

7000 RF Terminal™

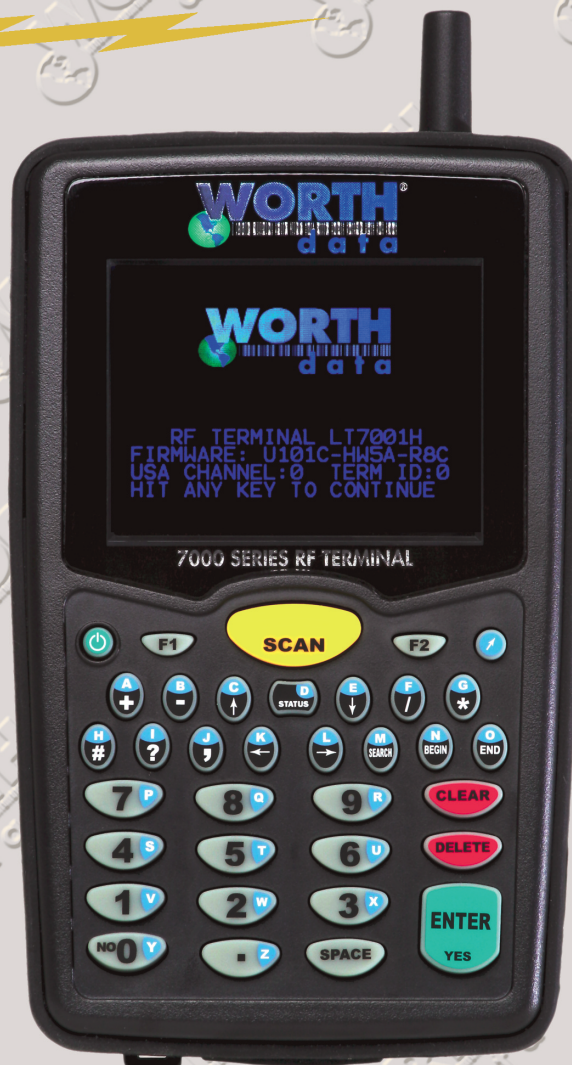
Portable Radio Frequency Terminal



Worth Data®
7000 Series
Host Controlled
RF Terminal System



www.worthdata.com



Owner's Manual

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 Worth Data may void the user's authority to operate this equipment.

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

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

The 7001 RF Terminal and B5001 Base Station have been approved for use in the United States and Canada as a low power frequency hopping spread-spectrum radio operating in the unlicensed 915 MHz frequency range.



The LT7001 model of this product has a laser scanner integrated with the Terminal as one unit. The laser used is a Class II Laser Product and has a 1.2 Milliwatt Output. To operate the laser scanner, aim the top of the case at a bar code, and press the yellow scan key on the keyboard of the RF 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.

The LTnnnn models of the RF Terminal 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	5,367,151
5,373,148	5,378,882	5,396,053	5,396,055	5,399,646
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.

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Introduction

The 7001 RF Terminal is a low cost, easy-to-use radio frequency interactive terminal which communicates with PCs (or any computer) by RS-232 serial port. This new terminal offers unprecedented power and ease of use, while maintaining compatibility with programs written for the older Worth Data Terminals. The list of fantastic features include:

- Low Cost
- Up to 3.3 mile range, LOS (10 x the competition)
- 64 Terminals per Base Station
- Spread Spectrum frequency hopping avoids interference
- No license required in USA and Canada
- Small size, (5.9" L, 3.6" W, 1.0" D) even with laser
- Certified to multiple 5 ft. drops to concrete
- Long Battery Life (15 hours of usage)
- Fast Recharging (2-3 hours) from External Power Supply
- No programming necessary on terminal
- Host communication through RS-232 Serial
- User Customizable Voice Prompting plus Display
- Backlit Color TFT Display Standard
- Uses Li-Ion battery

The RF Terminal maintains software compatibility with applications written for the older generation T71/LT71 and T701/LT701 RF Terminals. Differences are noted below.

Differences

While the new **7000** series RF Terminals are fully software compatible with the older 70 and 700 series terminals, there are a few differences between them. The differences between the older generation of Worth Data RF Terminals and the generation referred to within this manual are:

- 64 Terminals per Base Station instead of 16. Valid Terminal IDs are 0-9, A-Z, a-z, - and =.
- Valid Channels are 0-5.
- Base Station parameters (Baud Rate, Parity, Security Code, etc) are not set through the Terminal, but rather set with a Windows program.
- The maximum number of characters that can be sent to a Base Station by a host program is 1000 instead of the old 247.

- Speaker volume is controlled by the RF Terminal's Setup menu.
- The 7000 Series does not have a choice of battery types. It comes with a built-in Li-Ion rechargeable battery. The battery is charged by the same power supply that is used with the Base Station. An adapter cable is provided to allow connection to the RF Terminal.
- Voice prompts are now recorded on the PC (and/or imported from sound files) and uploaded to the RF Terminal using the 7000 RF Terminal Voice Prompts Manager program. Up to 99 voice prompts can be stored in the RF Terminal with a total time of about 95 seconds.

-

Some differences are simply advantages:

- Greater range (3.3 miles line-of-sight vs. 3000 feet line-of-sight).
- Optional “gun” handle with secondary battery that doubles operational time.
- Color TFT display standard
- Faster transaction times.

Chapter 1: Installation

Components

The components in your RF Terminal system will vary according to the configuration of your system. Your RF Terminal shipment should contain at least:

- **An RF Terminal T7001 or LT7001** - If the RF Terminal is an LT7001 model, it will have an integrated laser scanner built-in to the body of the terminal.
- **Serial Cable** – for programming and voice prompt upload.
- **5V Power Supply** – battery charger with adapter cable.
- **Utilities CD ROM** – demo programs, DLL, and firmware loader program

If *Base Stations* were ordered with your system, you should receive at least:

- **A Base Station (B5001)** including a 5v power adapter for each.
- **A Serial Cable (F34 or F36).**
- **A Relay Test Cable and junction connector block** if ordering bases as *Relay Stations*.

Installation Sequence

1. **Start with one Terminal and Base Station.** Get everything working with the single terminal and base and then add other terminals, being certain that all terminals have unique ***Terminal IDs***. After all terminals are working, add the first relay. Then add remaining relays, remembering to: 1) assign ***Relay IDs***, and 2) set the jumpers of each relay to ***terminated*** or ***not terminated*** properly.
2. All equipment is shipped with the default setting of Channel 0, Terminal ID 0, and Relay ID 0. Unless you have other Terminal/Base configurations already operating on that channel, you probably don't need to change the channel.
3. A Base and a Relay are the same product. A jumper change is all that is required to use a Base station as a Relay. See *Appendix A* for details.
4. Without attaching the Base Station to the computer, and with only the power supply plugged in the base, you can perform a site test to be sure you have adequate coverage and the radios are working perfectly. (See *Chapter 4*).
5. Now connect the Base Station to the computer's serial port. Be sure to turn OFF all handshaking on the COM port used; in Windows, go to Start Menu, Settings, System, Device Manager, Ports (COM and LPT). Now run one of the RF Terminal demo programs found on the *Utilities CD-ROM*.
6. Now run one of the demo programs to validate that everything is working. If you have problems, refer to the **Trouble Shooting Section**.

Connecting the Base Station to a serial port

How it works...

The RF Terminal transmits data to the Base station, which in turn transmits the data **to** the host serial port. The computer software reads the data coming through the serial port and processes the information accordingly. When the computer software running on the host has a task for the terminal, it transmits data

out to the serial port, which then passes this data on to the Base station. The Base station then broadcasts the message to the terminal, causing the terminal to display the message to the user.

The Base station is not machine-sensitive (it needs a standard RS-232 serial port) nor is it operating system dependent (you just need to be able to read and write to the serial port as a separate device).

Connecting the Base station...

If you specified a 25 pin cable (part #F34) or a 9 pin cable (part #F36) when you ordered your Base station, simply plug the RJ45 end of that cable into the **COMPUTER** port on the Base station, and the 25 or 9 pin end into your computer's serial port. If you are *not* connecting to a PC, see **Appendix C** for cable and serial pin-outs.

For an extension cable, you can use existing network cabling already in existence, but you must be certain that the Transmit and Receive data lines are not in the same twisted pair.

If you are using an extension cable and are having problems, test the cable by:

1. Connecting the Base station *without* using the extension cable. Simply plug in the F34 or F36 cable that came with the Base.
2. If the Base works with *only* the F34 or F36 cable in place, add in the extension cable **without changing the physical location of the Base station**. If the extension cable appears to be the culprit, check to be sure that Transmit lines are connected to Receive lines.

Configuring the Base station...

After connecting the Base station to your serial port, you need to configure the serial settings on the Base station to match those required by your software. The default settings are:

- 9600 baud
- No parity
- 8 data bits
- 1 stop bit
- “None” protocol setting

You may want to increase the baud rate for performance. If you want to change any or all of these settings, see **Chapter 2** for details on configuring the Base station using the **7000 RF Base Station Serial Configuration Utility**.

Base station channel...

To determine what channel your Base station is set to, plug in the power supply and watch the LED light on the front of the Base station. The LED will blink “the channel + 3” times.

For example, the default channel is 0. On power up, the LED on a Base station set to channel 0 would blink 3 times. A Base station set to channel 5 would blink 8 times.

If this is the only Base station operating, leave the channel at 0. If you have other Base stations in the area and need to change the channel, see **Appendix A; Channel and Jumper Changes** for details on how to open the Base station and set the rotary switch inside to the desired channel.

RF Terminal Operation

Using the RF Terminal keypad...



The RF Terminal is turned on by pressing the green ON/OFF button located in the upper left-hand corner of the RF Terminal keypad.

It is a good idea to fully charge the RF Terminal before you use it the first time to make sure the battery charged. See below for more information on battery charging.

The RF Terminal has a *Shut Down Time* feature that allows you to determine the length of time the RF Terminal must be inactive before automatically shutting down to conserve battery power. When the RF Terminal shuts down, simply press the ON/OFF button to resume operation.

The keypad is custom designed for the RF 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 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, is the YES reply, and the 0 (zero) 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 by pressing the DELETE key, or you can clear all characters displayed on the screen by pressing the CLEAR key.

