have connected it to the host computer, you will need to set the serial parameters on the Base Station, unless you use the shipped defaults of 9600 baud rate, No parity, 8 data bits, 1 stop bit, and None protocol.

If you are using an extension cable, be sure the cable doesn't cause problems by 1) testing without extension, 2) testing the extension with the base in exactly the same location as in 1. This will isolate any problem to the cable. A relay should be connected from the Base's RELAY port to the relay's RELAY port.

The next pages describe the other changes possible in the R/F Terminal and how to wand the *R/F Terminal Setup Menu* to make them. All of these changes can be made by keyboard, referring to the *Setup Menu*.

Setup of Terminal and Base

The R/F Terminal can be configured from the keyboard or by wanding the laminated *R/F Terminal Setup Menu*. Even if you use the keyboard, you will have to refer to the *Setup Menu* for how to select the options. The R/F Base Station must be set up through the R/F Terminal's keyboard, (this is to minimize the possibility of confusion of thinking you are setting up the R/F Terminal serial parameters when in reality you are changing the Base Station Setup and thereby messing up the communication to the host computer). Therefore, let's start with the setup of the R/F Terminal. Remember, most people will not have to change anything -- some only the Terminal ID and Frequency.



Find the 8 1/2 x 11" laminated ***Terminal Setup Menu*** sheet and look it over. This simple menu lets you easily configure the R/F Terminal to work with almost any computer system, and to tailor its bar code reading and data format characteristics precisely to your needs.

If you unfamiliar with good scanning techniques, be sure to read the scanning instructions *Appendix N*. To read *Terminal Setup Menu* bar codes and configure your reader, you must know the right way to scan bar codes.

These are the R/F Terminal's default settings. The R/F Terminal is shipped configured to these settings, and can be reset to them at any time by reading the **Start Setup** and **Reset** codes on the *Terminal Setup Menu*.

Radio Terminal ID 0

RF Frequency 0

Relay Exist No

Code 39 Enabled
- Accumulate Mode enabled — Check digit disabled
- Start/stop chs not xmit — Caps Lock Off

2 of 5 Code Disabled
- I 2 of 5 Code — Disabled
- 6-digit code length — Check digit disabled

UPC and EAN Enabled
- UPC supps disabled,UPC-E Compressed and NSC of 0
- UPC-A NSC & EAN-13 1st 2 characters and check digits transmitted
- UPC-E NSC & EAN-8 1st characters & check digits not transmitted

Codabar Disabled
- Start/stop not transmitted
- CLSI Format disabled

MSI Disabled
- Check digit(s) not transmitted
- Plessey Code disabled
- Label Code5 disabled

Code 128 Disabled
- EAN/UCC-128 code disabled

Code 93 Disabled
- Full ASCII Extension disabled

Code 11 Disabled

General configuration settings
- Medium Beep pitch
- No preamble or postamble
- 9600 Baud Rate,No Parity,8 Data Bits,1 Stop Bit
- Full Duplex Transmission
- mm/dd/yy format for US Eproms
  - others are dd/mm/yy
- The default of the Base Station as shipped is Frequency 0
- The default of the Relay Station as shipped is Frequency 0 and ID 0
- As shipped, the R/F Terminal will not search for a listening Relay in the event of a transmission failure. It can be changed to search for an available relay.
- No Security ID
- Frequency Bank 0
- Don't Skip Opening Screens and go direct to communication

If you need to change any of the default settings, or would like to learn more about the R/F Terminal options, the next several pages will explain, step by step, how to set them and what they do.

If you have never scanned with a laser or a wand before, read the instructions in *Appendix N* before proceeding.

If you don't need to change the default frequency (0) or the default Terminal ID (0), and you're going to be only using Code 39, UPC, or keyed data, you skip ahead to page 26.

Using the R/F Terminal Setup Menu

1 To configure your reader using the *Terminal 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 *Terminal 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 in Appendix N 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 *Terminal Setup Menu*, scan the number or letter associated with the option you have selected. Let's change the beep pitch to **Highest**. Now scan the **4** on the "Barpad Table". You will again hear two beeps.

4 Now scan **End Setup** at the top-right corner of the *Terminal 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. Pay attention to the *Terminal ID* and *Frequency* settings.

The next several pages will take you step by step through configuring each R/F Terminal option. Default settings are shown in **bold** in this manual and marked with an * on the *Terminal Setup Menu*.

Beep Tone

Lowest	0
Low	1
Medium	2
High	3
Highest	4
None	

Terminal ID

As shipped, the R/F Terminal has a Terminal ID of *0*. If you have more than one R/F Terminal assigned to a Base Station application, you must be sure that each R/F Terminal has a unique Terminal ID. The Terminal ID is displayed on the first screen after powering up. To change the Terminal ID, wand the Terminal ID bar code enter one character 0-F, wanding the barpad table or the keying.

R/F Terminal Frequency

As shipped, the R/F Terminal has a frequency of 0. There are 16 field changeable frequencies on Bank 0, which almost everyone will want to use; there are 80 total frequencies with bank switching, (rarely needed). All terminals, base stations, and relay stations in the same network must have the same frequency assigned. To change the frequency on the R/F Terminal, wand the *Frequency* bar code and then wand your selection of 0-F on the *Barpad Table* of the *Setup Menu*. (Frequencies of the Base and Relay are set manually by rotary switch). The country and Frequency of the R/F Terminal show on the opening screen.

The USA/Canada 16 (80 as of 2/5/97) frequencies in MHz are:

		Add'l Frequencies as of RFT9057			
FQ	Bank 0	Bank 1	Bank 2	Bank 3	Bank4
0	911.75	902.35	908.75	915.15	921.55
1	912.15	902.75	909.15	915.55	921.95
2	912.55	903.15	909.55	915.95	922.35
3	912.95	903.55	909.95	916.35	922.75
4	913.35	903.95	910.35	916.75	923.15
5	913.75	904.35	910.75	917.15	923.55
6	914.15	904.75	911.15	917.55	923.95
7	914.55	905.15	911.55	917.95	924.35
8	914.95	905.55	911.95	918.35	924.75
9	915.35	905.95	912.35	918.75	925.15
A	915.75	906.35	912.75	919.15	925.55
B	916.15	906.75	913.15	919.55	925.95
C	916.55	907.15	913.55	919.95	926.35
D	916.95	907.55	913.95	920.35	926.75
E	917.35	907.95	914.35	920.75	927.15
F	917.75	908.35	914.75	921.15	927.55

The USA eproms (also for Canada and Mexico) versions are: RFT9.nnn for the Terminal, RLY9.nnnn for the Relay, and DLC9.nnn for the Base Station.

If you are using relays, you must restrict the sixteen frequencies on Bank 0. Relays cannot be configured to banks' 1-4 frequencies.

You should rarely need to deviate from Bank 0 anyway. The additional banks were added for merchandise marts with many businesses under the same roof, each business wishing to operate on a separate frequency for privacy and lack of interference from the many other businesses also operating R/F Terminals.

Australia and New Zealand Frequencies

The sixteen frequencies for Australia and New Zealand (AUZ on opening screen) in MHz are:

0-921.50	1-921.90	2-922.30
3-922.70	4-923.10	5-923.50
6-923.90	7-924.30	8-924.70
9-925.10	A-925.50	B-925.90
C-926.30	D-926.70	E-927.10
	F-927.50	

The Aus/NZ eproms are DLA9.nnn for Base Station, RLA9.nnn for Relay and RFA9.nnn for the R/F Terminal.

United Kingdom Frequencies

The eleven (and only 11) United Kingdom Frequencies are:

0	458.525	**6**458.675
1	458.550	**7**458.700
2	458.575	**8**458.725
3	458.600	**9**458.750
4	458.625	**A**458.775
5	458.650	

The United Kingdom eprom versions are DLG9.nnn for the Base Station, RLG9.nnn for the Relay Stations, and RFG9.nnn for the R/F Terminal.

Continental Europe Frequencies

The nine (and only 9) continental European (Germany and France primarily) frequencies are:

0	433.575	**5**433.825
1	433.625	**6**433.875
2	433.675	**7**433.925
3	433.725	**8**433.975
4	433.775	

The eprom versions for the Continental Europe are DLE9.nnn for the Base Station, RLE9.nnn for Relay Stations, and RFE9.nnn for the R/F Terminal.

Singapore Frequencies

The four (and only 4) Singapore frequencies are:

0	453.725	**3**	458.725
1	453.750	**4**	458.750

The eprom versions for Singapore are DLS9.nnn for the Base Station, RLS9.nnn for the Relay Station, and RFS9.nnn for the R/F Terminal.

Relay Existence

As shipped the R/F Terminal is not configured for relays. If you want the terminal to be able to switch to a R/F Relay unit as you walk out of range from the Base Station, you need to set the **Relay Existence** from *No* to *Yes*. This can only be done by the keyboard setup, not by scanning the *Setup Menu*. (See page 19 for how to setup by keyboard). **Caution:** Relays cannot work with any USA frequencies other than the 16 in Bank 0. Relays are not supported in One-Way mode. Site testing will work with a relay, but to do a site test, you must only have the Relay active with no other Base Stations or Relays active; switching will not take place in Site Testing; as a precaution, set Relay Existence to No before doing a site test.

The Relay Existence parameter is displayed on the screen as below:

RELAY EXISTENCE
0-No, 1-Yes
Relay Status is 0

Press 0 or 1 to change the ability to switch to relays.

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 ch transmission	6
Disable Start/Stop ch 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 75 for information about Accumulate Mode.

Enabling Start/Stop character transmission means that the R/F Terminal will transmit the * Start/Stop characters to your computer along with the data. For example, data of **1234** would be transmitted as ***1234***. Most people don't want this option, but it can be useful if you want your software to be able to differentiate between keyboard and bar code data.

Enabling the Mod 43 Check Digit requires the units position of the data to match the calculated 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.

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

Code 128

Disable Code 128	**0**
Enable Code 128	1
Disable UCC/EAN-128	**2**
Enable UCC/EAN-128	3

For a complete discussion of Code 128 and UCC/EAN-128, See Appendix F.

To enable a Bar Code ID character (a-for Codabar, b-Code 39, c-UPC, d-EAN, e-I2of5, g-128, j-MSI) to be transmitted at the beginning of each bar code read, wand **E**. To disable bar code ID characters, wand **F**.

To enable the Storage Technology Tape Code, wand **D**. The default is **C** for disabled.

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 digits	**4**
Disable transmission of UPC-A NSC and EAN-13 1st 2 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 1st Digit	8
Disable transmission of UPC-E NSC and EAN-8 1st Digit	**9**
Enable transmission of UPC-E and EAN-8 Check Digit	
Disable transmission of UPC-E and EAN-8 check Digit	**B**
UPC-E0 Compressed	**C**
UPC-E0 Expanded	D
EAN-8 observes 9 & A Above	**E**
EAN-8 is forced to transmit 8 digits	F

Enabling transmission of UPC or EAN NSC's (leading digits, 1 for UPC; 2 for EAN-13) or Check Digits means that these digits will be transmitted to your computer along with the rest of the UPC or EAN data.

UPC-E Compressed Format transmits UPC-E0 codes as is; Expanded Format adds zeros to make them the same length as UPC-A.UPC-E with an implicit NSC of 0 is enabled. UPC-E1 is disabled as shipped. Don't enable UPC-E1 with EAN-13 also enabled or you may experience partial reads of UPC-E1 when reading EAN-13. To enable UPC-E1, wand *2 of 5 Code* and then wand 8; 9 is the default of UPC-E1 disabled.

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

Enabling supplements allows you to read 2 and 5-digit supplemental codes used with magazines, and books. This disallows right-to-left reading of UPC/EAN codes with a wand, to minimize the chance that a supplement is skipped. Recognize that with any scanner, it is possible to skip the supplement -- so plan on it -- use the host computer to enforce any required lengths.

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. 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 *Laser Options* and **D**. Scanning **C** the default, disables conversion to ISBN format back to regular EAN-13 format.

For more information about UPC and EAN, see Appendix H.

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 LabelCode 5	8
Enable LabelCode 4	9

For more information about MSI code, see Appendix I.

If you've enabled the Mod 10 or Mod 11 check digit(s), enabling transmission of one or two check digits causes the R/F Terminal to transmit it/them to your computer along with the bar code data.

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**

CLSI format is a form of Codabar often used by libraries.
For information about Codabar, see Appendix E.

Enabling Start/Stop character transmission means that the R/F Terminal 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.

Code 93

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

For more information on Code 93, see Appendix D.

2 of 5

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 Std 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 G. *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 R/F Terminal 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 a **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 length to **00**, read a bar code, count its digits, and then set it back to the proper length.

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.

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

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

following table to understand how trimming works:

Bar Code Data	Preamble	Data Transmitted
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's previous discussion for a list of the ID character associated with each bar code type.

You can also use the Preamble (or Postamble) to set a minimum and maximum of bar code data length to be read. Enter |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, wand up to 15 characters from the "FULL ASCII MENU" on the back of the *Terminal Setup Menu*, and then wand **SET** when you're done. To return to the no postamble setting, wand **CLEAR** here instead of wanding **SET** or any characters from the FULL ASCII MENU.

You can trim 1-15 trailing characters from bar code codes by wanding 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:

Bar Code Data	Postamble	Data Transmitted
123	**XYZ**	**123XYZ**
12345678	**~3XYZ**	**12345XYZ**
12345678	**~9**	**12345678**
12345	**~A**	**12345**
123456	**~5**	**1**

Bar codes which are shorter than the sum of the Postamble trimming and Preamble trimming will be transmitted without trimming.

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 postamble of ~b2~c1 says trim 2 characters from the back of Code 39 output and 1 character from the back of UPC-A. Refer to the Code 128 parameter's previous discussion for a list of the ID character associated with each bar code type.

Characters

This setup option allows you to output ASCII characters different from the ones wanded.

For example: Suppose you want the R/F Terminal to output a hex 92 character every time you wand 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) Wand the **Start Setup** Bar Code
2) Wand the **Characters** Bar Code on the Setup Sheet.
3) Wand **3 1** and **9 2** to output hex 92 when reading a "1".
4) Wand up to 7 other pairs of character reassignments.
5) Wand **Set** when complete.
6) Wand **End Setup** to exit setup mode.

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 wand **2 4 F F** in step 3.

Speaker Operation

Speaker On	0
Speaker Off (Earphone Only)	1

The beeps, key click, and voice prompts are all produced through the speaker. Key clicks and beeps don't draw much power. Voice prompts can lower battery life by 50% if the voice prompts option is used continually. Should you be in a noisy environment or desire to conserve power with exclusive use of an earphone, wand or key **1** for this parameter; that disables the Speaker so that messages and beeps can only be heard through the earphone.

Set Date

Use the Barpad Table to wand a *6-digit* date in mmddyy format. For instance, to set a date of 1/1/92, you would wand 010192. You can press the keypad's **STATUS** key to see the date and time. For the US Version only, if you intend to select the European Date format, do so before wanding in the date to be sure it is in the correct format. Otherwise, you will have to set the date again.

Date Formats

US Format	0
European Format	1

The USA normal displayed date format is mm/dd/yy. The alternative European Date Format is dd/mm/yy; this is normal for the Australian, UK and European eprom versions. Setting the date with US format active and then changing to the European format won't work. After changing the format, you must reset the date in the new format for correct operation.

Set Time

Use the Barpad Table to wand a *4-digit* time in military hhmm format. For instance, to set a time of 3:08 p.m., you would wand 1508. You can press the keypad's **STATUS** key to see the date and time. The Real-Time-Clock is maintained by batteries with a backup capacitor. When changing batteries, you must finish within 5 minutes for the RTC to be maintained.

Reset

Once you are in the Setup Mode, don't scan **Reset** unless you're sure you want to restore the R/F Terminal to its default settings (as described on page 5), erasing all changes you've made.

Voice Message Partitions

This parameter is to partition the total time between different length messages. The unit is shipped with a default of:

303015 (for 75 secs)

which means,	30 1/2 second messages allocated
	30 1 second messages allocated
	15 2 second messages allocated

Notice the total is 75 seconds. You can change this allocation by wanding the bar code and then wanding 6 new digits:

the 1st two digits for the number of 1/2 second messages,
the next two digits for the number of 1 second messages,
the next two digits for the number of 2 second messages.

The total for the wanded digits must not exceed the total seconds available for recording - 75 seconds.

CAUTION. If you change this parameter, you will probably have to re-record some of your messages. The words will still be there, but one message may be divided into 2 messages or 2 messages may appear in one message's allocated area of recording.

Shut Down Time

This setting allows you to override the default 5 minute time of inactivity on the R/F Terminal which results in the unit being shut down completely to conserve power. In between keystrokes and wanding, the R/F Terminal goes into sleep mode, waiting for a keystroke or wanding action to awaken it. If it stays in the sleep mode for 5 minutes, it will assume you have forgotten to turn the unit off and shut itself down, (including SIGNing OFF if appropriate). To resume operation after a shut down, you will have to turn the power on again. You can override the 5 minute shut down time by wanding the bar code for *Shut Down Time*, and then wanding two digits from the barpad, i.e. *0* and *1* for one minute. If you don't want the R/F Terminal to ever turn off automatically, wand *00*.

Laser Scanner Options:

None	**0**
Double decode	1
Long range laser	2
4.5 second laser beam	3

"Double-scan checking": To minimize the possibility of misreads with very poorly printed bar codes or when reading through windshields, you have the option of forcing the R/F Terminal to keep reading until it gets two results that are exactly the same. This "double scan checking" takes a little longer, but it will minimize misreads. To activate double scan checking wand *1*.

"Long Range Laser": Long range laser scanners, such as the Symbol 3200 Laser Scanner, are often reading retroreflective labels. To maximize the range of a long range laser scanner, specify 2. For normal range laser scanning, leave it at *0* default.

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. This is also used with Long Range Scanners to allow time for the user to aim properly at the distant bar code, usually using the marker beam. To select the 4-second beam wand *3*

Baud Rate

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

This is the baud rate of the R/F Terminal to a serial printer. Use as high a rate as your printer can accommodate.

Data bits

7 bits	0
8 bits	**1**

Set the data bits ("word length") to the same setting your printer is using.

Parity

None	**0**
Even	1
Odd	2

Set parity to the same setting your printer is using. **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 printer is using.

Reset

After entering the Setup Mode, don't scan **Reset** unless you're sure you want to restore the R/F Reader to its default settings (as described on page 5), erasing all changes you've made, because that's exactly what **Reset** will do.

Setup By Keyboard

The Base Station has to be setup through the R/F Terminal's keyboard. The R/F Terminal can be setup by wanding or through it's keyboard. Keyboard setup is provided for convenience. In the preceding section, are details about the RF Terminal's parameters and how to change them.

To enter the *Setup Mode*, perform the following:

a) Turn on the R/F Terminal, and then press any key.

b) At the display prompt:

SIGN ON? KEY[YES/NO]?	key NO.

c) At the display prompt:

SETUP MODE KEY [YES/NO]?	key YES.

d) At the display prompt:

SETUP MODE PASSWORD?	key WDTRI

e) At the display:

R/F Terminal Setup-1 R/F Base Setup-----2 Voice Operations---3	Key 1 for RF Terminal

f) You will see the display below:

RF Setup--0 BarCodes--1 RS232-----2 Date/Time-3	Speaker--4 Other----5 Exit----F1	Key 0

Select *RF Setup* by keying 0.

If you select any other parameters, use the *Setup Menu* for guidance.

Each terminal in a network must have a unique ID, so that the messages can be properly routed to the appropriate terminal. The default *Terminal ID* shipped is *0*. All Terminals, Base Stations, and Relays must be on the same frequency to communicate. The shipping default frequency is *0*. To set the Terminal ID or the Frequency for the R/F Terminal, you can wand from the *R/F Terminal Setup Menu* or key the following:

g) At the display message:

RF TERMINAL ID
0

Press the Enter key to accept the *0* or
Press any key from 0-F for the Terminal ID

i) You will go to the next message which is:

RF Frequency
0

Press the Enter key to accept the *0* frequency or
Press any key from 0-F for the next frequency assignment

If you change the frequency on the Terminal, you must be sure it matches the frequency on the Base Station. After setting the Frequency and/or Terminal ID, press the *F1* key repeatedly until you are back at the SIGN ON? prompt.

The next pages describe in detail the other changes possible in the R/F Terminal and how to make them.

Terminal Setup by Keyboard

Referring again to the screen below:

RF Setup--0	Speaker--4
BarCodes--1	Other----5
RS232-----2	Exit----F1
Date/Time-3	

The parameters within groups are:

RF Setup
- R/F Terminal ID
- RF Frequency
- Relay Existence
- Security ID
- Frequency Bank
- Host Response Delay

Bar Codes
- Code 3 of 9
- UPC/EAN
- 2 of 5 Code
- 2 of 5 Length
- Code 128
- Codabar
- MSI/Plessey

RS-232
- Baud Rate
- Protocol
- Parity
- Data Bits
- Stop Bits
- Skip Opening Screens

Date/Time
- Set Time
- Set Date
- Date Format

Speaker
- Speaker On/Off
- Beep Tone

Other
- Shut-Down Time
- Preamble (CR by scanner only, Enter is equivalent to SET)
- Postamble (CR by scanner only, Enter is equivalent to SET)
- Laser Options
- Voice Messages
- Arrow Keys Only

Not available for keyboard changing
- Characters
- Reset

The following are available for keyboard setup only:

Security ID	Arrow Keys Only	Protocol
Frequency Bank	Skip Opening Screen	Display of Year
Host Response Delay		

Once you have selected to which group you wish to go, you will see each parameter displayed in the order listed above. Referring to the R/F Terminal Setup Menu for details of the displayed character

can:

1) change the parameters by keying in data, or
2) set the individual parameter back to its default by pressing the CLEAR key, or
3) press ENTER to leave the parameter unchanged and go to the next parameter in that category file, or
4) press the Arrow keys to move forward and backwards:
   a) Up Arrow moves to the beginning of the category
   b) Down Arrow moves to the end of the category file
   c) Left Arrow moves one up the category file
   d) Right Arrow moves one down in the category file.
5) Press the F1 key to go back to the category selection screen.

Security Code Under RF Setup

SECURITY CODE
0-Disabled
1-Enabled
Status is n

To minimize the possibility of another Base Station listening to data being entered from a terminal talking to another Base Station, or to prevent interference from many Base Station/Terminal configurations in one area, the *Security Code* can be enabled. When you get to this prompt on the screen, you can enter a 3 character Security Code. These characters can be ASCII 33 - ASCII 126; for 3 characters, this yields 830,000+ combinations. You must set up the Base Station with which you intend to communicate with the identical Security Code. All terminals communicating with that Base Station must have the identical Security Code. It doesn't matter whether the Base Station or Terminal is set up with a Security ID first. The default is "Disabled". If you select "1" for Enabled, you will see the prompt:

Enter Security Code_

As you are entering the Security Code on the Terminal you can see the code you are entering, but once you have gone past the Security Code in the Setup, upon returning, you will only see "Enabled" or "Disabled"; the Terminal's Security Code will not be displayed. If you forget the code which other already Terminals have, you will have to go into Base Setup to see the Security Code. (This requires you to have full control of the Base to set a jumper). You can return a Terminal to Security Code "Disabled" status by pressing the CLEAR key on the Terminal.

Frequency Bank Under RF Setup

Frequency Bank
0,1,2,3,or 4
Setting is n

The default Frequency Bank is 0. You can change it to 1,2,3, or 4 for different sets of frequencies. This allows up to 80 frequencies to be selected. Setup to a Base is always done with Bank 0, regardless of setting. Relays are not supported on any Bank except 0.

0, regardless of setting. Relays are not supported on any Bank except 0.

Arrow Keys Only Under Other Category

Some customers have requested that the Arrow Keys on the RF Terminal's keyboard be able to function independently so that pressing any one of them will result in a separate message being sent, (without having to press the Enter Key.

This is a little bit risky, because the Arrow Keys have a shifted state that produce alpha characters. If the user thinks that the keyboard is in a shifted state and it is not, unanticipated data will be transmitted. But, for those people who judge the potential problem to be small, the option is offered. The default shipping state of the R/F Terminal is to require the ENTER key to be pressed before transmission.

In the RF Terminal Setup under the *Other* category, you will see the following prompt:

ARROW KEYS ONLY
0-No 1-Yes
Arrow Key Status is n

Where n is the current status of 0 or 1. To enter a new status, key 0 or 1. If it is set to 1 for *Yes*, in a data entry sequence, if the first key is one of the 4 arrow keys, the value for that arrow key will be transmitted immediately. The values are:

Key on Terminal	Code Transmitted to Host
Up Arrow Key	FS (ASCII 28)
Down Arrow Key	GS (ASCII 29)
Left Arrow Key	RS (ASCII 30)
Right Arrow Key	US (ASCII 31)

The actual message will be:

Bytes	Function	Value
1	RF Terminal ID	0-F
2	Data Transmitted	
Last	Terminator of Msg	CR

If one of the arrow keys is pressed after one of the other keys has been pressed first in a data entry sequence, the arrow keys will be ignored.

Skip Opening Screens Under RF SETUP Category

Once a program is operational, most users will want to skip the opening screens and go directly into SIGN ON (two-way) or ONE WAY communication.

SKIP OPENING SCREENS
0-No
1-Go to Two-Way (SIGN ON)
2-Go to One-Way (ONE WAY)
Skip Status is n

By selecting 1 or 2, you will skip the opening screen and skip the mode menu of SIGN ON?[Y/N], SETUP MODE? [Y/N], ONE-WAY?[Y/N], SITE TESTING? [Y/N] and go directly into the application. If you wish to get to the Mode Menu referenced in the above sentence, just press the F1 key.

Host Response Delay Under RF SETUP Category

Most DOS and Windows applications can respond within 200-300ms. The RF Terminal listens for 300ms waiting for the host to reply to its data entry with the next prompt. If the RF Terminal doesn't get a response in that time, it goes to sleep for 625ms and then waits a random time of 250-650ms before retransmitting the data. If the Base Station has already successfully received the data, it will reply to the Terminal: "Go to sleep, I don't have any prompt from the host computer yet". The RF Terminal will then go to sleep and awaken repeatedly on an exponentially growing time until it finally gets the host prompt.

The above process has generated a lot of radio transmissions and busy air time.

So, if you know that your host application cannot get back within 300ms with a prompt, you can significantly cut down on the extraneous radio traffic by telling the RF Terminal to wait a fixed length of time before listening for the host prompt to come back. You can vary this amount of time from 0.1 seconds to 9.9 seconds by changing the *Host Response Delay* from 00 to a new value, each increment specified being 0.1 seconds.

For example, suppose your host computer takes 2 seconds to respond to a data received. If you enter *20* for the *Host Response Delay*, there will be no wasted radio time. Therefore, more terminals can share a Base Station and the total response time will be actually less on the average than if you left the *Host Response Delay* at *00*.

Display of Year Under DATE/TIME Category

For transmitting the time stamped date from the RF Terminal to the host computer, you may want to change the default 2 digit year date to be a 4 digit year. (Be sure your software will accept a 4 digit year.)

To do this, do to the *Display of Year* parameter and you will see the following screen:

DISPLAY OF YEAR
0-2 Digits
1-4 Digits
Status is:n

where n is 0 or 1 for what is the current format specified.

Enter the 0 or 1 for your desired format number.

Entering 1 will display and tranmit a 4 digit year instead of the default 2 digit year.

Configuring the Base Station Serial Parameters

The Base Station has serial parameters (baud rate, parity, data bits, etc.) which are setup through the keyboard of an R/F Terminal on the same frequency. R/F Terminals can be "Signed On" when the Base Station is in *Setup Mode*. The Base Station cannot be setup with the *Setup Menu* to minimize the possibility of setting up the Base Station while intending to setup the R/F Terminal. As a further precaution for accidentally changing the Base Station's serial parameters and thereby destroying the communication to the host computer, a jumper in the Base Station must be set to *P* for Program Mode. (Turn all other Base Stations off or go to an isolated area to set up a new base station)

To move the jumper that allows Base Station setup, first have all current users SIGN OFF the system. Unplug the power supply. Refer to Appendix A for instructions on how to remove the cover of the Base Station and expose the circuit board with the jumpers on them. Move JP103 to the P position. Plug the power supply back into the Base Station.

Now you are ready to change the Base Station serial parameters from a R/F Terminal.

Get close to the Base Station with an R/F Terminal which is on the same frequency as the Base Station. (The frequency of the R/F Terminal is displayed on the opening screen, and the frequency on the R/F Base Station is set on the rotary switch located on the circuit board).

Turn on the R/F Terminal and press any key at the opening screen.

Press the NO key at prompt: SIGN ON?

Press the YES key at prompt: SETUP MODE?

Key WDTRI at prompt: SETUP MODE PASSWORD?

Key 2 at the prompt below:

PROGRAM FUNCTION	KEY
R/F Terminal Setup	1
R/F Base Setup	2
Voice Operations	3

Now you will see the BAUD RATE screen as below:

0-300, 1-600, 2-1200
3-2400,4-4800,5-9600
6-19200
Baud Rate is *n*

Where *n* is the current baud rate 0-6. Press ENTER to accept the current baud rate, or key 0-6 to select a new baud rate. The higher the baud rate, the less distance. 19,200 bps cannot be transmitted more than 50-100 feet. 9600 baud more than 200 feet typically. (Remember, the RS-232 specification is for just 50 feet). Most people can easily achieve several hundred feet, especially at the lower baud rates -- but a lot depends on the quality of cable and other electrical equipment that the cable comes near, (especially electrical motors starting). If you need more distance use inexpensive line drivers.

Now you will see the XON/XOFF SENSITIVE screen as below:

XON/XOFF SENSITIVE
0-No
1-Yes
The Setting is *n*

Where *n* is the current setting. The *0-No* setting send out ASCII 19 for the "Base Initialized" message and ASCII 17 for a "Terminal ID not Signed ON" message; unfortunately this conflicts with anyone using a multi-user system that uses XON/OFF. The alternative setting send out ASCII 20 instead of ASCII 19 and ASCII 16 instead of ASCII 17, thus avoiding conflict with XON/XOFF sensitive systems. The XON/XOFF SENSITIVE settings are summarized below:

	Initialized Code	Not Signed On Code
0-No	ASCII 19	ASCII 17
1-YES	ASCII 20	ASCII 16

Having selected the XON/XOFF SENSITIVE setting, you will next see the PARITY screen as below:

PARITY
0-none, 1-even,2-odd
Parity is *n*

Where *n* is the current setting for parity. Press ENTER to accept the current setting, or key 0-2 to select a new parity.