Battery Life Indicator

The RF Terminal detects low battery and displays the following message:

LOW BATTERY
Charge Battery
Hit Any Key_

At this point you have approximately 10% of battery life remaining. You should complete what you are doing and charge the battery soon. When the battery is too low to operate the unit properly another message is displayed:

Battery too Low to Operate
Hit Any Key to Power Down

If you turn it back on without charging batteries, you may experience constant beeping, intermittent scanning, and very irritating symptoms that look like equipment failure.

The RF Terminal also has a battery life indicator that can be accessed while operating in ONE-WAY or TWO-WAY mode or while in the MENU. To display the remaining battery life of the battery (as well as the date and time) press the **STATUS** key:

mm/dd/yy hh:mm:ss
BATTERY: ||||| zz%
R7Uxxx ID=0 CH=0 RL=N
SC=N RF=8C C=N

zz=percent in numbers i.e. 99, 10, 05

Press the **STATUS** key again to resume processing.

The lifetime of the RF Terminal's Li-Ion battery is 500-1000 charge cycles. If the battery runtime seems to

be significantly shorter than when the device was new, the battery should be replaced. If you have the optional “gun” handle with the extended battery then both batteries should be replaced at the same time. The main battery is a common digital camera battery sold as Fujifilm NP-120 or Pentax D-LI7. We use a high quality Japanese Li-Ion cell in our OEM pack that we supply with the RF Terminal. You can obtain a replacement from Worth Data (P/N: L02) . Our pack is rated at 1950 mAh and provides the longest runtime available. Do not use a battery pack of unknown quality or origin. Doing so can risk damage to your unit. The optional handle battery is custom made for Worth Data and must be ordered from us.

Your old battery should be recycled. You can get free recycling information at: <http://www.rbrc.org/>

To change the internal battery:

1. Turn **OFF** the RF Terminal.
2. Remove the battery holder door on the back of the RF Terminal by removing the two screws holding the door in place..
3. Remove the old battery and insert a new one, making sure to orient the battery with the battery contacts facing the battery connector.
4. To replace the optional handle battery, remove the 2 screws holding the handle in place. Unplug the handle battery assembly.
5. Replace the battery door and screws and turn the reader on using the ON/OFF switch.
6. Sign ON and resume your application.

Recharging the battery:

1. With the RF Terminal shut off, plug the 5V power adapter into the RF Terminal using the supplied adapter cable.
2. The RF Terminal will turn On and display the following message:

Charging Battery
Please Wait.....

3. When the battery is fully charged after 2-4 hours the following messaged is displayed:

Battery Charge
Complete

4. The unit will remain ON for a half hour or so after the charge cycle has completed and then turn OFF.
5. If you press the POWER key while the unit is charging, nothing will happen.
6. If you press the POWER key after the unit has turned OFF after completing a charge cycle and the charger is still attached, the “Charging Battery” message will display again and a charge cycle will begin.
7. It will take about 2 hours to fully charge a unit with a single battery and about 4 hours to fully charge a unit with the optional handle battery.
8. Do not charge the battery if the Terminal is very hot or very cold since this will give a false reading on the condition of the battery and it may not get charged properly.
9. You cannot operate the unit when the charger is attached, except to charge the battery.

RF Terminal Menu Functions

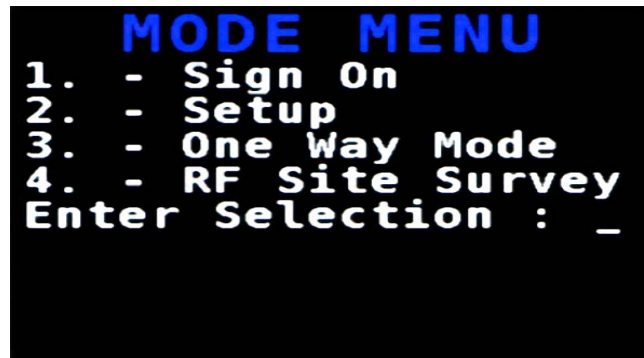
Upon power-up, the RF Terminal displays the following opening screen:

```
RF TERMINAL LT7001
FIRMWARE: Uxxx – HWyy-Rzz
USA CHANNEL: 0 TERM ID: 0
HIT ANY KEY TO CONTINUE
```

*(The opening screen can be bypassed upon power up. See **Chapter 2**)*

- On second line on the screen, FIRMWARE: Uxxx, gives the firmware revision number. The letter U indicates USA frequency. Rzz refers to the version of the radio processor firmware.
- HWyy indicates the version of the hardware.
- TERM ID: 0 refers to the current Terminal ID. The default setting is 0. Every Terminal must have a unique ID.
- Line 3 refers to the channel currently used by the RF Terminal. USA CHANNEL: 0 refers to a Terminal set to channel 0.

To move on to the main menu, press any key on the RF Terminal keypad. The display now reads:



```
MODE MENU
1. - Sign On
2. - Setup
3. - One Way Mode
4. - RF Site Survey
Enter Selection : _
```

- Press the 1 key to SIGN ON to a two-way communication host computer program through the Base station.
- Pressing 2 enters the Setup Mode for the RF Terminal or Base station.
- Press 3 to enter ONE-WAY mode. ONE-WAY mode allows the RF Terminal to transmit data to the host computer without prompting from the host computer program – we call this “dumb” data entry. (If you want a Terminator Character on the bar code, you will have to enter a Postamble using the Setup Menu). ONE-WAY mode is also useful for demos, as it does not require any interaction from the host computer.
- Press 4 to enter SITE TESTING. SITE TESTING is an excellent way to assess your RF communication in any area. It can help you determine the best place to locate your Base station for maximum RF performance as well as troubleshoot problems that may relate to range or interference.

You can back-out of any mode or prompt by pressing the F1 key. For example, if you select SETUP MODE but really want ONE WAY MODE, press the F1 key to take you back to the menu. The F1 key on the RF Terminal keypad works like the ESC key on the PC – it will usually get you out and back to the previous step. You can use the F1 key to exit and SIGN OUT when using a Two-Way communication program

running on the host computer.

The entire mode menu can be skipped (see **Chapter 2**; *RF System Setup*), causing the RF Terminal to automatically SIGN-ON or go to ONE-WAY mode on power up.

Installing the RF Terminal Utilities Software

The RF Terminal system ships with a CD of programs for use with the RF Terminal and Base station. You have the choice of installing the following:

Windows Demo Programs and RF DLL Programmers Library

- Demo Programs in VB, Access, and Delphi
- 16 bit and 32 bit DLLs
- VB DLL-based QL3 printer demo program

Windows 7000 RF Base Serial Configuration Utility

ActiveX Tools

- Serial Interface (includes Excel and VB demos)
- TCP/IP (includes VB/Access and Delphi demos)

Windows 7000 RF Terminal Firmware Loader Program

Windows 7000 RF Terminal Voice Prompts Manager Program

DOS/BASIC source demo programs (requires GWBasic or QBasic)

Click on the set of programs you wish to install.

To install any of the programs found on the Utilities CD, simply insert the CD into your CDROM drive. The install program should start automatically. If it does not, simply run the SETUP.EXE program found on the CD.

Running the demo programs...

The demo programs are all programs provided to help you test your RF Terminal with a two-way communication program.

Using the Windows 7000 RF Terminal Firmware Loader Utility

The 7000 RF Terminal Firmware Loader program is a Windows application that allows you to download new RF Terminal firmware from Worth Data into your RF Terminal, Base or Relay. New firmware can be obtained on CD ROM directly from Worth Data or downloaded via the Web at:

<http://www.barcodehq.com/downloads.html>

Installing the Windows 7000 RF Terminal Firmware Loader Utility

This program is for Windows 98, ME, NT, 2000, XP, and Vista:

1. Insert the CD into your CDROM drive. The "Hardware Utilities Installation" program should start automatically. If it does not, double click on the SETUP.EXE program on the CD in Windows Explorer.
2. Click on the RF Terminal button to select the type of hardware.
3. Click on the "Install RF Loader" button.
4. Follow the installation instructions on the screen.

Setup installs three programs and creates a program group for them:

- ***7000 RF Terminal Firmware Loader***
- ***7000 RF Terminal Firmware Loader Help***
- ***7000 RF Terminal Firmware Loader README***

See **Appendix D**; *Firmware Upgrades* for details on how to use the 7000 RF Terminal Firmware Loader program (Windows).

RF System Setup

The RF Terminal can be configured using the Terminal Setup Menu. Most users do not need to change anything in the setup. The most commonly changed setup parameters are the *Terminal ID* (especially if you have more than 1 terminal) and the *Channel* (if you are adding an additional Base station).

Factory Default RF Terminal Configuration

Parameter	Default Setting	Parameter	Default Setting
RF Configuration	RF Channel - 0	MSI /Plessey Code	MSI - OFF
	Terminal ID - 0		MSI with 1 mod 10 - OFF
	Security code - OFF		MSI with 2 mod 10 - OFF
	Skip opening screen - OFF		MSI with mod 11/mod 10 - OFF
	Control Keys Only - OFF		Transmit check digit - 0
	Auto Check Back - 00		Plessey - OFF
Code 3 of 9	Code 39 - ON	Codabar	Codabar - OFF
	Full ASCII - ON		CLSI format - OFF
	Accumulate Mode - ON		START STOP Char - OFF
	Transmit Start Stop - OFF	Code 128	Code 128 - ON
	MOD 43 Check Digit - OFF		UCC/EAN-128 - OFF
	Transmit MOD 43 - OFF	Databar / RSS-14	Databar / RSS-14 - OFF
	Caps lock - OFF		
	Decode Option - 0		
2 of 5 Code	Interleaved 2 of 5 - OFF	Code 93 / Code 11	Code 93 - OFF
	Check Digit - OFF		Code 93 full ASCII - ON
	Transmit Check Digit - OFF		Code 11 - OFF
	Standard 2 of 5 - OFF		Code 11 Check Trans - 0
UPC-A EAN 13 UPC-E EAN 8	2 of 5 Length - 06	RS-232 I/O Settings	Baud Rate - 9600
	UPC/EAN ALL - ON		Parity - none
	Supplements - OFF		Data bits - 8
	UPC-A NSC - ON		XON/XOFF Printer - ON
	UPC-A check digit transmitted - ON	Time & Date Settings	Date Format - USA
	EAN-13 country code transmitted - ON		Year Output - 2 digits
	EAN-13 Check - ON		Shut Down Time - 5 min
	ISBN EAN-13 mode - OFF	Speaker Options	Beep Volume - medium
	UPC-A as EAN-13 - OFF		Beep Tone - 2
	UPC-E First Char - OFF		Voice Volume - medium
	EAN-8 First Char - ON		Keypad Tone - ON
	UPC-E Check Digit - OFF	Laser Options	Double Decode - OFF
	EAN-8 Check Digit - ON		4.5 Second Beam - OFF
	UPC-E Expanded Transmission - OFF		Aiming Dot Duration - 0 seconds
	UPC-E1 - OFF		
Other Bar Code Options	Storage Tek Label - OFF	LCD Settings	4/6 Line Legacy Mode -OFF
	LabelCode 5 - OFF		Background Color - 1 (black)
	LabelCode 4 - OFF		Text Color - 2 (blue)
	Barcode IDs - OFF		Brightness - medium
			Brightness Timeout - 5 sec

Using the Setup Menu on the RF Terminal

The RF Terminal can be setup via the Terminals' keypad by entering *Setup Mode* from the menu. Turn on the Terminal and press any key. You should see the **MODE MENU** message:

1. - Sign On
2. - Setup
3. - One Way Mode
4. - RF Site Survey

Press the **2** key. The next menu allows you to choose which item to configure:

- | | |
|---------------------------------|----------|
| RF TERMINAL SETUP | |
| RF CONFIGURATION | 1 |
| BAR CODE OPTIONS | 2 |
| RS-232 I/O SETTINGS | 3 |
| DATE & TIME SETTINGS | 4 |

SPEAKER SETTINGS	5
LASER SETTINGS	6
LCD SETTINGS	7
OTHER SETTINGS	8
SYSTEM TOOLS	9
DONE/EXIT	0

Select the option you want to set or verify or press 0 or the F1 key to exit back to the **MODE MENU**.

The groups in the keypad Setup Menu contain the following setup parameters:

Setup Group	Parameter	Setup Group	Parameter
RF Setup	RF Channel	Speaker	Beep Volume
1	Terminal ID	5	Beep Tone
	Security Code		Voice Volume
	Skip opening screens		Keypad Tone
	Control Keys Only	Laser	Double Decode
	Auto Check Back	6	4.5 Second Laserbeam
Bar Codes	Code 3 of 9		Aiming Dot Duration
2	UPC-A, EAN 13	LCD	4 Line Legacy Mode
	UPC-E, EAN 8	7	6 Line Legacy Mode
	Code 128		Background Color
	2 of 5 Codes		Text Color
	Codabar		Brightness
	MSI/ Plessey		Brightness Timeout
	Code 93 / Code 11	Other	Preamble
	Databar / RSS / Other	8	Postamble
RS-232	Baud Rate		Characters
3	Parity		Control Keys
	Data Bits		
	XON/XOFF Printer		
Date/Time	Set Time		
4	Set Date		
	Date Format		
	Year Output		
	Shut Down Time		

Once you have selected a group to edit, you will see each parameter displayed in the order listed above. Use the next section of this chapter as a reference for all RF Terminal Setup Parameters.

RF Configuration

Default settings are shown in **bold** type.

The RF Terminal will typically require no setup changes except, Terminal ID (if more than one terminal) and enabling bar codes to be read other than UPC or Code 39.

RF Terminal ID

Default ID	0
Available IDs	0-9, A-Z, a-z, - =

- Every terminal needs a unique **Terminal ID**. The default **Terminal ID** is always shipped as **0**. If you have more than one RF Terminal assigned to a Base Station, you must be sure that each RF Terminal has a unique **Terminal ID**, (otherwise you will have big troubles including false error messages). The **Terminal ID** is always displayed on the Start Up screen when you power up the terminal. There are 64 **Terminal IDs** available - **0-9, A-Z, a-z**, and the special characters "-" and "=". To change the **Terminal**

ID, select option 2 on the keypad after which a box will appear where you can enter the desired **Terminal ID**. Enter one character for the **Terminal ID**.

RF Terminal Channel

Default Channel

0

- The terminal's radio operates by "frequency hopping" spread spectrum. The radios hop from one frequency to another using a pseudo-random sequence. The radio goes through 26 different frequencies and then repeats the sequence – all in the 902-928 MHz band at 250 milliwatts of power. Different sequences define the channels. It is possible to have more than one RF Network in the same area, providing each RF Network is on separate channels to avoid interference and general confusion.
- The default Channel is always shipped as 0. There are 6 channels in the USA. The Channel can be set by pressing the 1 key when in the RF Configuration menu. Each time you press the 1 key the Channel will increment through the 6 possible channels.

All Terminals, Base Stations and Relays in the RF Network must be set to the same channel. The channel is always displayed on the Start Up screen when you power up the Terminal. It is possible to have more than one RF Network in the same area, providing each RF Network is on separate channels to avoid interference and general confusion.

Security Code

Security Code

OFF

Available security codes

3 characters

- A Security Code can be utilized to minimize the possibility of a Base Station listening to data from a Terminal that is talking to a different Base Station. A Security Code can also prevent interference from having many Base Station/RF Terminal configurations in one area; i.e. a merchandise mart with multiple vendors all running RF Terminal networks.
- A Security Code consists of 3 characters - any combination of ASCII 33 - ASCII 126. This allows for the possibility of more than 830,000 different character combinations. The characters are entered using the bar coded FULL ASCII MENU provided in Appendix O; ASCII Code Equivalent Table.
- Once you press 3 to enable the Security Code, you will see 3 boxes appear where you can enter the desired security code. Pressing the CLEAR key will reset the Security Code to the default value which is OFF. You can enter any key on the keypad. If you press the shift key the cursor will turn RED and you can enter any of the shifted values on the keypad.
- You must also enter a matching security code into the the Base using the Hardware Utilities program.

To enter characters that are not on the keypad, use the FULL ASCII MENU provided in **Appendix O**.

Skip Opening Screens

OFF

Go to Two-Way (TWO WAY)

Go to One-Way (ONE WAY)

Many users want to skip the opening screens and go directly to TWO WAY or ONE WAY communication once their programs are fully operational. Selecting **TWO WAY** or **ONE WAY** will automatically take the operator to the corresponding mode and into your application, skipping the usual Mode Menu. If you want to return to the Mode Menu at any time, simply press the F1 key.

Control Keys Only

Control Keys Only

Off

Control Keys Only

On

- Several special keys on the RF Terminal keypad can generate a response automatically, sending a separate message to the host by simply pressing the appropriate control key (without pressing the ENTER key afterward). This allows for simple and fast scrolling by the operator. The arrow keys, Begin, End, and Search are the specific keys supported. The default setting is to require the ENTER key to be pressed before data transmission.
- If you set this feature to ON, in order for the RF Terminal to transmit the following values, the corresponding Control Key must be the first key pressed in a data entry sequence. If it is not the first data entered, the arrow key is ignored.

Control Key on RF Terminal	Code transmitted to Host
Up Arrow	FS (ASCII 28)
Down Arrow	GS (ASCII 29)
Left Arrow	RS (ASCII 30)
Right Arrow	US (ASCII 31)
Begin	ETB (ASCII 23)
End	CAN (ASCII 24)
Search	VT (ASCII 11)

The message is sent to the host as:

Bytes	Function	Value
1	RF Terminal ID	0-9, A-Z, a-z, - =
2	Data Transmitted	ASCII Value from Table Above
Last	Terminator of Message	CR

Automatic Check Back

This parameter should not be changed under normal circumstances. After the host sends a prompt, the Terminal goes to sleep waiting on the operator to key or scan input in response to the prompt. It waits until the *Automatic Shut Off* time or until the operator responds. This parameter sets the time that the Terminal stops waiting on input from the operator, discards the current prompt, and goes back to the host to see if there is a change in instructions. If no change, the host must resend the prompt again because the Terminal has discarded the original prompt. The host now has the opportunity to change a prompt. The time can be set in increments of 5 seconds, up to 495 seconds. The default value is 00. The values possible for entry are 00-99. An entered 99 gives 99x5 seconds, or 495 seconds between check backs. The Terminal sends back an *ASCII 07* for the data back to the host (ID ASCII 07 CR). To change this value press the **6** key in the **RF Configuration** menu and enter the 2 digit value desired.

Bar Code Options

Code 3 of 9 (Code 39)

Code 3 of 9	ON	OFF	1
Full ASCII	ON	OFF	2
Accumulate Mode	ON	OFF	3
Transmit Start Stop	ON	OFF	4
MOD 43 Check Digit	ON	OFF	5
Transmit MOD 43	ON	OFF	6
Caps Lock	ON	OFF	7
Decode Option	0, 1, 2		8

- The Start and Stop character for Code 39 is the * character. Setting 4 determines whether or not those

characters are transmitted to the computer along with the data. For example, at setting ON, the data of 1234 would be transmitted as *1234*. Transmitting the start and stop characters can be useful if you need to differentiate between data that comes from a bar code versus data coming from the keypad.

- Enabling use of the Mod 43 check character requires that the last character of your bar code conform to the Mod 43 check character specifications. See Appendix E; Code 39 for more information. Enable transmission (6) will send the check digit data along with the rest of the bar code data to your computer. To use 6, you must also be using 5.
- Caps Lock ON causes lower case letters read as data to be transmitted to the computer as UPPER CASE, and upper case letters to be transmitted as LOWER CASE. Numbers, punctuation and control characters are not affected. Caps Lock OFF means that letters will be transmitted exactly as read. This setting applies to all bar code types.
- See Appendix E; Code 39 for more information regarding Accumulate Mode.
- Decode Option is used to allow reading of Code 39 bar codes through a windshield. Setting this option to 1 will loosen up the decoder a little and option 2 will loosen up the decoder a bit more. This should be used with caution since using a looser decoder can cause substitutions.