Now you will see the DATA BITS screen as below:

DATA BITS
0- Seven Data Bits
1- Eight Data Bits
Data Bits is *n*

Where *n* is the current setting for data bits. Press ENTER to accept the current setting, or key 0-1 to select a new data bits setting.

Now you will see the STOP BITS screen as below:

STOP BITS
0- One Stop Bit
1- Two Stop Bits
Stop Bits is *n*

Where *n* is the current setting for stop bits. Press ENTER to accept the current setting, or key 0-1 to select a new stop bits.

Now you will see the BASE LISTENING TO screen as below:

BASE LISTENING TO:
0-Terminals & Relays
1-Relays only(No RF)
Listening is *n*

Where *n* is the current setting for base listening. In small networks, the base will be always be listening on the RF channel. In large

networks with critical response time requirements, it can be advantageous to have the Base Station act only as a Relay Control Unit, communicating only with multiple overlapping relays on different frequencies. The base becomes a dedicated control unit passing data from the host to relays and back. Multiple relays could be operating on different frequencies, thereby avoiding any RF collisions and minimizing the number of computer work stations to be installed in the overlapping area.

The Base Station will wait for a message from the host.

Next you will see the SECURITY CODE screen:

SECURITY CODE
0-Disabled
1-Enabled
Status is n xxx (where xxx is current security code)

You can change the Security Code by pressing the Clear Key. You can enter a Security Code by keying or wanding from the Full ASCII chart any 3 characters from ASCII 33 to ASCII 126 followed by pressing the Enter key. If the Security Code on the Base Station is enabled, only Terminals with the same Security Code will be able to communicate with the Base Station. The Security Code is only displayed during Base Setup, not Terminal Setup; if you forget what Security Code you are using, you will have to go into Base Setup to see what the current code in use is. A terminal's communication on the same frequency as the Base, but without the same Security Code, will be ignored; Base transmissions to a Terminal without the correct Security Code, will be also be ignored.

Next you will see the Frequency Bank screen:

Frequency Bank
0,1,2,3,or 4
Setting is n

For the USA and Canada only. This allows the number of frequencies to be increased from 16 to 80 in non-Relay configurations. Where there are many different users in a small area (i.e., shopping malls or merchandise marts), more frequencies than 16 might be required to avoid interference. The default Bank is 0. You can select another frequency bank by simply pressing a different key of 0-4. See page 8 for the listing of each of the banks associated frequencies. Relays only use Bank 0.

When setting up the RF Base , regardless of the Bank setting, Bank 0 will be used. The RF Terminal will also be forced into Bank 0. The Frequency Number (0-F) must be the same on the R/F Terminal and the Base Station. Only Bank 0 is supported with Relays.

When you are finished making changes to the Base Station setup, press the F1 key to be returned to the Setup Menu. Press the F1 key again to get to the SIGN ON prompt. You won't be able to sign on unless you move jumper JP103 from the P position back to the N position and re-power the base.

Terminal Operation

Performance Guidelines

If multiple terminals are on the same frequency, there will be contention between the terminals. The terminals are not always on listening; rather they only listen for 300ms after transmission to see if there is an immediate answer from the host. If two terminals transmit at the same time, a collision will occur and neither's message will get through to the base. The terminals are programmed to listen for 300ms after transmission for a reply; if no reply occurs, each waits for a further random time, and transmits again until a reply is received from the base. If the Terminal's message has been received by the Base, but a host prompt has not been received by the Base for that Terminal, the Base will tell the Terminal to go to sleep and ask later. Each time the Terminal is told to go to sleep, the Terminal sleeps longer before waking up and asking the Base if it has anything yet. If the Terminal or Base transmits 10 times with no answer, you will get the "Transmission Failed, press Enter to Retry" message. Hosts with rapid response will cause less radio traffic.

The more terminals are attached to one Base Station sharing the same frequency, the more the contention and the longer the response time. You could only have two terminals transmitting every second attached to one base without experiencing 2-5 second response time. The rough rule of thumb is to take two times the average number of seconds between each transaction as the maximum number of terminals to be attached to a single Base Station; i.e., if the average number of seconds between transactions on each terminal is 8 seconds, then a maximum of 16 terminals should be installed on a single Base Station. (This assumes that each of 8 terminals will have one transaction per 8 seconds). If each terminal is expected to transmit a message every 4 seconds, then the maximum number of terminals on a Base Station should be limited to 8.

A great feature of the RF Terminal, is the ability to take an overloaded network and split the terminals to an additional base; half the terminals would be on one base and frequency and the other half would be attached to a second base on a different frequency. This is made possible by the low cost of the Base Station and the field changeability of the frequencies.

So far we have only talked about the radio traffic's effect on the response time of the terminals. The computer and the application code also affect the response time. To understand just how much response time is due to the radio, run the DEMO.BAS program or the Visual Basic demo program on the *RF Terminal Utilities Disk*. The response time is instantaneous with these programs, so any delays seen are due to radio traffic.

This assumes that you have previously qualified the frequency and location using *Site Testing* later discussed in this section. This must be done to be sure that the successful transmissions on that frequency with no other terminals running is 100%. See *Site Testing* if you have not already verified the frequency is clear and the coverage of your site is adequate.

On/Off Key

After installing batteries or plugging in wall power, press the ON/OFF key to power up the R/F Terminal. The ON/OFF key functions the same under battery or wall power.

Turning on the R/F Terminal, you will see the messages: (this screen can be bypassed - See *Skipping Opening Screen*)

```
R/F TERMINAL S9nnn        (Firmware Rev=9nnn)
TERM ID:0            RELAY=NO
USA FREQUENCY:0           (Frequency=0)
HIT ANY KEY
```

The top line gives the firmware revision number. The Terminal ID is necessary for multi-terminals/base distinction; each Terminal in a network must have a unique ID. The frequency is displayed on the third line. Hitting a key, you will next see the message:

```
SIGN ON?
KEY[YES/NO]?
```

If you press the YES key, the R/F Terminal will attempt to SIGN ON to a two-way communication host computer program through the Base Station. If you press the NO key, you will see the following message:

```
SETUP MODE?
KEY [YES/NO]?
```

If you press the YES key, you will be asked for a PASSWORD. If you press NO you will see the following message:

```
ONE-WAY?
KEY [YES/NO]?
```

If you press the YES key, you will be in ONE-WAY mode. This is useful for two purposes: 1) hostless demo, and 2) dumb scanning of data to the computer. See page 29 for the details of ONE-WAY. By pressing the NO key, you will see the following message:

```
SITE TESTING?
KEY [YES/NO]?
```

SITE TESTING is provided to give you a very critical assessment of RF communication wherever you decide to test. Standing in one place, you get a measurement of what percentage of communications were complete on first try - a good way to test the location of the Base Station and possible Relay Stations.

By pressing the NO key, you will loop back to the SIGN ON? message.

There are only four modes of operation for the R/F Terminal:

SIGNED ON	data transmission to host
SETUP MODE	to setup Terminal and Base
ONE-WAY	for dumb scanning & demo
SITE TESTING	for evaluation of sites

You can go into any of the modes and get out by pressing the F1 key. In fact, you can use the F1 Key to exit and back out of any Menu with which you are finished or any Menu where you don't want to do anything. The F1 key is like the Escape Key on the PC; it usually gets you out and back one step.

The entire mode menu can be skipped, (see *Skipping Opening Screens*), and at Power On the terminal will automatically enter SIGN ON or ONE-WAY.

Keyboard Operation

The keypad is custom designed for the R/F Terminal operations. It has numeric and control keys in the non-shifted state, and alpha characters in its shifted state. You can readily determine if the SHIFT is on by the cursor on the display. When SHIFT is on, the cursor is a large black rectangle. When SHIFT is off, the cursor is a narrow underline character.

For all prompts which ask for a YES or NO response, the <ENTER> key, (as labeled) is the YES reply, and the -(minus) key is the NO reply.

As you key data, you will see each character displayed on the screen. If you make a mistake, you can delete the last character with the DELETE key, or you can clear all characters displayed on the screen with the CLEAR key.

Battery Operation

You can use rechargeable batteries or alkaline batteries. If you use rechargeable batteries, you must use an external recharger. Plugging in the power supply to the R/F terminal does not recharge the batteries; we want to exclude the possibility of recharging regular alkaline batteries which might explode and cause expensive damage.

Rechargeable alkaline batteries are probably best suited for this device's power drain. With alkaline or rechargeable alkaline batteries, you should get at least 14 hours of continuous operation with 8 transactions per minute average usage.

There is only one set of batteries in the R/F Terminal. That is because no data is stored in the R/F Terminal to protect. As the batteries go low, the following message will be displayed:

```
LOW BATTERIES
Finish, Sign Off
Change Batteries
Hit Any Key_
```

You will have approximately 2 minutes of operation left to finish or take note of where you are in a transaction, so that you can SIGN OFF, (by pressing the F1 key or the OFF key), before you see the message:

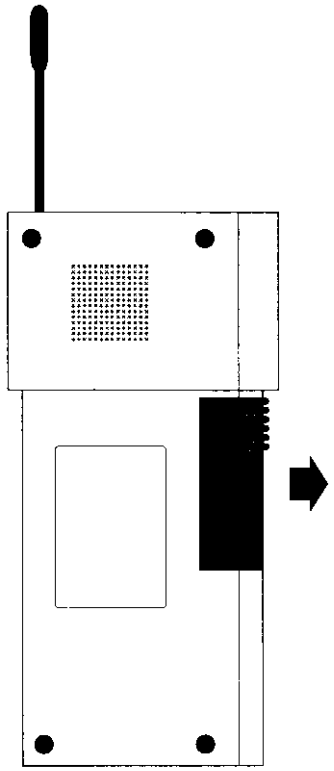
```
CHANGE BATTERIES
UNIT SHUT DOWN_
```

After displaying the above message for 20 seconds, the R/F Terminal signs off from the host, (if SIGNED ON), and shuts down by itself to protect from unstable power conditions in operation and to preserve the Real-Time-Clock.

You must now change the batteries. If you try to turn the unit back ON, it will know the batteries have not be changed and not turn on. To change the batteries:

1) **power OFF** the R/F Terminal.

2) remove the battery holder door on the back side of the R/F Terminal by pressing down on the grooved part of the door and pushing outward.



3) take out the old and insert the new, (the orientation for the batteries is marked in the battery holder). Notice the tops of the batteries should be facing down, to the bottom of the R/F Terminal.

4) replace the battery holder door, and

5) power the unit back ON.

6) SIGN ON and resume your transaction if it was not finished.

Once you have removed the batteries, you have 5 minutes to get new batteries back into the R/F Terminal, otherwise, you will loose the settings for Time and Date.

One Way Communications

Some users will want to do dumb data entry to the computer, perhaps even using PortKey to transmit the data as though it has been keyed into any program. The Terminal ID will not be transmitted as in 2-way, so if you have multiple Terminals transmitting, use the *Preamble* to enter unique identifying information. This *One Way Mode* allows data to be sent to the computer by terminal(s) without any host prompting. The data is transmitted without a Terminator Character, (such as CR or TAB), so if you want a Terminator Character, enter it into the *Postamble* of each R/F Terminal you wish to use in *One-Way Mode*. The receipt of data by the Base Station is acknowledged by it echoing it back to the R/F Terminal that sent it along with a beep. If the data transmission did not make it through to the Base Station, the R/F Terminal will give two long beeps and display the following message:

Transmission Failed.
To Retry,Move Closer
and Press Enter.
F1 to Exit.

This *One Way Mode* can also be used as a simple demonstration program without the need of the host computer being connected and running a program to control the R/F Terminal. After having powered up the Base Station, (and connected it to host computer's serial port, if you want data entry on the host -maybe using the Windows Terminal Program or WDS's PortKey) perform the following: (if using Windows Terminal program, be sure to disable Xon/Xoff as a program enabled option)

Turn on the R/F Terminal with the ON key, and then press any key. At the display prompt:

SIGN ON?	key NO.
SETUP MODE	key No.
ONE WAY MODE	key Yes.

If there are other users in *two-way communication* already SIGNed ON the Base Station, you will not be allowed to proceed. A Base Station has to be dedicated to *One-Way* transmission. If it is dedicated, you will see:

Data Received Was

Enter Data?

Since this is the first time you are entering data, there is no previously received data on the screen's 2nd line. The 3rd line of the screen is prompting you to **key** or **wand** data, (followed by the ENTER key, if keying). If the data is received by the Base Station, the Base Station sends back the following screen:

Data Received Was
aaaaaaaaaaaaaaaaaaa
Enter Data?

Where aaaaaaaaaa is the data received by the Base Station, (and transmitted to the host computer if attached for dumb scanning). At any time, press the F1 key to Exit this *One Way Mode*.

Site Testing

Operating Range Considerations

It is almost impossible to predict the effective RF communication range in a given environment. 400-1000 ft. radius is typical.

To maximize the range, the Base Station or Relays should be located:

1) at the center of area of intended coverage, and

2) if not in the center, tilt the Base Station in the direction of use. Raising the Base helps too, (i.e. on the ceiling of the room). Sometimes just raising the base station to 12 feet will dramatically increase the distance, especially in warehouses or grocery stores with tall shelving. Mounted on the ceiling with the antenna pointing down works best.

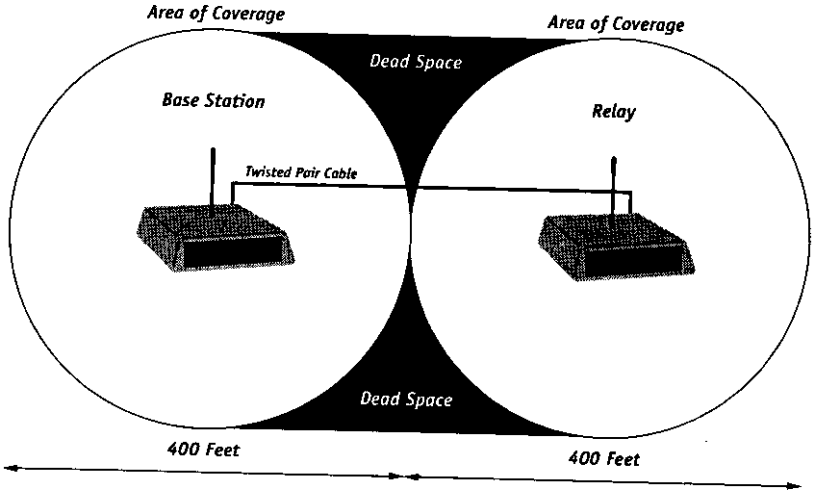
Metal walls are almost impenetrable by RF. So, even though a warehouse's office computer may be located in a metal shed, don't locate the Base Station inside -- run a serial cable outside the shed and locate the Base Station there. Elevator shafts have similar blockage problems. Likewise, the more walls you try to go through, the more the signal breaks down. Walls that have metal studs, (interior office walls), and concrete walls with steel rebar cut down on the signal slightly with each wall you try to go through. You may have to use Relay Stations with metal walls.