UPC-A / EAN-13 Options

UPC/EAN ALL	ON	OFF	1
UPC/EAN Supplements	ON	OFF	2
UPC-A NSC	ON	OFF	3
UPC-A Check	ON	OFF	4
EAN-13 First 2 Digits	ON	OFF	5
EAN-13 Check	ON	OFF	6
ISBN EAN-13 Mode	ON	OFF	7
UPC-A as EAN-13	ON	OFF	8

- Use setting 2 to enable reading of the 2 and 5 digit UPC/EAN supplements commonly found on magazines and paperback books as well as the Extended Coupon Codes. Using this setting force left to right reading of UPC codes to assure that the supplement code is not missed.
- Use setting 3 to enable transmission of the NSC character to your computer. The Number System Character is the leading character in the bar code. For details, see Appendix J, UPC/EAN.
- Use setting 4 to enable transmission of the check digit character to your computer. The check digit is the last character and is based upon a calculation performed on the other characters.
- Use setting 5 to enable the transmission of the EAN-13 country code (the first 2 digits).
- Use setting 6 to enable the transmission of the EAN-13 check digit.
- ISBN (International Standard Book Numbering) bar codes are EAN-13 with a 5-digit supplement. If the “Bookland” bar code uses 978 (books) or 977 (periodicals) as the first three digits, then the RF Terminal can transmit it in the ISBN format. To enable transmission of the ISBN format, set option 7 to ON. To return to the default of normal EAN-13 transmission, set option 7 to OFF. For details on ISBN, see Appendix J, UPC/EAN.
- UPC-A can be transmitted in EAN-13 format by adding a leading 0 (USA county code) to the UPC-A data. To transmit in EAN-13 format, set option 8 to ON.

UPC-E / EAN-8 Options

UPC-E First Digit	ON	OFF	1
EAN-8 First Digit	ON	OFF	2
UPC-E Check Digit	ON	OFF	3
EAN-8 Check Digit	ON	OFF	4
UPC-E Expanded	ON	OFF	5
UPC-E1	ON	OFF	6

- Use setting 1 and 2 to enable or disable the UPC-E or EAN-8 first digit.
- Use setting 3 and 4 to enable or disable the UPC-E or EAN-8 check digit. The check digit is the last character and is based upon a calculation performed on the other characters.
- Use setting 5 to select UPC-E0 compressed or expanded. When set to ON (the default setting) UPC-E1 codes are transmitted as is, when set to OFF UPC-E1 codes are transmitted with inserted zeros to make them the same length as a UPC-A bar code. An NSC of 0 is assumed.
- Use setting 6 to enable the reading of UPC-E1 bar codes. Do not enable UPC-E1 if you plan on reading EAN-13 bar codes. You may experience partial reads when reading EAN-13.
- If you prefer to transmit UPC-E bar codes in a 6-digit format while EAN-8 is transmitted in its original 8-digit format, set option 7 to ON.

Code 128

Code 128	ON	OFF	1
UCC/EAN 128	ON	OFF	2

- UCC/EAN-128 is a subset of Code 128 that follows certain specifications regarding character content, length and check digits. Enabling UCC/EAN-128 (2) causes the RF Terminal to look for a Code 128 bar code that begins with the Code 128 F1 (Function 1) character. See **Appendix H: Code 128** for more details.

Codabar

Codabar	ON	OFF	1
Codabar CLSI	ON	OFF	2
Start Stop Character	ON	OFF	3

- CLSI is a form of Codabar often used by libraries.
- Setting 3 will transmit the Codabar *start* and *stop* characters with the bar code data to your computer. If you are varying the start and stop characters to differentiate between different labels, transmitting the start and stop can be helpful. See **Appendix G; Codabar** for more information.

2 of 5 Code

Interleaved 2 of 5	ON	OFF	1
Check Digit	ON	OFF	2
Transmit Check Digit	ON	OFF	3
Standard 2 of 5	ON	OFF	4
2 of 5 Code Length		06	5

- Setting 2 requires that the last digit in your bar code conform to the specifications for the 2 of 5 check digit calculation. See **Appendix I; 2 of 5 Code** for more information.
- Transmission of the check digit (3) requires the use of setting 2 and will transmit the check digit along with the bar code data to the computer.

- 2 of 5 is so susceptible to misreads that the RF Terminal adds an additional safeguard - it can be configured to look for fixed-length data only.
- The default setting of **06** causes the RF Terminal to read **only** 2 of 5 codes that are 6 digits in length. To set the RF Terminal to read a different length, enter any two-digit number. 2 of 5 code must always be an even number of digits so the length setting must always be an even number.
- Reading variable length I 2of5 or 2 of 5 codes is to be avoided if at all possible. The **00** setting is supplied for the purposes of reading codes of unknown length, counting the digits and setting the length to the proper number.

MSI and Plessey

MSI/Plessey	ON	OFF	1
MSI/Plessey-Single Mod 10 Check Digit	ON	OFF	1
MSI/Plessey-Double Mod 10 Check Digit	ON	OFF	1
MSI/Plessey-Single Mod 11/Single Mod 10 Check	ON	OFF	1
Enable Plessey / Disable MSI	ON	OFF	1
Transmit Check Digits	0, 1 or 2		2

- The MSI/Plessey options are selected by pressing the **1** key to select the desired mode of operation.
- If you have enabled the Mod 10 or Mod 11 check digits, they will be transmitted along with your bar code data from the RF Terminal to your host.
- For more information regarding MSI or Plessey Code, see **Appendix K**; *MSI Plessey Code*.

Code 93 / Code 11

Code 93	ON	OFF	1
Code 93 Full ASCII	ON	OFF	2
Code 11	ON	OFF	3
Code 11 Check Digit Transmission	0, 1 or 2		4

- Code 93 is similar in character set to Code 39. See **Appendix F**; *Code 93* for more information. Code 93 is not a commonly used bar code symbology.

DataBar / RSS-14 Options

DataBar / RSS-14	ON	OFF	1
DataBar / RSS-14 plus Identifiers	ON	OFF	1
DataBar / RSS-14 plus UCC-128 Format	ON	OFF	1

By default, DataBar / RSS-14 is disabled. Press the **1** key to toggle through the DataBar / RSS-14 options listed above. We support the standard and stacked version of DataBar / RSS-14.

For more information on GS1 DataBar, see the GS1.org website at

<http://www.gs1.org/productssolutions/barcodes/databar/>

Other Bar Code Options

Storage Tek Label	ON	OFF	2
LabelCode 5	ON	OFF	3
LabelCode 4	ON	OFF	4
Bar Code IDs	ON	OFF	5

The Storage Tek Tape Label code is a proprietary variation of Code 39 code used for the storage of computer data tapes. Enabling the tape label code does not disable reading of Code 128 or Code 39 bar codes.

LabelCode 5 and LabelCode 4 are proprietary bar code types used by Follet.

Bar Code ID's are characters assigned to each bar code type to identify that particular type of code. These Bar Code IDs can output as prefix to the bar code data to identify what type of bar code you are using. The Bar Code ID's are assigned as follows:

Bar Code	ID	Bar Code	ID	Bar Code	ID	Bar Code	ID
Codabar	a	2 of 5	f	UPC-E (1)	o	LabelCode 4	y
Code 39	b	Code 128	g	EAN-8	p	LabelCode 5	z
UPC-A	c	Code 93	i	RSS-14	r		
EAN-13	d	MSI	j	StorageTek	s		
I 2of 5	e	UPC-E(0)	n	Plessey	x		

The ID character is transmitted in front of the bar code data.

External Communications Settings

RS-232 Settings:

Baud Rate

Use the **1** key to select the baud rate. The default value is **9600**. The available baud rates are 2400, 4800, **9600**, 19200, 38400, 57600 and 115200.

Parity

- Use the **2** key to select the parity.
- The options are **None**, Even or Odd.
- **None** is generally used with 8 data bits
- Even or Odd parity is generally used with 7 data bits.

Data Bits

- Use the **3** key to select either **8** or 7 data bits.

XON / XOFF Printer

- Setting **4** pertains to use of a *serial Printer* with your RF Terminal. Use key **4** to enable **XON / XOFF** if your *serial Printer* supports it. It DOES NOT apply to the Cameo and QL3 Printers.
- Settings **E** and **F** pertain to the way the RF Terminal handles illegal statements coming from the host computer. RF Terminal software versions *prior* to 9.059 did not handle illegal statements the same way as current versions. ***This setting is really only applicable if you had written your host program to be compatible with RF Terminal versions prior to RFT9059.***

Bluetooth Settings:

Note: The Bluetooth option became available on the LT7002 with hardware revision 7. The Bluetooth Settings option only appears on the LT7002 model.

The Bluetooth Settings menu has 4 options that allow the LT7002 to pair with other Bluetooth devices. Currently only the Serial Port Profile (SPP) is supported. This is the most common profile for serial cable replacement and is typically used for Bluetooth enabled printers.

Bluetooth Interface (On/Off)

This setting controls the power to the Bluetooth module and also sets the operation of the “S” command. The Bluetooth interface is Off by default and must be set to On to use the Bluetooth module. The “S” command will send data to the RS-232 port when the Bluetooth Interface is set to **Off**. The “S” command will send data to the Bluetooth module when the Bluetooth Interface is set to On.

Add New Devices

Use this command to add a new Bluetooth device. The LT7002 can have up to 5 “known” devices at one time and paired with 1 device at a time. The “**Add New Devices**” screen shows up to 5 devices that have been added at the top of the screen and the names of up to 5 “found” Bluetooth devices at the bottom of the screen. When the “**Add New Devices**” option is selected the LT7002 will scan for active Bluetooth devices. You must make your Bluetooth device “discoverable” before the option is selected for the device to be found. Consult the manual for your Bluetooth device to find out how to make it “discoverable”. You can select any of the “found” devices to add to the list of known Bluetooth devices. If the LT7002 is currently paired with a previously found Bluetooth device then (**PAIRED**) will appear next to the name of that device. The LT7002 can only pair with one device at a time. You must pair the LT7002 with a Bluetooth device before you can send data to that device.

Delete/View Devices

This command is used to see what Bluetooth devices are “known” by the LT7002 and delete them from the list of known devices. If one of the devices is paired with the LT7002 then (**PAIRED**) will appear next to that device. This is a quick way to see what device, if any, is currently paired with the LT7002.