Organic material also absorbs RF energy with remarkable efficiency, cutting down the effective range. So if you're trying to operate in a warehouse with lots of densely packed organic material, (such as bags of beans or corn), expect reduced operating ranges.

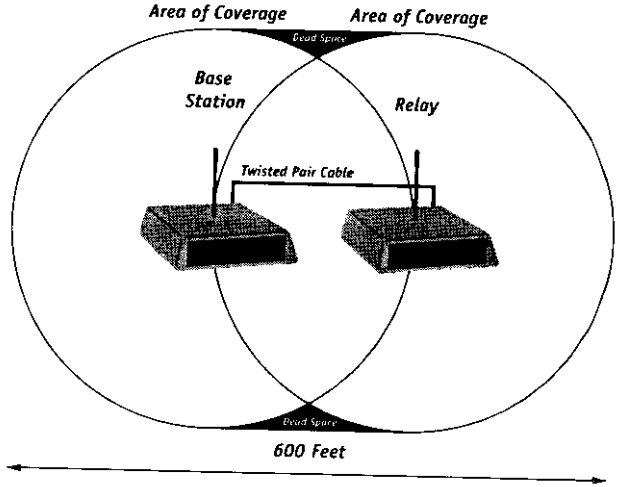
Relays can increase the area of coverage up to 5X times more. Connect a relay from the Base's RELAY port to the Relay's RELAY port. Relays work like a remote antenna, but remember that you will have slower response time with a relay in the loop, (the time to assemble the data and pass it through to the Terminal or the Base). You must set up the R/F Terminal to know that relays are present. If the Terminal knows relays are present, when it gets a transmission failure, it will ask if anyone out there can hear it; a relay can then respond and the Terminal will talk through the relay until a subsequent transmission failure. If both the base and relay hears a "who can hear me" message, both will respond; the first to successfully establish contact will then be addressed. You can test this by setting the Terminal and Relay to a common frequency but different from the base's frequency. When you start the communication program, the Terminal will fail in communicating with the Base Station and broadcast the "who can hear me" message. Since the relay and terminal are on the same frequency, the relay answers.

If you are going to locate the Base Station more than 20-30 feet from the host computer, you need to use good quality foil-wrapped cable with a bare wire touching the foil and connected to Pin 1 of the DB25 or DB9. You will need a total of three additional wires: Transmit Data, Receive Data, and Signal Ground. If you are going to locate the Base Station more than 200 feet from the computer, use low cost line drivers.

To effectively cover a given area, there must be overlap. Consider the following location of a relay and base:



As you can see, only at the point where the two circles touch is there coverage between the two units. The dead space is without coverage. Alternatively locating the base and relay as below results in coverage:



To accurately determine the required hardware to cover a given site, you should use the *Site Testing Mode* built into the firmware of each R/F Terminal.

Relays can be tested by turning off all other Relays and Bases to be sure you know which relay is responding. Alternatively do the test of a Relay's radio out of range of other operating units.

Site Testing Mode

To perform site testing, you do not have to be connected to a host computer. All you need is one R/F Terminal and a R/F Base Station. The idea of a site test is to find out if you have adequate communication in all the places you want to be able to roam with an R/F Terminal. You may decide to relocate the R/F Base Station to a more central location, an/or you may decide to purchase R/F Relay Stations to increase your RF coverage.

Before starting: 1) be sure all other Bases and Relays are turned off and 2) be sure the Base Station and the R/F Terminal to be tested are on the same frequency assignment. As shipped from the factory, both units are on RF Frequency 0. If you are unsure about the Base Station's frequency, refer to the section on *Appendix A* for how to set it.

It is best to have a site layout and several colored pens to record the results of the testing. With each location of the Base Station, record it on the site layout in a different color. Record the test results in the same color at the location tested. If you move the Base Station to a different location, use another color pen to record the location and the results at each location.

You don't have to connect the base to anything but wall power to do a site test. Just locate your Base Station where you think best, power it up, and then get into the *Site Testing* mode by the following:

1) Turn the R/F Terminal on and press any key.

2) At the SIGN ON? prompt press the NO key.

3) At the SETUP MODE? prompt, press the NO key.

4) At the ONE WAY MODE prompt, press the NO key.

5) At the SITE TESTING prompt, press the YES key.

The Base Station should be powered up and you should move to your first location that you wish to test thoroughly for adequate communication with your R/F Terminal. Once you are in a test position, stop. The screen shows:

Press Enter When
Ready, F1 to Exit

After pressing the ENTER key, hold still in the test location while the R/F Terminal transmits 50 messages and waits for an acknowledgement from the Base Station. The following message will show on your screen:

Site Testing in
Progress, Please
Wait.....

PLEASE WAIT will show on your screen until the test is finished, (if it takes more than a few seconds, something is wrong). When it is finished,

you will see the results on the screen as follows:

1st Try nn% Good
2nd Try mm% Good
Press Enter When
Ready, F1 to Exit

The first line shows the % of successful transmissions on 1st try. The second line shows the % of successful transmissions on 2nd try. If you are only planning for one Terminal, even 50% successful on the 2nd retry is probably OK for most applications. If you plan on several Terminals operating in the same area, then 50% would be a result in very long delays too often -- 50% would not be acceptable.

Consider the following rough guidelines:

In a Given Area Number of Terminals	Rough Minimum Acceptable Percentage
1	75 on 2nd Try
2	85 on 2nd Try
3	95 on 2nd Try
4	75 on 1st Try
5-8	85 on 1st Try
9-+	96 on 1st Try

If you don't get the above minimum results:

1st. Be sure to try hanging the base station upside down or tilt (30 degrees) it towards the area of usage; this can double the effective distance.

2nd. If its really bad up close, try a different frequency. Maybe there is interference to be avoided on another channel. There are many to choose from. Just try one or two others.

3rd. Try locating the base (or relay) closer to the area of difficulty. Just moving it closer will require you to recheck the other locations already tested.

4th. Plan for a Relay. Move the Base to where you expect to place a relay and try again.

In a few cases coverage can be increased by adding bases and splitting the terminals onto different frequencies to get less contention, (this assumes that functions can be isolated in certain non-overlapping areas).

At any time, press the F1 key to exit the Site Testing mode.

Host Programming Guidelines

From Host to Terminal

The RF Terminal has a 4x20 LCD screen and up to 99 voice messages which can be activated by the host user program. Messages from the host user program are written to the serial port to which the applicable Base Station is attached. Up to 16 RF Terminals can be controlled by one base station, so the host user program must address the applicable RF Terminal by its ID character. When the host receives a message from the Base Station, it will receive data with the Terminal ID also included, (this applies to two-way communication but not for one-way communication).

The initial dialog is initiated by the Terminal SIGNing INto the network. Then a forced host prompt/terminal response dialog, (one for one), takes place. Every message to the R/F Terminal results is data response from the R/F Terminal. The host's basic program flow is to wait for the terminal to initiate a dialog by Signing In. If a terminal Signs Out, the host program can either 1)trash any incomplete transactions, or 2) wait for the terminal to sign in again to complete the transaction. , (it depends on the application as to what approach is best.) If the Terminal doesn't receive a prompt from the Host computer in 400ms, it will go to sleep, wake up, and ask the Base Station if it has a message for it; if not, it will go back to sleep. The question and sleep will repeat, each time with the Terminal sleeping more between queries, (to conserve battery power).

We have tried to make it easy for the programmer to communicate with the Base Station, requiring no protocol or handshaking; this will be satisfactory when communicating with a Base Station that is located only a few feet of the computer's serial port. Short distances are not subject to noise corruption of data on the serial cable. For longer distances be sure to use shielded cable with Pin 1 a bare wire touching the shield, consider lower baud rates, and consider line drivers for very noisy environments.

The basic format of a message to be transmitted to the R/F Terminal is as follows:

Bytes	Function	Possible Value
1	RF Terminal ID	0-F
2+	Command(s)	
Last	Termination	EOT

It is not possible to have more than one base station on the single COM port. Multi-dropping or daisy-chaining of multiple base stations on one COM port is not supported.

The Command(s) Body of the Message can consist of one or more commands (including data to be displayed and voice messages to be played) as shown in the following message examples:

Examples:

*@ ---------- Reinitializes all terminals
3@ ---------- Reinitializes Terminal 3
1@Bn ---------- Beep the Terminal 1 n(1-9) times
2@C5 ---------- Clears the entire screen(4 lines) on Term 2
0@C1 ---------- clears line 1 on Terminal 0
1@C2 ---------- clears line 2 on Terminal 1
2@C3 ---------- clears line 3 on Terminal 2
0@C4 ---------- clears line 4 on Terminal 0
1@Dn ---------- displays date and time on line n
in format of mm/dd/yy hh:mm:ss
or European dd/mm/yy hh:mm:ss
1@Vnn ---------- play voice message nn(01-99) on Terminal 1
1@Sdataaaaaaaa ---- output data to serial port on Terminal 1
0@n,m,o,data ----- **display** "data" at position n of line m
and wait for **data input** if o=1, (display
only if o=0)

Reinitialize commands clear the buffer for terminal(s) in the base station. The host program should follow a reinitializing command with re-display of all the screen data necessary to start the application.

The following are command formats without the preceding Terminal ID.

@2,1,1,ENTER ITEM NO	on display line 2, start in pos-ition 1,show ENTER ITEM NO position cursor after O in NO and wait for data input.
@V23@1,2,1,WRONG ITEM	play voice message 23; on display line 1, starting in position 2, display WRONG ITEM, and wait for data input (the last 1 would be a 0 if it was a display only).
@C1@1,7,0,PICKING	Clear line 1. At Position 7 of line 1 display PICKING. No data input. **This command by itself is illegal** because it does not request data entry; it must be followed with an additional data entry command
@1,1,1,ITEM@2,1,1,QTY	This is an illegal command. Only one data entry command may be included in any message. The entire command will be ignored and displayed on the terminal..lh2

A message with multiple commands is legal and useful. For example, the command "@1,1,0,PLEASE ENTER@2,1,1,QTY" would display PLEASE ENTER on line 1 and then display QTY on Line 2 and then wait for data input. You can fill all 4 lines with one message.

The third number in the sequence determines data input from the terminal. Values and their meanings are:

0- No Data Input for this Command, Display Only
1- Data Input from the Keyboard or Scanner
2- Only Keyboard Input, Start Unshifted
3- Only Keyboard Input, Start Shifted
4- Only Scanner Input
5- Only Accept Yes or No keyed response
(the Terminal sends back a 1 for Yes
and 0 for No)
A-Same as 1, but time stamped (prefix HHMMSS)
B-Same as 2, but time stamped "
C-Same as 3, but time stamped "
D-Same as 4, but time stamped "
S-Shifted Keypad Input or Scanner Input

The total message is terminated by EOT (ASCII 4). A user programming in BASIC would send down a complete command as:

PRINT #1,"3","@C1@V21@1,1,1,ITEM"chr$(4);

On RF Terminal 3: Clear line 1; Display ITEM beginning at column 1,play voice message 21, and wait for data input with the cursor to the right of the M in ITEM; chr$(4) outputs ASCII 4, EOT to terminate the message to the base station.

Data entry/prompt commands can only be combined with Clear statements and data display statements. Multiple data entry/prompt commands cannot be combined.

The S for Serial command cannot be combined with any other command -- even clear commands. After a S command is successfully completed, the base station sends back the R/F Terminal ID followed by a CR. S Commands would be used for serial devices attached to the R/F Terminal such as the O'Neil MicroFlash serial printer. (To use the MicroFlash Printer, you must send NULL,CR,LF before valid data to wake up the printer.)

Single command statements must be a data entry command. In a multiple command statement, the last command must be a data entry/prompt statement. Any statement with illegal commands will be ignored, but displayed on the addressed terminal, (if there is no ID, it will try to display the invalid statement on ID 0). Once the *Enter* key has been pressed, the terminal will send back a question mark to the base and the base will send the ? back to the host program in the format of n?<CR> where n is the ID. Version of software prior to 9.059 did not handle illegal statements the same; for backwards compatibility in illegal statement handling, you can change setup of the terminal under *RS232 Protocol* to *E*.

Base Station to Host Formats

The format is:

Bytes	Function	Possible Value
1	RF Terminal ID	0-F
2+	Data Transmitted	

Illegal Command

When a Terminal receives an illegal statement, it will display the entire statement on the addressed terminal; once the *Enter* key on the terminal has been pressed, the terminal will send back a ? to the Base and the Base will send back the following command to the host program:

Bytes	Function	Possible Value
1	RF Terminal ID	0-F
2	?	
Last	Terminator of Msg	CR

Serial Reply

After a Serial S command is successfully completed, the base station sends back the R/F Terminal ID followed by a CR. If you don't have a serial device attached, this command can be useful to see if a specific R/F Terminal is on-line and responding.

Sign IN

When the R/F Terminal is powered up and a key is pressed, the user can Login into the host computer . As the user logs in, the Base Station sends back the following SIGN IN message to the host computer:

Bytes	Function	Possible Value
1	RF Terminal ID	0-F
2	SI	(ASCII 15)
3rd	CR	(ASCII 13)

The host program should send a message to the RF Terminal that just signed in with some instructions such as:

Standby for Assignment
Nothing to Do: See Supervisor
Pick Item 1234
etc.

If there is something to do, naturally the host program will instruct the Terminal what to do. If there is nothing in the queue at the time of Sign On, the host program should acknowledge that it has received the Terminal's Sign On and tell the Terminal to Stand By and Press the Enter Key to acknowledge receipt of the message (to fulfill the data entry requirement of the message). Then the host program should look for a response of Terminal ID + CR from the base station.

This procedure can also be useful for clearing up the doubt of a terminal operator who has not had anything to do for several minutes or longer; the operator might doubt that the host program is alive or that he is connected. By Signing Out and Signing In, the operator will get a message that there is nothing to do now. Of course, the host program could also note elapsed time with no instructions sent to a Terminal and send out a reassuring message requiring the Enter Key to be pressed in acknowledgement (or maybe tell him to sign off and go see his supervisor for reassignment - whatever makes sense to the application).

If the operator is leaving the area for lunch or to another building, before he disappears out of range, he could hit the END key followed by

ENTER causing the program to send a prompt which says, "Press BEGIN when ready again"; and then the operator to go do something else. When back in range, he hits the BEGIN key followed by ENTER. This allows the operator to get a message immediately upon returning to the range of the radio network. A simpler alternative is to simply Sign Out and Sign In later on his return.

Sign Out

When the R/F Terminal is powered down manually or the user presses the F1 key to get out of the data entry mode to one of the other modes, the host receives the following SIGN OUT message:

Bytes	Function	Possible Value
1	RF Terminal ID	0-F
2	SO	(ASCII 14)
3rd	CR	(ASCII 13)

Addressing a Terminal not Signed IN

If the Host attempts to address a terminal not signed on, the Base Station will send back the following message to the host computer program:

Bytes	Function	Possible Value
1	RF Terminal ID	0-F
2	DC1	(ASCII 17)
3rd	CR	(ASCII 13)

The ASCII 17 can be changed to ASCII 16 for XON/XOFF SENSITIVE systems by changing the BASE STATION SETUP parameters.

Sequence Error Message

The one-for-one host prompt/terminal response must be observed by the host program. The host cannot send a second data entry prompt without first getting a data response to the first data entry prompt; this would be a sequence error. If the base station receives a command out of sequence, it will send back the following message to the host computer program:

Bytes	Function	Possible Value
1	RF Terminal ID	0-F
2	DC2	(ASCII 18)
3	CR	(ASCII 13)

Base Station Initialized Message

Whenever the Base Station is powered up, it sends a message back to the host as follows:

Bytes	Function	Possible Value
1	BASE ID	Fixed as an *
2	DC3	(ASCII 19)
3	CR	(ASCII 13)

Since ASCII 19 is also XOFF, for those multi-user systems which have XON/XOFF sensitivity, ASCII 20 can be sent instead of ASCII 19 by changing the BASE STATION SETUP parameters.

The "Base Station Initialized Message" is provided so that the host will know that there has been a power interruption on the Base Station. When a serial device powers up, the first byte is often garbage; QBASIC handles this without incident, GWBASIC does not unless ON ERROR GOTO is used to trap the error. Beware, of this first byte problem. To isolate this potential garbage byte problem, power up the Base without the serial cable connected and then plug it in. Naturally you will not see the "initialized" code mentioned above, but it should not matter for problem determination.

There are also some special keys on the RF Terminal that, when pressed, result in the following codes being passed back to the host computer program: (the programmer might use these for reviewing transactions, etc.)

Key on Terminal	Code Transmitted to Host
Up Arrow Key	FS (ASCII 28)
Down Arrow Key	GS (ASCII 29)
Left Arrow Key	RS (ASCII 30)
Right Arrow Key	US (ASCII 31)
Begin Key	ETB (ASCII 23)
End Key	CAN (ASCII 24)
Status Key	Reserved to Display Time and Date
Search Key	VT (ASCII 11)

For these codes to be transmitted, they cannot be a part of a multi-character data entry. If another key has already been pressed, these keys are ignored, (the upper case of these keys are valid data to be entered and so are not ignored). For these keys to be transmitted, they must be pressed individually and exclusively and followed by the ENTER key.

If you want to bypass having to hit the ENTER key for the arrow keys only, see *Arrow Keys Only* in the R/F Terminal Setup.

Base Station to Terminal Protocol

The Base Station sends out prompts to the RF Terminal. If the Terminal doesn't get a host message after sending data back to the host, the Terminal will re-transmit the last message to the host. If the Base Station has the previously transmitted data, it will respond to the terminal to stand by -- data has already been received. The Terminal will then go to sleep and periodically wake up to check back with the Base Station to see if the base has a received a prompt from the host designated for the Terminal. Each cycle of going to sleep results in a longer sleep time -- sleeping up 2 minutes if 30 seconds elapses with no host prompt received.

This type of checking back, eliminates the need for the Terminal to always be ON waiting for the host to send it a prompt, thereby saving batteries.

Failure Planning

Let's assume that each part of the system fails. Think out how you are going to know what has happened and how you are going to recover.

If the RF Terminal fails, it will not be able to SIGN ON. If a Terminal Operator SIGNs out in the middle of a transaction sequence, how are you going to handle that? Trash it, or resume where it left off, when and if the Terminal Operator ever signs back in? The most frequent failure will be at the Terminal level. The Terminal Operator can press the ON/OFF key, forcing a SIGN OUT or he can hit the F1 key, forcing a SIGN OUT; this will happen also at battery changing time. So plan for it.

If an operator turns off the Terminal in the middle of a transaction, upon SIGNing back IN, the Base Station clears any pending message previously destined for the Terminal before it SIGNed IN. If the Base Station fails, neither the Terminals nor the Host will be able to communicate with it. When it comes back up, there is a "Base Station Initialized" message sent back to the host. Then the host computer must re-initialize all the Terminals and pick up any incomplete transactions.

If Relay is not connected to a Base Station, when an R/F Terminal puts out the message "Who Can Hear Me" and the unconnected Relay hears it, it will send the following message to the R/F Terminal:

Relay *n* Cannot Be
Heard by the Base
Notify Supervisor
Press Any Key

where *n* is the ID character of the Relay Station. There is no message sent to the host computer later; therefore the operator of the R/F Terminal who gets the above message is depended upon to notify the proper authorities that a cable has been cut or broken or no longer works.

Operator Errors

Plan on the operator walking out of range and going to lunch in the middle of a transaction.

While SIGNed ON in *Two-Way* mode, if the operator hits the *OFF* key without first pressing the F1 key to exit, the R/F Terminal will attempt to SIGN OUT -- so there will be a delay until the SIGN OUT is acknowledged. Because of the delay, the operator might think he didn't hit the key hard enough and press the OFF key again -- turning off the R/F Terminal before the SIGN OUT would be complete. Therefore when the operator signs on again, your program needs to resend the last prompt to the terminal signing in again.

Changing Base Parameters from Host

Once a Base Station is hung from the ceiling, you don't want to have to get a ladder every time you want to change something on one. Therefore there are programming commands to allow you to change their setup, (except frequency) from the host. The command for the Base Station setup is:

@@*S b r p d s l aa EOT

b=Baud Rate(0-6)	0-300, 1-600, 2-1200 3-2400,4-4800,5-9600 6-19200
r=XON/XOFF Sensitive(0-1)	0-no, 1-yes
p=Parity (0-2)	0-none, 1-even 2-odd
d=Data bits (0-1)	0-7bits, 1-8bits
s=Stop bits (0-1)	0-1bit, 1-2bits
l=Listening (0-1)	0-Terminals and Relays 1-Relays only

1 add'l byte for future (make 0 for present)
2 2nd add'l byte for future (make 0 for present)

EOT -normal host to base message terminator

If the command does not have the exact length of all bytes present and any byte does not have a valid value, the command will be ignored. Be careful using this command, because it does change the way you can communicate with the base; your program must make adjustments to the new parameters immediately after making changes to continue communication.

Host to Base Link Testing

You can also issue a command to test the data transmission to and from the base from the host. The command format is:

@@*Edataaaaaa<EOT>

where dataaaaaa is any string of data sent in the command terminated by EOT (ASCII 04). If the data is received by the Base, it is echoed back to the host for reading in the format

dataaaaaa<CR>

where dataaaaaa is the echoed string and CR is the termination character. This verifies both directions of traffic to the Base.

Sample Programs

Sample Programs

The following program is DEMO.BAS, a simple program to control single R/F Terminal in a simulated picking application. (For testing multiple R/F Terminals, use the SHOW.BAS program). DEMO.BAS does have voice message broadcasting using the defualt messages shipped with the terminal.

```
5' this is the very simple DEMO.BAS program which asks for item and
6' quantity.  This will not work with more than one terminal.
10 DIM P$(10)
20 OPEN "COM1:9600,N,8,1,RS,DS,CS,CD" AS #1
30 P$(1)="@B1@V01@C5@1,7,0,PICKING" 'top line displayed, no entry
40 P$(2)="@C3@v02@@3,2,1,ITEM"          'display item, wait for entry
50 P$(3)="@C4@4,2,1,QUANTITY"           'display qty, wait for entry
60 B$="":T1$=""                         'initialize variable
70 IF EOF(1) THEN 70                    'wait for byte to read
80 A$=INPUT$(1,#1)                      'input a byte
90 IF RIGHT$(A$,1)=CHR$(13) THEN 110    'if CR then goto 110
100 B$=B$+A$:GOTO 70                    'else concat to B$, get another ch
110 IF RIGHT$(B$,1)=CHR$(19) THEN 180   'base initialized message?
120 IF RIGHT$(B$,1)=CHR$(14) THEN 210   'sign out message?
130 IF RIGHT$(B$,1)=CHR$(15)            'sign in message
      THEN T1$=LEFT$(B$,1)+P$(1)+P$(2): 'if sign in, 1st two msgs
      I=2:
      GOTO 150
140 T1$=LEFT$(B$,1)+P$(I)               'message =ID plus msgs
150 T$=T1$+CHR$(4)                      'add EOT for terminator
160 PRINT #1,T$;                        'send message to Terminal
170 I=I+1:IF I=4 THEN I=2               'handle indexes
180 PRINT "TRICODER/BASE DATA : ";B$    'display data received
190 PRINT "HOST RESPONSE : ";T1$        'display data transmitted
200 GOTO 60                             'wait for another message
210 PRINT "TRICODER ";LEFT$(B$,1);" SIGNED OUT"
220 GOTO 60
```

The following is a sample program to control two R/F Terminals simultaneously doing different applications This program is on the R/F Terminal Utilities Disk under the name of TWOAPS.BAS. There are no voice messages activated by this program, but voice messages would be trivial to add.

```
5' this is an example or two applications - one on each terminal
10 DIM P$(2,10),I(2),J(2)
20 OPEN "COM1:9600,N,8,1,RS,DS,CS,CD" AS #1
30 P$(0,1)="@B1@C5@1,7,0,PICKING"    '1st prompt for terminal 0
40 P$(0,2)="@C3@3,2,1,ITEM"          '2nd prompt for terminal 0
50 P$(0,3)="@C4@4,2,1,QUANTITY"      '3rd prompt for terminal 0
60 P$(1,1)="@B3@C5@1,6,0,INVENTORY"  '1st prompt for terminal 1
70 P$(1,2)="@C2@2,1,1,LOCATION:"     '2nd prompt for terminal 1
80 P$(1,3)="@C3@3,1,1,PRODUCT:"      '3rd prompt for terminal 1
90 P$(1,4)="@C4@4,1,1,COUNT:"        '4th prompt for terminal 1
100 J(0)=4:J(1)=5                    'max. values of prompt counters
110 B$="":T1$=""
120 IF EOF(1) THEN 120
130 A$=INPUT$(1,#1)                  'receive a message from base
140 IF RIGHT$(A$,1)=CHR$(13) THEN 160
150 B$=B$+A$:GOTO 120
160 TID$=LEFT$(B$,1):ID=ASC(TID$)-48   'R/F Terminal ID
170 IF RIGHT$(B$,1)=CHR$(19) THEN 260  'DC3-RF base power up
180 IF  RIGHT$(B$,1)=CHR$(17)
        THEN  300      'DC2-terminal didn't sign in
190 IF RIGHT$(B$,1)=CHR$(18) THEN 310 'DC1-sequence error
200 IF RIGHT$(B$,1)=CHR$(14) THEN 290 'SO-Terminal signed out
210 IF RIGHT$(B$,1)<>CHR$(15) THEN 220
215  T1$=TID$+P$(ID,1)+P$(ID,2):I(ID)=2:GOTO 230 'sign in
220 T1$=TID$+P$(ID,I(ID))                    'get the next prompt
230 T$=T1$+CHR$(4)                           'append an eot
240 PRINT #1,T$;                             'send to base
250 I(ID)=I(ID)+1:
   IF I(ID)=J(ID)THEN I(ID)=2        'increment prompt ctr
260 PRINT "R/F Terminal/BASE DATA : ";B$
270 PRINT "HOST RESPONSE : ";T1$
280 GOTO 110
290 PRINT "R/F Terminal ";TID$;" SIGNED OUT":GOTO 110
300 PRINT "R/F Terminal ";TID$;" NOT SIGNED IN":GOTO 110
310 PRINT "SEQUENCE ERROR ON R/F Terminal ";TID$:GOTO 110
```


DLL for Windows Programmers

PromptCOMM comes in 16 and 32 bit versions of a Windows Dynamic Link Library (DLL) that allows programmers to easily add the ability to send prompts to and receive data from their R/F Terminal via an RF Base Station or direct serial link.

The DLL is a $50 option distributed on one disk. To install the program, run the INSTALL.EXE program on the floppy from Windows Program Manager.

The Application Programming Interface(API) for promptCOMM consists of the following functions:

InitComDLL
CloseComDLL
Setup
SendCommand
GetCommData

There are sample programs distributed on the disk in Visual Basic, Access, and Delphi. There is also a Visual Basic code example which doesn't require the DLL.

The help system is extensive.

The README file has the latest changes documented.

Voice Message Operations

Over 90 voice messages can be recorded for host triggered broadcasting. Voice messages need to be recorded and programmed before any message can be broadcast for user program prompts or selected system error messages. Your users of the R/F Terminal are not going to want to hear long messages, thousands of times. Short messages are preferable for prompts; most English prompts can be stated in 1/2 second. Don't say, "Enter the Item Number", say "Item". Error messages can be longer, because they are the exception and need more precise instructions.

Programming Voice Messages

To setup or playback voice messages or assign voice messages to error messages, you must enter the *SETUP MODE* including keying in the *password* as discussed previously in this section of the manual. Once you have entered the *SETUP MODE* and keyed in the correct password, you will see the following prompt:

R/F Terminal Setup-1	Key 3 for
R/F Base Setup-----2	Voice
Voice Operations---3	Operations

Key a 3 to select *Voice Operations*. The next prompt displayed is:

Record Playback---1
Assign Errors-----2
Cloning Master----3
Cloning Receiver--4

This prompt allows you to:

1) Go to the routines to record or playback messages by number, or

2) Assign voice message numbers to commonly used error messages, or

3) Clone voice messages from one Terminal to another.

We will detail them in their order.

Record and Playback of Voice Messages

If you respond with a 1 for *Record/Playback*, you will see the next display:

RECORD/PLAYBACK?
KEY [R/P]?

As a tutorial press the P key and release it. The screen should now show:

RECORD/PLAYBACK?
KEY [R/P]?
MESSAGE # : _

You are now supposed to enter a two digit number for the message number you wish to Playback or hear. Lets enter 01 <ENTER> here. You will probably hear nothing and see the display as follows:

MESSAGE # :01
RECORD/PLAYBACK?
KEY [R/P]?

If you heard nothing, we can safely record over the area assigned to message # 01, so let's respond with an **R** to request Record. Get the microphone out and plug it into the *AUX* jack located next to the *POWER* jack. Your display should now show:

RECORD/PLAYBACK?
KEY [R/P]?
MESSAGE : _

waiting for us to enter a message number. Let's enter 01 <ENTER>, and the screen will now show:

MESSAGE # : 01

HIT ANY KEY TO
START RECORDING

What that really means is: Press any key, and **when you release it**, start recording. Let's record something we can use in the default program #1. Get ready to say ITEM (or your language) very clearly into the microphone that is plugged into the R/F Terminal. When ready, press the *Enter* key, and when you release the key, speak ITEM into the microphone. You will hear two beeps when the message time is over, and you display will show:

HIT ANY KEY TO
START RECORDING
RECORD/PLAYBACK?
KEY [R/P]?

Tips of For Voice Usability

1) Record calmly. A frantic voice is very uncomfortable to listen to repeatedly.

2) Vary the tone of your voice for adjacent prompts. Use a different voice for the error conditions.

3) Record all the Error Messages that might be encountered in a data collection session.

4) Use a barpad table for simple numeric variable length data entries so the operator can scan everything and not have to use the keyboard -- only listen and scan -- potentially much faster than keyboard entry.