Pair with Existing Device

Use this command to pair the LT7002 with a Bluetooth device that has been found using the “**Add New Device**” command. You must add the device before you can pair with the device. A list of previously “found” devices will be displayed and the currently paired device, if any, will be indicated with (**PAIRED**). Select the device that you would like to pair with or press 0 to exit and make no change.

The LT7002 will attempt to pair with the Bluetooth device when the S-command is sent so make sure that your Bluetooth device is powered up and ready at that time.

Date & Time Setting

Set Time

The time is set using a 4-digit military **hhmm** format. For example, to set the time to 3:08 p.m., you would enter **1508**. To display the time during operation, press the STATUS key.

Set Date

For correct date display, the 6-digit date must be set in the date format you plan to use. By default the US terminals use the US date format of **dd/mm/yy**. If you change the date format, you must re-set the date to match the new format. For example, to set a date of January 20, 2009, you would enter 012009 (US format) or 200109 (European format). To display the date during operation, press the STATUS key.

Date Format

US Format	0
European Format	1

- The US format of **mm/dd/yy** is the default setting.
- If you switch formats, you must reset the date (SET DATE) in the new format also.

Year Output

2 digit	0
4 digit	1

- By default, the RF Terminal is configured to display and transmit the year in a **2-digit format**; i.e. 2009 would transmit and display as **09**.
- *Before* you change the RF Terminal to display a 4-digit year, i.e. **2009**, make sure that the software receiving data from the RF Terminal is set up to accept a 4-digit year.

Shut Down Time

By default, if the RF Terminal is inactive (no keystrokes or scanning) for more than 5 minutes, it will shut itself down in order to conserve batteries. This includes SIGNING OFF if appropriate. To resume operation, you must turn the RF Terminal back on using the ON/OFF key. To change the amount of time the RF Terminal waits before shutting down enter two digits - the default is 05 (5 minutes)- to correspond to the length of time in minutes. For example, 01 would be 1 minute. ***Setting the Shut Down Time to 00 will disable automatic shutdown.***

Speaker Settings

Speaker Options

Beep Volume

OFF	1
Low	1
Medium	1
High	1

The default volume of the “Beep” is Medium. Each time you press the “1” key you will hear a beep at the different volume settings. When you are happy with the loudness of the beep tone, press 0

or F1 to exit.

Beep Tone

1 - Lowest	2
2 - Low	2
3 - Medium	2
4 - High	2
5 - Highest	2

The default beep tone is **3 – Medium**. Each time you press the “**2**” key you will hear a beep at various tones. When you are happy with the tone of the beep, press 0 or F1 to exit.

Voice Volume

OFF	3
Low	3
Medium	3
High	3

The default volume of the “Voice” is **Medium**. Unless you need very loud voice prompts you should use the medium setting to conserve battery power. When you are happy with the loudness of the beep tone, press 0 or F1 to exit.

Keypad Tone

Keypad Tone	ON	OFF	4
-------------	----	-----	---

The “**Keypad Tone**” is the key click that you hear each time a key is pressed. Press the “**4**” key to toggle this On and Off.

Laser Options

Double Decode

Double Decode	ON	OFF	1
---------------	----	-----	---

- **Double Decode** is there to minimize the possibility of misreads when scanning very poor quality bar codes. This option forces the RF Terminal to keep reading until it gets two results that are identical. This "double scan checking" takes longer but will minimize misreads since it must get the same result twice before considering it a "good" read.

4.5 Second Laser Beam

4.5 Second Laser Beam	ON	OFF	2
-----------------------	----	-----	---

- **4.5-second laser beam** increases the amount of time the laser beam is activated, giving the laser more time to try and read a code. This option is useful for trying to read poor quality code. The default beam time is 2 seconds.

Aiming Dot Duration

Aiming Dot Duration (in 1/10 seconds)	00 – 99	3
---------------------------------------	---------	---

- This parameter applies to the built-in internal laser. Before the laser beam spreads, you can create a brighter aiming dot to be sure you are on the bar code you want to read. The default is set to 00, no aiming dot. You can key in 01 through 99 which creates an aiming dot in 1/10th second increments; i.e., 20 would be two seconds.
- This option is only available on the LT7001.

Filter Mode

• Filter Mode • 0 – 3 4

- This option is only available on the LT7011.
- If you are trying to read poorly printed bar codes, this setting may improve the performance of the decoder.
- Mode 0 is the default setting and works best with good quality bar codes.
- Mode 1 might help when reading codes printed with uneven levels of dark and light areas.
- Mode 2 might help when reading codes with poor print contrast (like a dark or colored background).
- Mode 3 might help when reading codes with holes or voids such as damaged or dot-matrix printed codes.
- When selecting mode 1 or 3 it would be a good idea to set double decode to ON to avoid errors.

LCD Options

4 / 6 Line Legacy Mode

6 Line Legacy Mode	OFF	1
4 Line Legacy Mode	OFF	1

The LT7001 is backward compatible with the LT701 6-Line and 4-Line display modes. This will enable you to use the LT7001 without making any changes to your software that you use with your LT701. This is host software compatibility only and the LT7001 will not communicate with the B551 Base Station.

Background Color

Background Color	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F	2
------------------	--	---

The default background color can be set to one of 16 different values. Each time you press the “2” key a small rectangle will show the selected background color with the current text color. The default value is 1 for Black. You can find more information about colors in chapter X.

Text Color

Text Color	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F	3
------------	--	---

The default text color can be set to one of 16 different values. Each time you press the “3” key a small rectangle will show the selected text color with the current background color. The default value is 2 for Blue. You can find more information about colors in chapter X.

Brightness

Brightness	LOW, MED, HIGH
------------	----------------

The default brightness of the LCD is medium which works well for indoor use. In high ambient light areas, like outdoors, you may want to increase the brightness of the display. Increasing brightness shortens battery life.

Brightness Timeout

Brightness Timeout (in seconds)	00..05..99
---------------------------------	------------

This setting controls the timeout for the display to dim after a key is pressed or data is displayed on the LCD. The dim setting is the same as the LOW brightness setting so if you have the brightness above set to LOW you will not see any effect from the timeout. Dimming the display helps extend battery life. The default is 05 for 5 seconds. A setting of 00 will disable the timeout and keep the display always at the standard brightness level.

Other Settings

Preamble

Preambles are user-defined data that is attached to the beginning of data (bar code or keyed) that is transmitted to the host by the RF Terminal. For example, if you set a preamble of @@ and scanned bar code data of 12345, @@12345 would be transmitted to the host.

By default, the RF Terminal has no preambles configured. Preambles can contain up to 15 characters entered from the keypad or scanned from the bar coded FULL ASCII Menu. **To set a preamble:**

- 1. Select option “8” from the **RF Terminal** Setup menu then “1” for **Preamble** from the **Other Settings** menu.
- 2. Enter the desired characters (up to 15). Pressing the shift key will turn the cursor red to indicate that the shift is active. Pressing shift again will turn the cursor white and return to unshifted mode.
- 3. Press “ENTER”.when you are finished entering data.
- 4. To clear the **Preamble** and return to the default (no Preamble defined), press “CLEAR”.

You can use the **Preamble** to trim characters from the data you are entering into the RF Terminal. You can trim from 1-15 characters from the data by creating a preamble of:

~x

where ~ is ASCII 126 and x is a single hex digit 1-F (corresponding to 1-15). Data that is shorter than the trim amount is transmitted without trimming. **Preambles** trim characters from the front of the data. Here are some examples:

Data	Preamble	Data Transmitted
123	XYZ	XYZ123
12345678	~3XYZ	XYZ45678
12345678	~9	12345678
12345678901	~A	1
123456	~5	6

Preamble trims leading characters

Using the Bar Code ID feature and the **Preamble**, you can trim data selectively, trimming characters only on the bar code type specified. To use selective trimming, enter:

~bx

where b is the Bar Code ID character (see the *Code 128 setup parameter*) and x is the number of characters to trim from the front of the data. For example, ~b2~c1 says “trim 2 characters from Code 39 data and 1 character from UPC-A data”. Remember that the **Preamble** trims leading data. This applies to One-Way and host prompted communication.

Lastly, the **Preamble** can be used to check a minimum/maximum data length for bar code data entered. To check for bar code length in the **Preamble** enter:

|nnmm

where | is ASCII 124, nm is the two-digit minimum and mm is the two-digit maximum. |0210 would check for a minimum of 2 characters and a maximum of 10. If you try to scan a bar code outside the minimum or maximum lengths, no decode will result. Entering data by keypad is not affected.

Postamble

Postambles are user-defined data that is attached to the end of data (bar code or keyed) that is transmitted to the host by the RF Terminal. For example, if you set a Postamble of **@@** and scanned bar code data of **12345**, **12345@@** would be transmitted to the host.

- By default, the RF Terminal has no Postambles configured. Postambles can contain up to 15 characters. **To set a Postamble:**

- 1** Select option “**8**” from the **RF Terminal Setup** menu then “**2**” for **Postamble** from the **Other Settings** menu.
- 2** Enter the desired characters (up to 15). Pressing the shift key will turn the cursor red to indicate that the shift is active. Pressing shift again will turn the cursor white and return to unshifted mode..
- 3** Press “ENTER”.when you are finished entering data.

- To clear the **Postamble** and return to the default (no Postamble defined), press “**CLEAR**”.
- You can use the **Postamble** to trim characters from the data you are entering into the RF Terminal. You can trim from 1-15 characters from the data by creating a Postamble of:

~*x*

where ~ is ASCII 126 and *x* is a single hex digit 1-F (corresponding to 1-15). Data that is shorter than the trim amount is transmitted without trimming. Postambles trim characters from the end of the data. Here are some examples:

Data	Postamble	Data Transmitted
123	XYZ	123XYZ
12345678	~3XYZ	12345XYZ
12345678	~9	12345678
12345678901	~A	1
123456	~5	1

Postamble trims trailing characters

- Using the Bar Code ID feature and the **Postamble**, you can trim data selectively, trimming characters only on the bar code type specified. To use selective trimming, enter:

~*bx*

where *b* is the *Bar Code ID character* (see the *Code 128 setup parameter*) and *x* is the number of characters to trim from the end of the data. For example, ~**b2~c1** says “trim 2 characters from Code 39 data and 1 character from UPC-A data”. Remember that the **Postamble** trims trailing data.

- Lastly, the **Postamble** can be used to check a maximum character length for data entered. To check for length in the **Postamble**, enter:

|*nnmm*

where | is ASCII 124, *nn* is the two-digit minimum and *mm* is the two-digit maximum. |0210 would check for a minimum of 2 characters and a maximum of 10. If you try to scan a bar code outside the minimum or maximum lengths, no decode will result. Entering data by keypad is not affected.

Characters

This setting allows the RF Terminal to output chosen ASCII characters in place of the actual characters entered. For example, if you scanned the number **1** (*hex 31*) and wanted the RF Terminal to output *hex 92* instead, you would enter **3192** for the **Characters** parameter. This would re-assign the output characters, with the RF Terminal outputting *hex 92* every time it sees *hex 31*. To re-assign characters:

- Select option “**8**” from the **RF Terminal Setup** menu then “**3**” to enable character entry. A square cursor will appear.
- Enter up to seven 4-digit pairings where the first 2 digits represent the hex number to *replace* and the second 2 digits represent the hex number to *insert*. You can have up to seven character reassignments.
- Press “**Enter**” when done or “**Clear**” to reset to none.

You can eliminate the output of a character by using **FF** as the hex number to insert. For example, if you wanted to eliminate all \$, following the above instructions, enter **24FF**.

Data Encryption

Beginning with firmware version R7U301 and B5U301 data encryption is available. Both the Base and the Terminal must have xxx301 or later firmware and have matching “KEYS” to communicate. The default is no encryption so any Terminal can talk to any Base. Relays are not affected and do not need to be running firmware xxx301 or later.

The Encryption Key on the Terminal is set in the **OTHER SETTINGS** menu. Select option 4 to enter the KEY. The key can be any 8-digit hex value. Valid characters are 0-9 and A-F. Use the shift key to enter the alpha characters. 00000000 and FFFFFFFF are invalid keys. Setting the Encryption Key to either 00000000 or FFFFFFFF will disable data encryption. For more robust encryption, avoid using 0 and F. A Terminal with Data Encryption set will display an “E” after the 7001 on the opening screen.

The Encryption Key on the Base is set using the Worth Data Hardware Utilities program that is included on the CD that came with the Base or can be downloaded from the Worth Data website. Start by connecting the Base to a PC then run the Hardware Utilities on the PC that is connected to the Base. From the menu on the left select “7000 Series Terminal” then “Base Configuration”. If you know the COM port that the Base is connected to, enter it in box 2 then click the button to connect to the Base. When the Base is found it's configuration is displayed. Check the box to enable Data Encryption and enter the same 8-digit value that was entered on the Terminal. Once the value is stored into the Base, cycle power on the Base to restart it using Data Encryption. The LED will blink RED to indicate that the Base has Data Encryption enabled.

If a Terminal attempts to Sign On to a Base with a non-matching Key the Terminal will display the error: “Invalid Command”.

Site Test is not effected by Data Encryption and should always work if a Terminal and Base are within range of each other.

System Tools

Download File

This will allow you to update the terminal's voice prompts when using the 7000 RF Terminal Voice Prompts Manager program.

Play Voice Prompt

To play a voice prompt, select option “**2**” then enter the 2-digit number of the voice prompt that you wish to play. The valid range is 01 to 99.

Reset to Factory Default

Select option “**3**” to reset all setup values to the factory default values. This will reset all values in all menus of the **RF TERMINAL SETUP**.

Base and Relay Setup

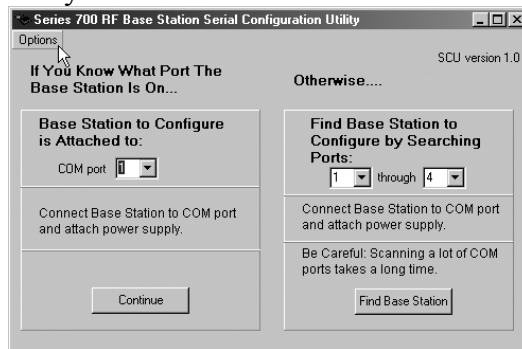
The Base and Relay Setup is only accessible via the RF 7000 Configuration Utility included on the Utilities CD that came with your RF Terminal. You can also download the utility from our website at:

<http://www.barcodehq.com/utilities/rfbasecfg7k.exe>

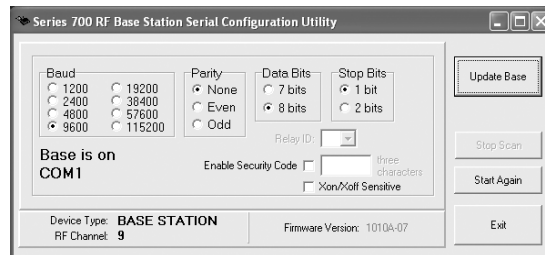
Using the RF 7000 Configuration Utility

After you install the Configuration Utility from the CD or from the web, make sure your Base Station or Relay is attached to one of the computer COM ports using the 9 pin serial cable (F36) cable included with your system and that the power supply (5v from Worth Data ONLY) is plugged in. A Base Station will light the LED Green, while a Base jumpered as a Relay will light a the LED Yellow, so be sure your unit is jumpered properly.

Start the RF 7000 Configuration Utility.



If you know which COM port you are attached to, select that port in the program, then click "**Continue**". If you are unsure of the COM port number, the program can find it for you. Enter the range of COM ports to search, then click "**Find Base Station**".



The program will look for the Base or Relay and determine its current configuration. Once the program finds it, it will display the Device Type (BASE or RELAY), the RF Channel (default is 01) and the Firmware Version (xxxxx-pp). The first five characters are for the main processor's firmware, which can be updated by you from the latest firmware always available on our website. The last two last two characters are the firmware version of the radio processor; this is not field updateable. If these two characters don't show, (you see only xxxxx), it means your radio processor is not responding and you need to call us to authorize a repair.

If you want to change any of the settings (**Baud**, **Parity**, **Data Bits** and **Stop Bits**), you can do so by clicking the desired setting.

If you are configuring a Relay, the first Relay should be configured as **Relay ID "0"**, which is the default. If you have more than one Relay, then select the desired Relay ID for this unit.

You can enable a **Security Code** for either a Base or a Relay. The Security Code needs to be three characters and when enabled, requires anyone wanting to make a change to the Base or Relay to enter this 3-character code.

"**Xon/Xoff Sensitive**" should be checked ONLY if your system has XON/XOFF specified for handshaking on the serial port in use. Typically in Windows, handshaking will be set to "None" and you should leave this setting unchecked. See "*Addressing a Terminal not Signed In*" and "*Base Station Initialized Message*" in **Chapter 6** for details.

Once you have made any and all changes, click on the "**Send Settings**" button. Your Base or Relay is now configured!

Testing the RF link between base station and host

Use the following command to test the transmission of data from host to Base and back again to the host:

@ @*Edataaaaaaaaa<EOT>

where *dataaaaaaaaa* is any string of data, terminated by EOT. This string should be sent from the host to the Base Station. If the data is received by the Base, it is echoed back to the host in the format:

dataaaaaaaaa<CR>

where *dataaaaaaaaa* is the data string from the original transmission, terminated by a CR (ASCII 13). This test verifies communication in both directions (host to Base, Base to host).

- If the data isn't echoed back, either your host COM port or the Base Station has a problem.
- Once you know the Base Station is communicating with the host correctly, compare the channel of the Base Station with the channel of the Terminal. Use Site Testing to check the communication of the Terminal to the Base and back. Stay close, make sure no other Terminals are in use, and go to Site Test mode on the Terminal. You should get 90-100% on first try. If you don't, it's a good chance your radios need repair. Call Worth Data for an RMA.

If you are using PICK or UNIX as your operating system, make sure the Base Station is set to "XON/XOFF Sensitive".

Operational Theory

Before you jump in and start writing a complex host program, it might be nice to be familiar with the theory behind the operation of your RF Terminal. The RF Terminal has three different modes of communication:

- **Two-Way Mode** - the host program transmits requests for data to the terminal via the Base Station. The RF Terminal transmits a response back to the Base Station, which in turn sends the data on to the host program. This is a truly interactive mode allowing you to create flexible programs for a variety of applications that are computer led and controlled.
- **One-Way Mode** - the RF Terminal transmits to the host with only confirmation from the Base Station. The host program receives data from the Base Station as it would any other serial device. The host cannot send data to the terminal; it can only receive information.
- **Site Survey Mode** – the Base Station and RF Terminal work together to evaluate the site and determine the best

location for the Base Station. The site survey evaluates the signal strength of a number of test packets that are exchanged between the Base and Terminal. The higher the number, the more successful your communications will be from that area. This helps you to identify problem areas before you implement your RF Terminal system. At 30 ft., this is also the acid test for suspected bad radios in a base or in a terminal.

Let's start with a discussion of the basic theory behind a **Two-Way** RF Terminal system.

How the Two-Way RF System works

Basic RF System communications...

The RF system consists of three components – *Host Computer*, *Base Station* and *RF Terminal*. The *Base Station* connects to the *Host Computer* via the serial port. The application running on the *Host Computer* sends a data prompt to the com port where the Base Station receives it. The *Base Station* then transmits the data prompt via radio frequency to the intended *RF Terminal*. The *RF Terminal* displays the data prompt on the display and waits for the operator to enter the requested data. Once the operator enters his data, the *RF Terminal* transmits the data to the *Base Station*, which in turn passes it on to the *Host Computer*. The application on the host computer processes the information and sends a new data prompt out to the *Base Station* and the whole process begins again.

A little more in depth...

This RF system's dialogue is Terminal initiated. The Terminal says, "I'm here, give me something to do. The Worth Data RF system is different from other systems in that our RF Terminal does not constantly "listen" for a data prompt from the host. We decided to use a different approach that would help to eliminate unnecessary radio traffic, conserve battery power, reduce the size of the Terminal, and greatly simplify the operation.