Now you're all set to listen to your first recording. Just hit the **P** key and key in 01 for the message number. The author's first attempt produced EM and a very frantic tone of voice. Practice starting as soon as you release the key and speaking clearly and calmly, (think of the poor guy who has to hear it 10,000 times next week). Keep trying. There's plenty of time to say ITEM in 1/2 second calmly.

That's the way all messages are recorded. If you're not sure where blank space is, you can listen to messages until you've found a usable message space for recording.

When you are finished, Press F1 to exit the voice operations.

Assigning Voice Messages to Error Conditions

Voice messages for error conditions are even more useful than voice messages for operator prompts. Hearing prompts over and over can be rather tiring so you may want to provide for stopping the repetitive prompts after 3-5 times, depending on the complexity of the prompts.

To assign voice messages, you need to get into the *SETUP MODE* as previously discussed.

Having selected *Voice Operations*. The next prompt displayed is:

Record/Playback-->1
Assign Errors---->2
Cloning Master--->3
Cloning Receiver->4

Key a 2 to *Assign Errors*. The screen will appear as:

Record/Playback-->1
Assign Errors---->2
LOW BATTERIES
0000

This is the first message we have the opportunity to assign an error message(s). You can have one message or two messages (back to back) assigned to an error condition. The above prompt is giving you the opportunity to create a voice message for the LOW BATTERIES condition. Whenever the R/F Terminal displays that message, if you assign a message(s) here, the R/F Terminal will broadcast your message. Lets go record a message to use here. Press and release each key in this sequence: Shift, F1 and F2. Now the screen reads:

RECORD/PLAYBACK?
KEY [R/P]?

Before we record over a message number area, let's play it to see if there is anything there. Press the P key. Now the screen shows:

RECORD/PLAYBACK?
KEY [R/P]?
MESSAGE # : _

Lets enter in 31, the first of our 1 second messages. Key in 31<Enter>. As shipped, the R/F Terminal has a LOW BATTERIES message there; you'll hear it immediately. If nothing is recorded, you will hear static. Chances are you heard the correct message or only static. If so, its clear to record. This message has already been recorded at the factory, but you can change it. We can safely record over the area assigned to message # 31, so let's respond with an **R** to request Record. Get the microphone out and plug it into the *AUX* jack located next to the *POWER* jack.) Your display should now show:

RECORD/PLAYBACK?
KEY [R/P]?
MESSAGE : _

Now it is waiting for us to enter a message number. Lets enter 31 <ENTER>, and the screen will now show:

MESSAGE # : 31
HIT ANY KEY TO
START RECORDING

What that really means is: Press any key, and **when you release it**, start recording. Let's record something we can use in the default program #1. Get ready to say LOW BATTERIES(or your language) very clearly into the microphone that is plugged into the R/F Terminal. When ready, press the Enter key, and when you release the key, speak LOW BATTERIES into the microphone. You will hear two beeps when the message time is over, and the display will show:

HIT ANY KEY TO
START RECORDING
RECORD/PLAYBACK?
KEY [R/P]?

Now you're all set to listen to your recording. Just hit the **P** key and key in 31 for the message number. Practice starting as soon as you release the key and speaking clearly and calmly. Keep trying. There's plenty of time to say LOW BATTERIES in 1 second calmly.

That's the way all messages are recorded. If you're not sure where blank space is, you can listen to messages, until you've found a usable message space for recording.

Now lets go back to the ERROR ASSIGN process where we were when we went to RECORD. Press the F1 key and we're back to:

LOW BATTERIES
3100

Now let's assign that message number we just recorded. Hit the CLEAR key and then key in 3100. We left the second message unassigned, (as we will most of the time).

The messages available for assignment are:

LOW BATTERIES
Finish, Sign Off
Change Batteries
Hit Any Key
CHANGE BATTERIES
UNIT SHUT DOWN_
TRANSMISSION FAILED.
To Retry,Move Closer
and Press Enter.
F1 to Exit.

You will be cycled through all of them. At any time, you can hit F1 to exit the *ASSIGN ERRORS* operations. You can also use the arrow keys to move through the messages:

UP Arrow - transfers to the Beginning of File
DOWN Arrow - transfers to the End of File
RIGHT Arrow - moves down one message in the file
LEFT Arrow - moves up one message in the file

Cloning Voice Messages

Once voice messages have been recorded in one R/F Terminal, those messages can be cloned to other R/F Terminals, (along with the Terminal Setup except the Terminal ID). You will need cloning cables F38 and T15. F38 plugs between the two *Computer* ports on the Terminals and the T15 cable plugs between the two *AUX* ports on the Terminals; plug the double black banded jack into the "Receiving" Terminal and plug the single black banded jack into the "Master" Terminal.

After having plugged in both cloning cables with the doubled banded stereo jack in the receiving Terminal, you are ready to clone the voice messages. Having selected *Voice Operations* from the *Programming Mode Menu*, you should see displayed on each R/F Terminal's screen the following:

Record/Playback-->1
Assign Errors---->2
Cloning Master--->3
Cloning Receiver->4

Start the Receiving Terminal first, by hitting *4*. Then start the Cloning Master by keying 3. The messages will now be transmitted and played as they are copied. It will take about 75 seconds to complete. The display of the Receiving unit has the following message:

Recv Setup/Voice
Please Wait

The display of the transmitting Terminal has the following message:

Xmit Setup/Voice
Please Wait

After the units have finished cloning, both displays will have the following message:

End of Cloning
Hit Any Key

Troubleshooting

I can't communicate at all

First, check out the communication link from the Base Station to the Host. There is a command to test the transmission of data from host to Base and from Base to host. The command to be issued from the host is:

@@*Edataaaaaa<EOT>

where dataaaaaa is any string of data sent in the command terminated by EOT (ASCII 04). If the data is received by the Base, it is echoed back to the host for reading in the format

dataaaaaa<CR>

where dataaaaaa is the echoed string and CR is the termination character. This verifies both directions of traffic to the Base.
If the data isn't echoed back, either your host COM port or the Base Station has a problem. Check to see if the Base Station JP103 is jumpered to N for Normal, not P. If it is jumpered to P, no communication with the Base can take place.

Once you know the Base is communicating with the host, compare the frequency of the Base Station with the frequency of the Terminal; they must be the same.

Now you can use the Site Testing to check the communication of the Terminal to the Base and back. Move in very close. Be sure no other Terminals are in use, and bring up the SITE-TESTING mode. You should get 96-100% on first try. If you don't the radios need repair. Call for an RMA.

To check out the operation of a Relay, first check out the radio by doing a site test on the Relay with all other Relays and Bases off. To check out its working with a Base Station, set the Base to a different frequency than the Relay and set a Terminal's frequency to the Relay's frequency. Be sure to set the R/F Terminal to RELAY=YES. Then cable connect the Relay's (RELAY port the Base's RELAY port). Start communicating with your program or the DEMO.BAS program; It will take 10 + seconds for the Terminal to switch to the Relay, (if it was formerly communicating with a Base). When the Terminal can't communicate with the Base, it will put out a "who can hear me" message. The Relay will answer and communication will be established through it. You will notice a slightly slower throughput with the Relay in the loop.

You can also test the link of the Relay to a Terminal, go into *SETUP MODE* on an R/F Terminal, and set the Base Station to "listening only to relays", then when you communicate with a Terminal set to the same frequency as a Relay, any message received by the BASE has been forwarded by the Relay.

If you are running with Unix or Pick, be sure the base is set to "Xon/Xoff Sensitive."

I'm not getting the distance I need

To maximize the range, the Base Station or Relays should be located:

1) at the center of area of intended coverage, and

2) as high as possible, (i.e. on the ceiling of the room). Sometimes just raising the base station to 12 feet will dramatically increase the distance, especially in warehouses or grocery stores with tall shelving. Mounted on the ceiling with the antenna pointing down works best. Mounted on a wall with the antenna pointing parallel to the floor is worst.

To accurately determine the required hardware to cover a given site, you should use the *Site Testing Mode* built into the firmware of each R/F Terminal.

My response time is poor

First do a site test next to the base. If it's not 98%, RF in the problem.

Next, run the demo program. If it runs fast, it is your program that is slow. If your program is not responding within 300ms, the radio messages are duplicated every 300 ms until the terminal receives a prompt from the host. A host program that takes 2 seconds to respond to a terminal's data entry with a new prompt will increase the radio traffic by 400%, requiring you to limit even further the number of terminals on a base. See *Host Resonse Delay* for help.

If you have good response time everywhere except on the fringe of the area, you may need a relay; but remember, relays are not as fast as the base only.

If there are several terminals per base station, consider adding another base station and splitting the terminals to reduce contention.

The reader won't beep when reading bar codes

Try reading a known good bar code -- the *1* on the *Setup Menu*, following the steps for proper scanning technique on page 73.

Try scanning at different speeds -- a common error is scanning too slowly.

Read the instructions beginning on page 7 configuring the Terminal for different bar code types and formats, and make sure you properly enabled the bar code types you're trying to read.

I get a beep when reading , but nothing is transmitted

Do you get a "Waiting for Base to Acknowledge" or "Waiting for Host Prompt" message. If so, move closer and check the Frequencies. If not check the Base Power Up sequence to the host. See Above.

If you are getting two beeps, any Code 39 or 128 bar code with leading spaces (such as the Barpad on page 75) will **not** be transmitted to your

computer until you read a bar code <u>without</u> a leading space. Try reading the *1* on the *BarPad* of the *Terminal Setup Menu* 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.

If the read failure is on Interleaved 2 of 5 codes, make sure the data length is the same that you selected on the *Terminal Setup Menu*. Be sure you don't have the check digit enabled for Code 39 or Interleaved 2 of 5 if you're trying to read data without check digits.

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

Clear the Preamble and Postamble.

Poor read rate

Carefully follow the scanning instructions on page 73 when reading any and all bar codes. As straightforward as scanning may seem, many people who call with a complaint about poor read rate are simply not wanding correctly.

I get six beeps when the R/F Terminal powers up

The unit needs repair. Call for an RMA.

The R/F Terminal transmits data to your screen or serial port, but some characters are garbled or missing

Make sure you've set the R/F Terminal 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 (upper and lower transposed) case, set **Caps Lock Off** on the Setup Menu.

I Can't Communicate With My RS-232 Port on Host CPU

One of the biggest problems called in. Check your cables first. For other circumstances, see the section titled *R/F Terminal Serial Model Pinouts*, and check your host's serial port pinouts to be sure that you have "Transmit Data" wired to "Receive Data".

Use a "null modem" connector to test switching pins 2 and 3 on one or more serial cables, or get a technician with a breakout box to modify your cable(s).

If you are communicating to a Unix or Pick host system, be sure you have setup the Base for "Xon\Xoff Sensitive" to prevent the XOFF code being sent as the "Base Initialized" message.

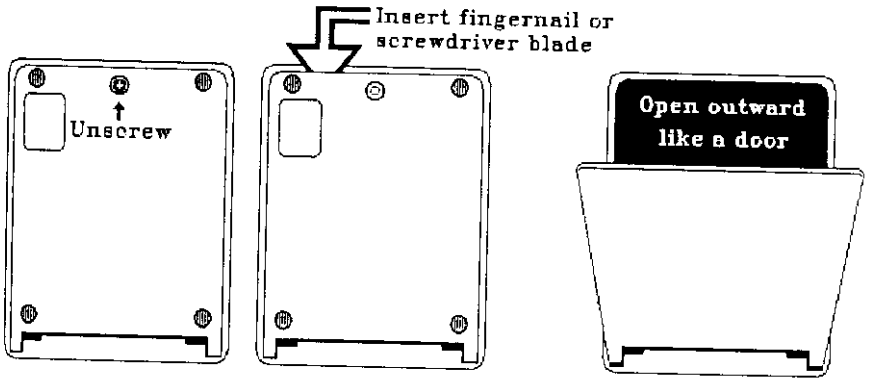
Windows 95 com port setups must also be changed to turn off XON/XOFF.

Frequency & Jumper Changes

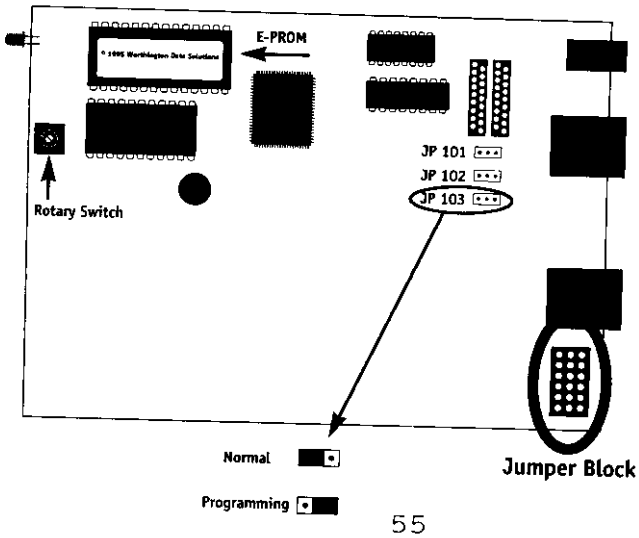
Base and Relay Opening Procedures

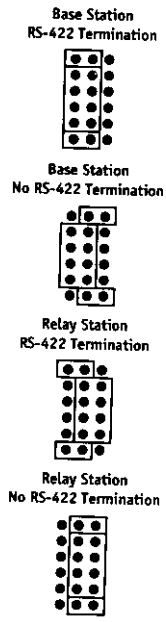
The Base and Relay on Power UP will blink "Frequency +3" times to show the frequency. Frequency 0 will blink 3 times, frequency 5 blinks 8 time. As preparation for changing Base Station's frequency, baud rate, protocol, data bits, stop bits, and parity; or in preparation for changing a Relay Station's ID, frequency, or 422 termination, the case must be opened to expose the circuit board with the switches and jumpers. Be sure you disconnect power before starting.

Turn your R/F Base or Relay Station 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, and 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 circuitboard, as shown below.





JP101 controls the DTR serial line. *NC* is low. *H* is high. Some modems require the DTR signal to be high. If so, set it to *H*.

JP102 should always be set to *S*.

JP103 Controls the *Programming Mode* for the Base or Relay. For normal operation, leave this jumper in the *N*ormal setting. To program the Relay ID or to program the Base Stations *Computer Port* settings from an R/F Terminal, move this jumper to *P* for Programming Mode. If the Base Station is jumpered for *P*rogramming, the user will be unable to "Sign On" for communication and will see the following message displayed:

BASE IS JUMPERED
FOR PROGRAMMING,
CANNOT SIGN ON
HIT ANY KEY

If the Base Station is set for *N*ormal, the user will be unable to setup the base and will see the following message displayed:

BASE IS NOT JUMPERED
FOR PROGRAMMING,
CANNOT SETUP
HIT ANY KEY

After changing the N/P jumper (JP103), you need to cycle power on the Base Station or Relay for the new setting to take effect. Now by entering the SETUP MODE on the R/F Terminal, you make changes to the Base Setup from the R/F Terminal. All changes to the Base Station must be made from the keypad only; this is to minimize confusion between setup of the R/F Terminal and the R/F Base Station. Refer to Base Setup Instructions in the main body of the manual for instructions on how to make the baud rate, parity, protocol, etc. changes to the Base Station. There is also a program furnished on the R/F Terminal Utilities Disk to make changes on inaccessible Base Stations or Relays.

The Base Station and Relay must have their frequencies set to the same frequency as the R/F Terminals in their network. The frequency is set by turning a rotary switch to the setting 0-F (16 different frequencies to choose from). Use a **very small** flat head screwdriver to turn the switch to the desired number.

Each Relay must also have a unique ID and is set by moving Jumper JP103 to P, and then move the Rotary Switch (SW1) to a position (0-F) to correspond to the ID to which you wish to set the Relay Station. Now cycle power on the Relay Station. Set JP103 back to N (for normal) and restore the Rotary Switch to the frequency setting which you intend operate the Base Station and Terminals in the network.

The Base and Relay can be jumpered to be the 422 terminated or not terminated. If the Base has multiple strings of relays radiating from it, it would not be terminated. If it is the first in a string, not in the middle of a string), set the 422 jumpers to Base w/RS-422 termination.

The last Relay in each string should also have its jumpers set as a Relay w/RS-422 termination.

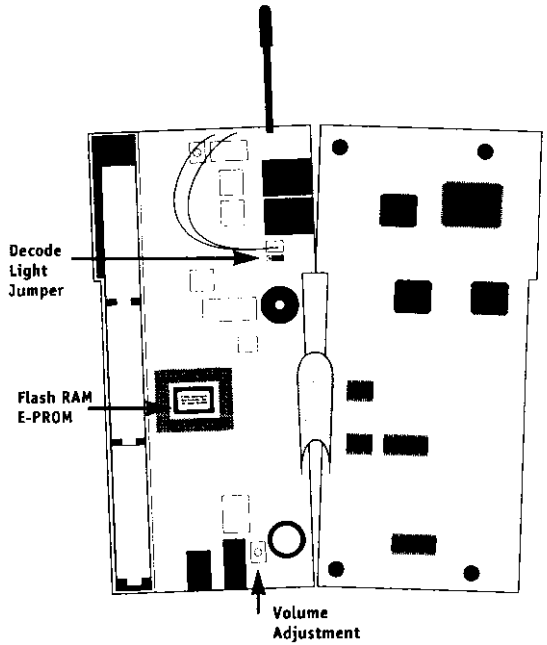
R/F Terminal's Case Opening

To change the Laser decode light operation or the speaker volume, the case of the R/F Terminal must be opened.

The volume of the speaker can be increased or decreased in loudness by adjusting a tiny pot inside the R/F Terminal.

Before opening up the R/F Terminal, **be careful of static discharge to the board** by at least touching some large metal object immediately before opening the case. To open up the R/F Terminal, after unplugging the power supply and turning the R/F Terminal OFF, unscrew the four screws in each back corner. Lay both halves of the R/F Terminal on the desk; you will have access to the decode light jumper and the potentiometer to adjust the speaker volume.

Lay the two halves of the R/F Terminal on a desk like the diagram below. Locate the volume adjustment, (right next to the speaker jack) and make adjustments within the red lines marked on the potentiometer. Use a knife or a very fine blade flat screw driver to turn the volume control. Turn it clockwise to increase volume. Turn it counter clockwise to decrease the volume.



If you are in a noisy environment, you may prefer the earphone which plugs into the AUX jack on the bottom of the R/F Terminal. If using the earphone, you will probably want to turn off the speaker to conserve power. You can do this by entering the SETUP MODE and specifying 1 for Speaker OFF.

Appendix B

R/F Subsystem Serial Pinouts

R/F Base Station Pinouts

The Base Station is connected to a PC with one of the following cables.

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 PC's DB25 male host COM.

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

(Pins 5-8 are connected, but are not used by the R/F Base Station. If you are connecting to a modem, you should use Cable *F32A* which is a straight cable with pin 6 cut. You may also have to set the DTR jumper, JP 101, to high - to the H setting.)

F36, DB9 Straight Cable Pinouts

These are the pinouts for the DB9 Female Straight Cable, *F36*, used for connection of the R/F Base Station directly to a PC's DB9 Male host COM.

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

(Pins 5-8 are connected, but are not used by the R/F Base Station

Relay Station 422 Pinouts

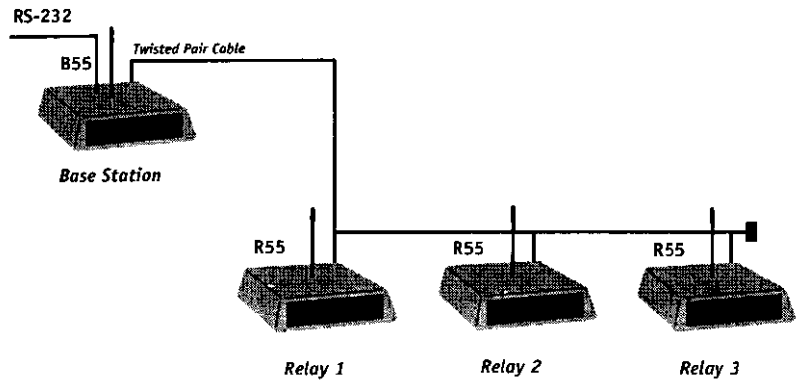
The R/F Relay Stations are connected by twisted pair wire -- use Belden 9502 or equivalent. The Relay Port on the Base Station and Relay Station are connected with a straight cable from the RELAY port on the Base Station to the RELAY port on the Relay Station with the following pinouts:

Base Connector	Pin #	Relay Connector
Receive Data +	5	Transmit Data +
Receive Data -	6	Transmit Data -
Ground	4	Ground
Transmit Data +	2	Receive Data +
Transmit Data -	3	Receive Data -

Make a cable with 5-5, 6-6, 4-4, 2-2, and 3-3 (a straight cable); but, be careful that you select wires so that the 2 wire in the twisted pair with the 3 wire and the 5 wire is in the twisted pair with the 6 wire.

Using these pinouts you can make your own 422 multi-drop cables by tying T+ on each R/F Reader to the R+ (and T- to R-) of the continuous cable going from the Base to the last Relay in the loop, or you can order our "T"(F44) cable, one for each Relay. The bottom end of the "T" cable connects to the Relay; the two ends on the top of the "T" have female modular 8 connectors. The only cables you need to provide are cables with male modular 8 connectors on either end which connect between Base and Relays. At cable string ends, jumpers on the Base or Relay should be set for 422 w/Termination. (See Pages 54 for jumper settings.) Connect Relay port on Base to Relay port on the Relay.

Follow these instructions to connect R/F Relays to your Base Station as shown. (If used, each relay would have a F44 connected as the T junction.)



Remember, each Relay must have a unique ID. Set Jumper JP103 to P, and then move the Rotary Switch (SW1) to a position (0-F) to correspond to the ID to which you wish to set the Relay Station. Now power down and power up the Relay Station. Set JP103 back to N (for normal) and restore the Rotary Switch to the frequency setting which you intend operate the Base Station and Terminals in the network. Connect Relay port on the Base to Relay port on the Relay.

Appendix C

Code 39 Specifications

Code 39 is the *de facto* standard of non-retail American industry. It is both flexible, featuring a large character set, variable data length and density, and bi-directional readability. It's also very accurate, with substitution errors almost nonexistent. Its character set consists of numbers **0** through **9**, *upper-case* letters **A** to **Z**, and punctuation characters **space $ % . / +** and **-**.

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 .75 characters per inch (cpi) to a high 9.4 cpi. There should be a quiet zone of 1/4" white space to the left and right of the code. Exact specifications for Code 39 and other bar codes are available for $9 from the American National Standards Institute (ANSI), Sales Dept., 1430 Broadway, New York, NY 10018.

Code 39 can be printed with a **Mod 43 Check Character** derived by assigning a value to each character in the data to be bar-coded in 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		

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:
   1 + 2 + 3 + 33 + 34 + 35 = 108
2. Divide the sum by 43: (hence the name modulus 43)
   108/43 = 2 with a Remainder of 22
3. Find the character corresponding with the remainder.
   M (value 22) is the CHECK CHARACTER

The data to be printed becomes **123XYZM**.

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 Code 39 characters. Lower case letters, additional punctuation symbols and control characters are represented by two-character sequences. This gives Full ASCII Code 39 a character set suitable for any application, but at the cost of halving CPI for the lower case and other added characters.

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

ASCII	C39	ASCII	C39	ASCII	C39	ASCII	C30
NUL	%US	P	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	:	/Z	Z	Z	z	+Z
SUB	$Z	;	%F	[	%K	{	%P
ESC	%A	<	%G	\	%L	|	$M
FS	%B	=	%H	]	%M	}	%R
GS	%C	>	%I	^	%N	~	%S
RS	%D	?	%J	_	%O	DEL	%T
US	%E						%X

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), four 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 basic data characters.

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

Code 93 also has two built-in check digits, (never transmitted), which greatly minimize the possibility of reader substitution errors.

Check digits are never transmitted. The Start/Stop is never transmitted.

If you are reading this while trying to decide which code to use in your organization, while we agree that Code 93 is an excellent code, we believe that Code 128 is generally preferable because:

1) Code 93 doesn't have a numeric packing capability that 128 does, and

2) Code 93 requires pairings to make all Full ASCII while 128 doesn't.

Appendix E

Codabar

Codabar

Codabar is widely used in libraries, blood banks, and the cotton 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's variable data length and extremely low error rate make for a versatile bar code.

Though basically a numeric code, you can also use different combinations of start and stop characters to identify different types of labels.

Codabar start/stop transmission
The Codabar section on the *Terminal Setup Menu* lets you determine whether Codabar start/stop characters will be transmitted. If you're varying start/stop characters with different types of labels, you'll want to enable their transmission. Start/stop transmission can also be helpful if you want your program to be able to differentiate between data coming from the R/F Terminal and data coming from the keyboard. Otherwise, you'll probably want to disable it.

Appendix F

Code 128

Code 128 is a very powerful bar code, combining variable length and a character set containing all 128 ASCII codes with compactness and error checking. Characters are made up of three bars and three spaces, each element varying from one to four units in width, totaling 11 units of width per character. It contains two levels of error checking: each character is checked for internal parity, and the last character is a checksum.

There are three subsets for Code 128: A,B, and C. A Code 128 bar code can be made up of any mix of the subsets. There are three start characters for each subset, so subsets are switched within the code with an embedded start character. Subset C is the packed decimal version which is very space efficient, encoding two numeric characters into one bar code character pattern. Code 128 has a built-in check digit, Mod 103, which is not transmitted and is used to minimize the possibility of a missed read.

UCC-128 or EAN-128 code is a subset of Code 128 which always starts with a Function 1 Code 128 character. The possible formats are endless, but they all start with an Function 1 Code 128 character. Each variable length field (except if it is the last field) within a bar code is also supposed to be terminated by a Function 1 character. The specification for reading a UCC-128 or EAN-128 requires each Function Code 1 character encountered to be transmitted as]C1 by the bar code reader.

If UCC/EAN-128 is enabled on the R/F Terminal reader, all Function 1 codes are transmitted as]C1. In addition, should you be reading a 20 digit Shipping Serial Container code, the Mod 10 check digit is also compared with the computed Mod 10 value to give further assurance of no substitutions. The UCC/EAN-128 Shipping Serial Container Code is a subset of UCC-128 or EAN-128 adopted for voluntary marking of shipping boxes with the exact serial number of the box, (used with EDI typically to identify a specific boxes contents. The code consists of the following format:

Start C	(not transmitted)
Function Code 1	(transmitted)
2 Digit Qualifier	(transmitted)
17 Digit Data Portion	(transmitted)
1 Digit Mod 10 Check Digit	(transmitted) (Calculated with 19 digits-UPC method)
1 Digit Modulus 103	(nontransmitted)
Stop Code	(not transmitted)

Appendix G

2 of 5 Code

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

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 codes so that the length check can be activated. Interleaved 2 of 5 codes are normally read with the length check activated; you set the length using the *Terminal Setup Menu*. You can set the length to 00 digits, allowing variable length bar codes to be scanned; however we recommend that you then use the *Minimum/Maximum* digits in the Terminal programming to check each field for the proper length.

Use a check digit. This would be especially helpful when using variable length bar codes. Utility 1 and the LabelRIGHT printing programs will automatically calculate and print a check digit upon request according to the method below:

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) x 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**

Because the data now has an odd length, a leading zero is added, for the final result of **019873**.

Appendix H

UPC Specifications

UPC symbols are found on almost all grocery products and many other retail items. UPC is a fixed-length (12 digits) numeric-only code, with the first digit controlled by UPC coding assignments and the 12th digit a checksum. Each digit is constructed with two bars and two spaces.

EAN is basically an international superset of UPC, the main difference being that the first digit of a 12-digit UPC code is controlled by UPC coding assignments, and the first two digits of the 13-digit EAN are a country code. The final digit of each code is a checksum.

EAN-8 is a shorter version of the EAN code, with seven digits of data and a checksum digit.

The exact UPC symbol specification is available for $30 from the Uniform Product Code Council, Inc., 7051 Corporate Way, Suite 201, Dayton, Ohio 45459-4294, (513)435-3870. UPC has very precise standards of code size, structure, and numbers to be used.

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

- If you plan on using a "supermarket-type" slot scanner to read the codes, for an optimum first read rate, specify a Bar code height of at least .9".

- Make it an early practice to observe UPC Council numbering conventions. Don't start labeling unmarked merchandise with codes that may conflict with those already assigned. If they're not in your store now, they will likely be in the future, causing conflicts in your inventory numbering system. The leading number system character, (the first of the 11 digits to be entered) should conform to these UPC assignments:

  0,6,7 Regular UPC 12-digit codes assigned by the UPC Council. Don't use 0, 6, or 7 as leading numbers 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. Don't use this today, or you won't be able to process coupons through your system tomorrow.

UPC 2 and 5-character supplemental codes

The UPC/EAN standards include the addition of a 2 or 5-character supplemental code used with magazines and paperbacks. To read the

supplements, you must enable them using the *R/F Terminal Setup Menu*. Note: enabling the supplements disallows the reading of UPC codes from right to left, to assure that the supplement does not get skipped.

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, this is the method of calculation:

Step 1: We'll use Worthington Data Solutions' phone number (it's not a real UPC-A code) as sample data: **14084589938**

Step 2: Starting with the least-significant digit (in this case, **8**) label the digits from right to left alternately even and odd:

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

Step 3: Starting with the least-significant digit, **8**, take the sum of all the characters in the even positions: **8+9+8+4+0+1=30**

Step 4: Multiply the result of step 3 by **3**: **30 x 3 = 90**

Step 5: Now take the sum of all the odd characters: **3+9+5+8+4=29**

Step 6: Add the result in Step 4 to the result in Step 5: **90 + 29 = 119**

Step 7: Subtract the result from the next higher multiple of 10. In this example, the next higher multiple of 10 over 119 is **120**: **120 - 119 = 1**

Step 8: **1** is the Modulo-10 check character for the sample data, making the data to be printed: **140845899381**

The same formula is used for EAN-13 and EAN-8 bar codes.

The following page describes checksum calculation for UPC-E and UPC-E1.

UPC-E Checksum Calculation

This page will show you how UPC-E checksums are calculated, using an example UPC-E code with data of **123456**.