Here is how it works:

Each RF Terminal has a unique **Terminal ID**. When the RF Terminal powers up, it asks if you want to **SIGN ON?** Pressing YES at the **SIGN ON?** prompt causes the RF Terminal to transmit its *Terminal ID* and a byte of data indicating to the Base Station that it wants to sign on to the system.

When you press YES to the **SIGN ON** prompt on the RF Terminal, the Terminal will display the following message:

WAITING ON BASE TO ACKNOWLEDGE

This message is normal when first establishing communication and may occur occasionally during normal operation.

When the Base Station receives a **SIGN ON** message from a RF Terminal, the Base Station transmits the SIGN ON information to the host computer. The host computer application can then do one of two things:

- If it has something for the Terminal to do, it can send a prompt to the Base, which in turn transmits it to the Terminal. The RF Terminal receives the prompt, waits for the operator to enter the requested data, and then transmits the data back to the Base Station.
- If the host program does nothing within an allotted time, the Terminal displays the message:

WAITING ON HOST PROMPT

Lets suppose that a RF Terminal and a Base Station have been processing data by sending prompts and data

back and forth as described in example 1. The Base Station sends a data prompt to the RF Terminal, the RF Terminal transmits the operator-entered data back to the Base Station. If the host program has another prompt for the terminal, the Base sends it out, repeating the process above.

Suppose the host program does *not* have a prompt ready to send back to the Terminal; the Terminal transmits its data to the Base Station but does not receive a new data prompt. The Terminal then retransmits its data (it thinks maybe the host didn't receive it) and waits for a response.

Once the terminal has received a prompt back from the host, the time it took the host to respond is sent to the Terminal. For all subsequent transmissions, the terminal goes to sleep until the time it took the last time for the host to respond has expired; then the terminal wakes up and listens. If it has nothing, it retransmits its data and waits for a response.

The original data transmission could have collided with another message, or the Base could have received the Terminal's data but had not yet received the host's prompt response. If the previous transmission got through, the Base Station knows that the data is a retransmission rather than a new data transmission so it sends a message to the Terminal telling it:

“I have nothing for you from the host, go to sleep”.

While in “sleep” mode, the Terminal “wakes” up at a random interval and asks “do you have anything for me yet”, waiting for either a “go to sleep” message or a new data prompt. After each delay, the Terminal displays:

WAITING FOR HOST PROMPT

If a Terminal receives *no* response at all from a Base Station (no data prompt or “go to sleep” message), it retransmits its data and waits for a response. If the Terminal gets no response after 10 re-transmissions, it assumes it is out of range from the Base Station with which it was communicating, and attempts to establish contact with any Base Station. If the Terminal can't contact any Base Station, it displays:

TRANSMISSION FAILED
HIT ANY KEY_

Pressing a key on the Terminal starts the re-transmission process over again. The RF Terminal will try to retransmit its data, displaying the TRANSMISSION FAILED message after every 10 unsuccessful tries.

Can I change a prompt after it has been sent?

Normally once the Terminal has received a prompt from the host, it goes to sleep and waits (as long as it takes) for the operator to scan or key something in response. The host cannot send another prompt without creating a "Sequence Error." You might want to change the prompt or locate a lost terminal with beeping.

There is a special setting in the RF Terminal Setup in which you specify the time (between 5 seconds and 7 minutes) you want the Terminal to quit waiting for input from the operator, blank the screen, send back a special control character to the host program, display "Waiting on Host Prompt" and wait for a prompt from the host application program; the host application program can choose to send back different instructions or simply repeat the previous prompt's instructions, (See *Automatic Check Back* in the **Programming Section**).

How the One-Way RF System works

The RF System can be used to perform “dumb” data entry to the computer – you could even use **PortKey** to transmit the data through a serial connected Base as though it has been entered from the keyboard. This is useful if you want to enter data directly into an application. This type of data transmission is called **One-Way Mode**. Once the RF Terminal transmits data to the Base Station, the Base Station acknowledges receipt of the

information by echoing back the data to the Terminal that sent it, along with a beep. If the data transmission *did not* make it through to the Base station after 10 tries, the RF Terminal will give two long beeps and display the following message:

**TRANSMISSION FAILED
TO RETRY, MOVE CLOSER
AND PRESS ENTER.
F1 TO EXIT.**

One-Way mode also works well as a test program since it doesn't require a program running on the host computer or even that the Base Station be connected to the host. To get into **One-Way Mode**:

Hit any key at the opening screen, then select option 3 from the MODE MENU.

If the Base Station already has other RF Terminals signed on in Two-Way mode, you will not be allowed into the system. A Base Station must be dedicated to one mode at a time.

If the Base Station is dedicated to One-Way mode, you will see the following prompt on the RF Terminal display:

Data Received Was

Enter Data?

Since you have just started your One-Way session, there is no data to display on line #2. Line #3 is now asking you to scan or key data into the RF Terminal. If you are entering data from the RF Terminal keypad, you must press the ENTER key to transmit your data. If the Base Station receives the data, the RF Terminal displays the following prompt:

**Data Received Was
aaaaaaaaaaaaaaaaaaaa
Enter Data?**

Where *aaaaaaaaaaaaaaaaaaaa* is the data received by the Base Station (and transmitted to the Host Computer if connected). You can exit One-Way Mode simply by pressing the F1 key on the RF Terminal keypad.

In One-Way Mode, the RF Terminal transmits its *Terminal ID* to the Base Station but it *does not* pass it on to the Host Computer. If your application on the Host Computer needs to know which RF Terminal data came from, use the *Preamble* setup parameter to enter unique identifying information. Data is also transmitted *without* a *Terminator Character* (like a CR or TAB that is transmitted after the data); so if you need one, use the *Postamble* setup parameter to add the appropriate character(s) after your data. For more information on *Preambles* and *Postambles* see **Chapter 2; RF System Setup** for details.

How Site Survey works

The RF Terminal uses **Site Survey** mode to: 1) test the radios at short range, (50 ft.) as an acid test for correct operation, and 2) to evaluate a specific site for effective coverage. Because each operating environment is different, it is almost impossible to predict the range without **Site Survey**.

Before you permanently install any hardware, you should perform a Site Survey to fully evaluate your planned area of operation. During the test the RF Terminal is transmitting messages and waiting for acknowledgment from the Base Station. (Since this US Terminal hops over 26 different frequencies, the Site Survey goes across all frequencies to make comparisons valid; this takes about 10 seconds.). The Site Survey mode displays the success rate of sending 100 packets to the Base. The higher the number, the more

successful your communications will be from that area. Site Survey does not require your Base Station be attached to your Host Computer. All you need is your Base Station, 5v power supply and RF Terminal. For detailed information on how to perform a Site Test and use the results to determine the best location for your Base Station, go to **Chapter 4; Performance Issues**.

Performance Issues

Evaluating your area of planned operation

Since every operational environment is different, it is impossible for us to tell you exactly what equipment you need and where you should put it to achieve maximum performance from your RF System. However with 3.3 miles of open area range, unless you are going through a lot of walls, you probably won't care where the Base is located and you probably will not need a Relay.

Site Survey was developed so that the user could start with a minimum system (RF Terminal and Base Station) and determine for themselves what their realistic operating range is, what additional equipment they need, and where to install their Base Stations to achieve optimum performance. Some other manufactures require expensive Site Surveys before you can even purchase any equipment from them. Our Site Survey allows you the flexibility to Site Survey whenever you choose, whether it is before you install your system or during operation to troubleshoot RF problems. Site Survey is the most valuable tool you have to help you achieve an efficient RF System with maximum range.

There is also some basic information about Radio Frequency itself that can help you make smart choices about the location and composition of your system:

- **Metal walls are almost impenetrable by RF.** If your warehouse computer is located in a metal shed, don't locate the Base Station inside with the computer. Locate the Base Station outside the metal shed instead.
- **The more walls you try to transmit through, the more the signal breaks down.** Walls that have metal studs (interior office walls) and concrete walls with steel rebar slightly degrade the signal with each wall you try to go through. Metal walls may require the use of Relay Stations to achieve adequate coverage.
- **Organic material absorbs RF energy.** If you are trying to operate in an area with lots of densely packed organic material (bags of beans or corn), expect and plan for reduced operating ranges.

There are some additional measures (other than a Site Survey) you can take early on to maximize your range:

- **Base Stations should be located at the center of the area of intended coverage.** If they are not located in the center, they should be tilted in the direction of use.
- **Raise the Base Station.** Sometimes just raising the Base Station a foot or two will dramatically increase your operating range, especially in a warehouse or grocery store environment. Mounting the Base Station on the ceiling with the antenna pointing down is the best.

Performing a Site Survey

As we have said before, the Site Survey is your most valuable tool for evaluating your planned area of operation. All you need to perform a Site Test is a RF Terminal, a Base Station and its 5v power supply. There are a few things you need to do though before you begin:

- Make sure **all other** Base Stations are turned **OFF**.

- Make sure that the Base Station and RF Terminal you are using are set to the same channel. Base Stations and RF Terminals are shipped from the factory set to channel 0. If you need to change the channel, see **Appendix A; Channel and Jumper Changes**.

The Base Station does not need to be connected to a host computer to do a Site Survey. Simply connect the Base Station to wall power using the 5v power adapter. Locate the Base where you think you will have the best range and power it up. Turn on the RF Terminal and press a key at the opening screen. At the **MODE MENU**:

MODE MENU

- 1. - Sign On**
- 2. - Setup**
- 3. - One Way Mode**
- 4. - RF Site Survey**

Enter Selection : _

select option 4 to go to the Site Survey screen.

If the Base Station is powered up, walk to the area where you want to perform your first test (start at 50 ft. or greater). When in position, stop and look at the RF Terminal display. It should read:

**Press Enter When Ready
or F1 to Exit**

Press the ENTER key to start the test. During the test (about 10 seconds), hold still during the test – moving around can result in inaccurate results. During the test the RF Terminal is transmitting many messages and waiting for acknowledgement from the Base Station. During the test the following message displays on the RF Terminal screen:

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

Please Wait... will display on your screen until the test is finished. If it takes more than a few seconds, there is something wrong. When the test is finished, you will see the results displayed in the following format:

1st try Good : nn%
2nd try Good : nn%
Press Enter When Ready
or F1 to Exit

The first line shows the percent of successful transmissions. As long as you are getting at least 90%, you will have excellent results in the location tested. You can still get decent performance with results around 50% but there will be some slight delays due to re-transmissions.