Step 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 codeUPC-E ends in a	Data	Insertion Digits	Insertion Position	10-digit Code
0	**abcde0**	00000	3	**ab00000cde**
1	**abcde1**	10000	3	**ab10000cde**
2	**abcde2**	20000	3	**ab20000cde**
3	**abcde3**	00000	4	**abc00000de**
4	**abcde4**	00000	5	**abcd00000e**
5	**abcde5**	0000	6	**abcde00005**
6	**abcde6**	0000	6	**abcde00006**
7	**abcde7**	0000	6	**abcde00007**
8	**abcde8**	0000	6	**abcde00008**
9	**abcde9**	0000	6	**abcde00009**

Because the sample UPC-E code ends in a **6**, insertion digits **0000** are inserted at the sixth digit (insertion position 6), making: **1234500006**

Step 2:Preface the resulting 10-digit code with the number system character (0 for UPC-E.

For the sample UPC-E code: **01234500006**

Step 3:Use the UPC-A check digit procedure described on the previous page to calculate the check digit of the resulting 11-digit code as if it were a UPC-A code.

The sample UPC-E code's check digit is: **5**

Step 4:The data to be printed is an eight-digit number consisting of the number-system character, then the original six-digit code, then the check digit.

The sample UPC-E code becomes: **01234565**

Appendix I

MSI Bar Code

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. 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:

1. The example bar code data is: 82345
2. Form a number of the odd positions, starting in the units position. 8 3 5
3. Multiply the new number by 2 (835) x 2 = 1670
4. Add the digits of product 1 + 6 + 7 + 0 = 14
5. Add the even digits of the original number to the result in 4: 2 + 4 + 14 = 20
6. Subtract the result from the next highest multiple of 10 20 - 20 = 0
7. New Check Digit 0
8. Data with check digit is: 823450

The MSI Mod 11 check digit is calculated as follows:

1. The example bar code data is: 943457842
2. Assign a checking factor to each number starting in the units position of the number up to the higher order positions; use weights of 2,3,4,5,6,7,2,3,4,5,6,7.....
3. Multiply the checking factor with its assigned number and add the products:
   4 + 12 + 32 + 35 + 30 + 28 + 6 + 12 + 36 = 195
4. Divide the sum by 11 195/11 = 17 remainder 8
5. Subtract remainder from 11 11 - 8 = 3
6. New Check Digit 3
   (If the remainder is 10, no check digit is added.)
7. Data with check digit is: 943457823

Plessey is a variable length numeric only code with 2 check characters not transmitted. LabelCode4 and 5 are non-standard codes sold by Follett Systems.

Appendix J

Piggyback Laser Terminal

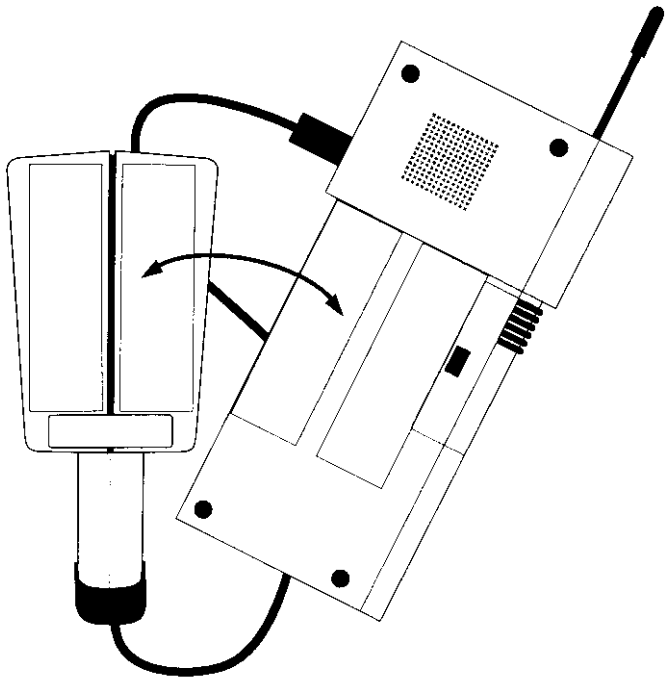
To install the Piggyback cable do the following:

1) If the normal long laser cable is still plugged into the LzX00 laser, at the base of the handle insert a pencil or flat blade screwdriver to depress the tab on the RJ45 and then pull out the cable.

2) Insert the end of the T24 with strain relief into the laser. Plug

3) Place the velcro strips on the laser and R/F Terminal separately (if not already on) according to the below figure.

4) Now plug the remaining end of the cable into the scanner port.



Press down on the velcro surface to be sure the sticky back makes good contact with the surface of the laser and R/F Terminal.

4) Plug the tagged end of the cable into the R/F Terminal.

Appendix K

Additional Cable Pinouts

There are several other cable pinouts which may prove useful to users, beyond those that are detailed in the body of the manual. (See RS232/422 pinouts in the index).

For all RJ Cable pin numbers, number from left to right with the metal pin side of the connector facing you and the cable running to the down position (O'Neil's documentation uses reverse orientation for numbering).

The pinouts for a cable to connect the O'Neil MicroFlash Printer to an R/F Terminal (Male RJ45 on Terminal ends and Male RJ11 on Printer) are : (This is using our numbering orientation, not O'Neil's)

	Printer RJ11	R/F Terminal RJ45
Pins	5	3
Pins	4	2
Pins	3	7
Pins	2	4

(To use the MicroFlash Printer, you must send NULL,CR,LF before valid data to wake up the printer.)

The wand pinouts are:

Pin 1 - 5Volts
Pin 2 - Data
Pin 4 - Enable
Pin 7 - Shield (Drain)
Pin 8 - Ground

(Wand emulation devices will not work properly - due to improper enable lines supported - don't even try, its useless.)

The laser and CCD TTL pinouts are:

Pin 1 - 5 Volts
Pin 2 - Data
Pin 3 - Phase
Pin 4 - LED
Pin 5 - Trigger
Pin 6 - Enable
Pin 7 - Shield (Drain)
Pin 8 - Ground

If you make your own cables, you are on your own. We accept no responsibility for damages resulting from incorrect wiring.

Appendix L

Firmware Upgrades

Base Station and Relay Firmware Upgrades

Occasionally it will be necessary to get firmware fixes for problems discovered with the R/F Terminal System, especially in the early stages of each advance in development. This is accomplished replacing the EPROM, a chip which is to replace the similar chip on the board of the R/F Base Station or Relay.

To replace the EPROM, remove the cover to the Base Station or Relay according to instructions in Appendix A.

Remove the EPROM, (the chip with the Copyright label on it), by gently prying with a small flat head screw driver -- alternate ends to keep from bending the metal legs.

Before inserting the new EPROM, notice that the EPROM has a small groove in one end; the end with the groove in it must match the groove in the socket which it is to be inserted into. Don't insert the chip backwards -- line up the groove in the chip to be on the same side as the socket's groove.

You may need to slightly bend into the center the legs of the EPROM so that they can be inserted into the socket. Place the chip into the socket and begin to lightly push the chip into the socket. Unless you check, you may bend one of the leads not in a hole underneath the chip -- making your Reader disfunctional. Once you are sure all legs are positioned into the holes correctly, you can push hard until the chip is firmly positioned into the socket.

After turning the re-powering the R/F Base or Relay, you should see the LED flash the number of time equal to the frequency assigned. This indicates that the EPROM has been successfully installed. If it doesn't flash, remove the EPROM and check for bent legs. Also be certain you have not placed it in upside down, (not matching the notches).

RF Terminal Firmware Upgrades

The same procedure applies to the R/F Terminal. Refer to Appendix A for how to open the Terminal's case. This Eprom is square and has a paper label on it for identification. To remove it, insert a paper clip leg at each corner with a groove in it, lifting up on the clip to pry out the EPROM. Notice that one corner is blunt. Put the new EPROM in the socket, lining up the blunt corner of the EPROM with the same blunt corner on the socket. Press it in, and put the case back together. Replace the batteries and turn it on. If the first screen comes up correctly-- you're done. Otherwise, you probably didn't get it seated all the way in. Try again.

The RF Terminal can also be upgraded in firmware by downloading a disk file with the current firmware into the RF Terminal's flash EPROM. You will need the *RF Terminal Utilities Disk* which has the LOADER.EXE program on it. (The source code is Loader.BAS)

If you have received a disk with the latest firmware or have downloaded the firmware from our Bulletin Board, the firmware is downloaded by the following procedure:

1) Without yet cabling the RF Terminal to the PC, cycle power on the RF Terminal and press any key to arrive at the prompt:

SIGN ON?
KEY[YES/NO]?

2) Now press and release the F1 key.

3) Now press and release the SHIFT key.

4) Now press and release the D key. The display shows:

0-RDM 1-XMT 2-RCV
3-TR 4-TON 5-RON
L-Load K-Reset EEPROM
I-R/Clone J-T/Clone

5) Now plug the serial cable from the computer (F36 or F34) into the *COMPUTER* port on the RF Terminal (the upper port).

6) Now press the END(L) key on the RF Terminal.

7) Now LOADER program. Type LOADER. The first question is:

The LOADER program will first ask you the following question:

COM PORT NUMBER (1 or 2) : _

key in a 1 or 2.

8) Now the LOADER PROGRAM will now ask you for the firmware filename you wish to download:

FIRMWARE FILENAME :

Type in the name of the program, including any different drive and path if it is not located on the same drive and directory as the LOADER.EXE program.

You will then see the message:

PREPARE TERMINAL FOR RECEIVING, THEN PRESS
ANY KEY WHEN READY

The computer will display dots until finished. Don't interrupt once the dots are being displayed -- neither the old firmware or new firmware will be complete -- just a non-working mixture.

8) If the display doesn't go to the opening screen displaying the new firmware revision number, unplug the cable and pop the batteries out and the replace them.

Finally you will see the message below allowing you to update more Terminals:

LOAD ANOTHER TERMINAL? [Y/N]

Reply with a Y to continue or N to stop and exit to DOS.

Appendix M

Wand Types

The R/F Terminal comes with a power-conserving low, medium, or high-resolution "switch scanner" bar code wand. A stainless steel wand with a black rubber belt around the middle is a "switch scanner". The label on the wand cord identifies the wand type:

8 MILRED or MED VIS:	Medium-resolution Visible -F57
6 MILRED:	High-resolution Visible -F58

These are the two resolutions of wands and their associated characteristics:

Medium-resolution Wand

This is a versatile, general purpose medium-resolution visible-red LED wand capable of reading well-printed dot-matrix codes and high-density bar codes up to 12 cpi for Code 39. It reads well-printed dot matrix codes with the same high read rate as the low resolution wand. It reads high density bar codes at slightly less angle from perpendicular than a high res wand.

High-resolution Wands

High resolution wands are designed to read any printing technology other than dot matrix. It can read up to 13 cpi for Code 39. It can also read any well-printed dot-matrix or other lower-density codes, providing there are no significant voids (white spots in the bars) in the codes and if using infrared light (invisible to your eye) that the bar codes are printed with infrared-light adsorbing ink. The higher the resolution, the greater the angle you can read a well printed bar code. So, if you are exclusively reading laser or thermal transfer printed codes, a high resolution wand will be your best performing wand.

Appendix N

Scanning Techniques

Scanning Techniques

Follow these instructions for proper scanning -- to read the *Terminal Setup Menu* bar codes and configure the R/F Terminal, you must know the right way to scan bar codes.

Wand scanners

After squeezing the black rubber belt around the stainless steel tube to switch the wand on, **start in the white space (quiet zone)** to the left or right of the bar code.

Hold the wand as if it were a pencil, with about a 30-degree tilt from perpendicular to the label. You can scan in either direction.

Quickly (3 to 30 inches per second) and lightly draw an imaginary line through the entire bar code. Don't go slow or press hard -- neither help the reading. But keep slight pressure on the switch.

Don't stop in the middle of the code. Move the wand smoothly across the entire bar code, stopping when it reaches the white space (quiet zone) to the right of the bar code.

Stay within the code throughout the entire scan. Do not move the wand's tip above or below the lines of the bar code.

If you don't get a read, you are probably scanning too slow.

Laser Techniques

Using a laser scanner is basically as simple and intuitive as "point and shoot".

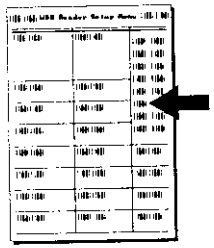
Basically, the scanner's beam must cross every bar and space on the bar code, without touching any other bar codes, as shown in the first example below. For laser scanners, you'll need to hold the scanner further away to produce a wider beam for large bar codes, and closer for bar codes with bars very close together. Even though momentary exposure to these low-power, visible-light lasers is not known to be harmful, you should not stare into the beam or aim it into anyone's eyes.

Right

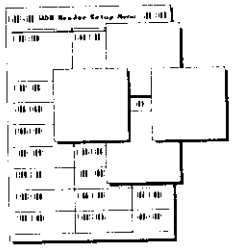
Wrong

Wrong

The important thing to remember about using a laser with the *Terminal Setup Menu* is that you need to make sure the scanner's beam covers only one bar code at a time. The scanner's beam is wide enough, and the configuration bar codes close together enough, that you will need to use your fingers, or the 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 *Terminal Setup Menu*, you would need to cover any adjacent bar codes with paper or a finger first, as shown on the right.

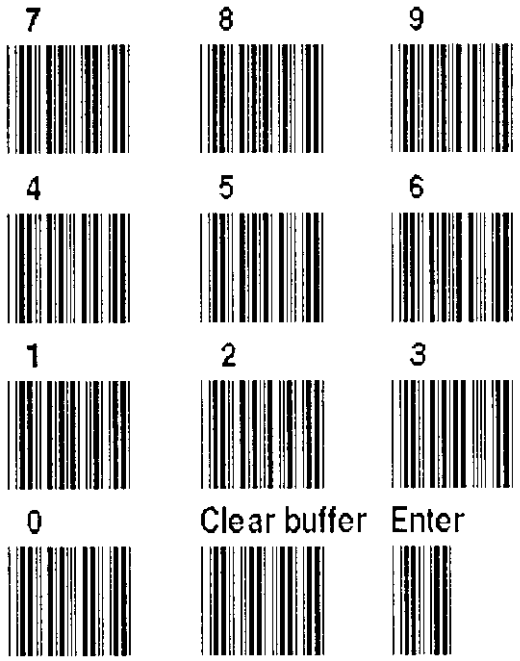


Accumulate Mode

Accumulate Mode is an option (which can be enabled or disabled using the *Terminal 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. The small laminated barpad card is provided 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.)

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



Appendix O

Optional Features

Optional features include:

Feature Code	Description	Price
T10	Earphone for noisy areas	$10
T15	Piggyback Terminal Package	$15
F40	Carrying Case	$55
T47	Piggyback Carrying Case	$65
T48	Integrated Laser Case	$65
T49	Integrated Laser Holster	$45
F38	Cloning Cable	$15
T15	Voice Cloning Cable	$15
F57	Med Res Switch Wand	$120
F58	Hi Res Switch Wand	$120
LZ100	Laser Scanner	$549
LZ200	Laser Scanner	$695
F86	Long Range CCD Scanner	$389
T12	Microphone	$15

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