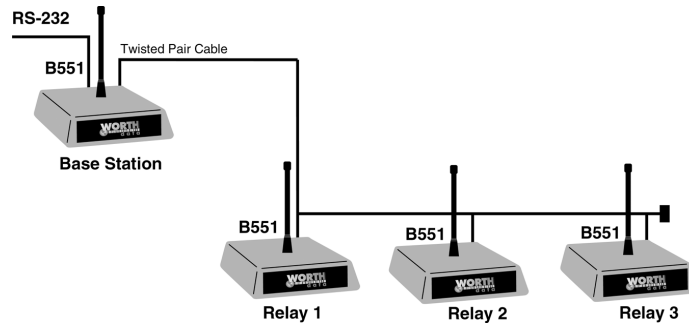
If you don't get the minimum results shown above:

- 1.** Try hanging the Base Station upside down or tilted toward the area of usage – this alone can double the effective range.
- 2.** Try locating the Base Station closer to the area of difficulty. Remember that moving the Base Station will require you to recheck the other locations already tested.
- 3.** If none of the above works, you will have to consider using a Relay.

Relay Stations

Since the range of the LT7001 Terminal is quite large you probably won't need a relay unless you must have

coverage in more than one location that is difficult to cover with a single base. An example of this would be inside two or more metal buildings where a base would be in one building and a relay in the other. Relays work like a remote antenna, passing data to the Base Station via cable instead of radio frequency. Base Stations are used as Relay Stations by changing the jumpers inside. See *Appendix A* for details.



Relay Stations are attached to the Base Station using a cable that connects from the Base's RELAY port to the Relays' RELAY port. When you order a Relay Station, you receive a 3-foot test cable with it. Although Relay Stations will increase your range of operation, they will also add about ½ second to the response time.

How Relay Stations work...

It helps to know how Relay Stations work before you add them to your system. Although Relays increase your operational range, they also slow the response time of your system. In order to use Relays, the Terminal must be configured to acknowledge that Relays are present. This is done using the **Relay Existence** setup parameter. By default, the RF Terminal is *not* configured to look for Relays. See **Chapter 2**; *RF System Setup* for details.

Once the RF Terminal is Relay-ready, it can use the Relay instead of the Base Station to communicate. If a RF Terminal tries to transmit 10 times to a Base Station without a response, it broadcasts a "who can hear me" message. If both the Base Station and the Relay hear the message, whoever answers back to the RF Terminal first becomes the point of contact for that RF Terminal.

Once a RF Terminal has established communication with a Relay, it addresses that particular Relay until another communication failure (10 transmissions with no response) occurs. If a Base Station is within hearing distance of the RF Terminal, it will ignore messages meant for the Relay.

When a Relay receives data from a RF Terminal, it then transmits that data to the Base Station over RS-422 twisted-pair cable. The Base Station in turn transmits data (via cable) for that RF Terminal to the Relay, for subsequent broadcast to the RF Terminal.

Relays are "dumb". Relays do not know whether a transmission was received by the Base Station or not, so it is up to the RF Terminal to retransmit its data if it does not receive a message from the Host Computer (via the Relay). The Relay can recognize data from the Terminal though and if it receives 10 retransmissions from the RF Terminal, the Relay assumes that the Base Station cannot hear it and broadcasts the message:

**RELAY n CANNOT BE
HEARD BY THE BASE
NOTIFY SUPERVISOR
PRESS ANY KEY**

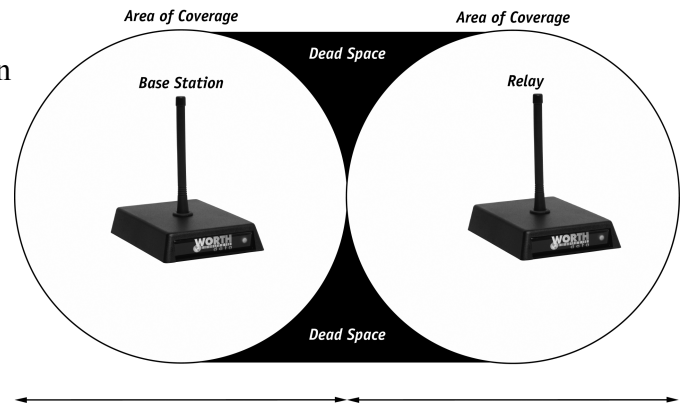
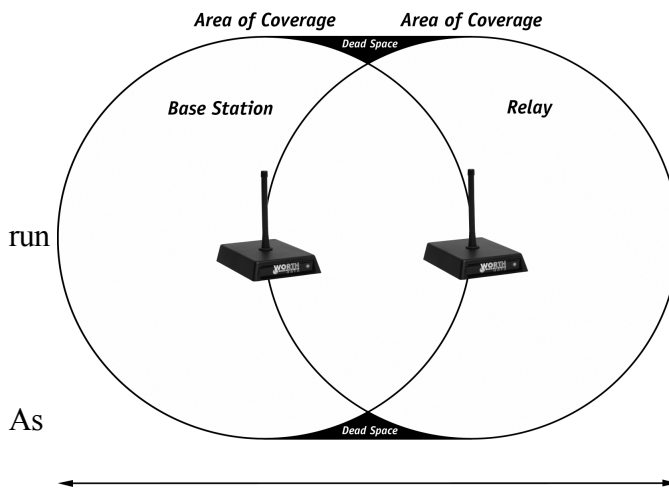
At this point, the RF Terminal puts out the "who can hear me" message. The **RELAY n CANNOT BE HEARD** message usually indicates a cabling problem and should be checked out immediately.

Sometimes a Relay gets a response from the Base Station that is partial data or garbage. The Terminal retransmits its data since it has not received a new prompt. If this occurs ten times, the RF Terminal broadcasts, “who can hear me”. At this point the Relay is still functioning and answers the RF Terminal’s call. Should the Relay respond to the RF Terminal first, the whole sequence starts again. If the Relay *again* gets “garbage” messages from the Base and the Terminal re-transmits 10 times, then the Relay concludes that there is something wrong and broadcasts the RELAY CANNOT BE HEARD message. This situation indicates that you may have an electrical “noise” problem – check your cabling as well as any electrical equipment that is in the area.

Determining coverage areas for Base Stations and Relays

As we said before, it is almost impossible to predict the effective RF communications range in a given environment. The typical area of coverage is a 3,000 – 10,000 ft. radius.

After a Site Test, if you have determined that you will need to add Relays to cover the area you want to operate in, you will need to determine where to place your Relay in relation to your Base Station. To effectively cover an area, there must be overlap between the area covered by the Base Station and the area covered by the Relay. The example on the right shows what can happen with no area overlap:



Keep in mind that the maximum length of wire that can be between a Base and a Relay or from Relay to Relay is 4000 feet. In most cases the range of the LT7001 to the Base will exceed this amount unless you are operating in a very challenging environment.

you can see, the only area adequately covered is in a path where the two circles touch. The “dead space” is completely without coverage. Alternatively, locating the

Base Station and Relay as shown below results in better coverage:

To Site Survey a Relay, all other Relays and Base Stations must be turned off. This is the only way to know for sure which Relay is responding. Alternatively, perform the Relays’ test out of range of the other Relays and Base Stations.

Relay Installation

Relay Stations are connected to the Base by twisted-pair wire. See **Appendix B: Adding Relays** for the pin outs and a testing plan.

Is radio traffic contention likely?

The radio traffic time is about 30ms per transaction. Radio time is not going to be a gating factor, even with more terminals than the allowed 64 maximum.

The bottleneck could partially be the serial port baud rate in high volume applications. The default baud rate is 9600 baud; you can increase this up to 115,200 baud, but the greater the baud rate, the less the RS-232

cable distance allowable.

The gating factor for the application is almost always going to be the application program. By splitting the application between two or more work stations, each talking to a separate set of Terminals/Base Station, that factor can be minimized.

Before you begin programming...

The RF Terminal operates in two basic ways:

One-Way communication, where all data transfer is initiated by the RF Terminal. This is not very useful, because it has no editing or prompting. The Base Station itself simply acknowledges the receipt of the data by echoing it back to the Terminal. The host computer has no dialog whatsoever with the Base Station or Terminal; it is simply used to take the data coming from the Base through the serial port and do something with it.

Two-Way communication, where messages from the host user program are sent to the Base Station (via the serial port), then from the Base Station to the RF Terminal. The Terminal responds back to the Base with data and its Terminal ID. The data is then transmitted from the Base to the host computer where it is processed and the next command is sent out. Each RF Terminal has a unique Terminal ID, allowing a single Base Station to handle up to 64 Terminals.

Two-way dialog is established when a Terminal SIGNS ON to the RF network. The host computer application waits until a Terminal SIGNS ON, then begins its processing by sending the first prompt out to the Terminal via the Base Station. If the Terminal does not receive a prompt from the host, it goes into “sleep” mode, “waking up” and checking with the Base periodically (see **Chapter 3; Operational Theory** for details) to see if it has any messages waiting. This conserves battery power and reduces radio traffic.

Two-Way mode requires programming to communicate with the Terminal where One-Way mode does not. We have tried to make it easy for the programmer to communicate with the Base Station; no protocol or handshaking is required. This type of communication is fine when the Base is located only a few feet from the serial port it is connected to. If you are locating your Base Station farther away, use shielded, grounded (bare wire Pin 1 touching shield) cable, lower baud rates and possibly, line drivers for very noisy environments. (Do not use Cat 5 wire for a serial cable).

Before you begin programming, there are some factors you should take into consideration during the planning process.

- **Plan for system failures.** This includes hardware failures, software failures and operator failures. In order to create an efficient application, you must put some thought into what you will do when different parts of the system fail.
- **Look for All Errors.** Be sure your program is trapping all possible error conditions that the Base Station may return to you. The list includes:

Sequence Errors detected
Illegal Command detected
Base Station Initialized
Addressing a Terminal Not Signed In
Command without an ID

All of these error conditions are detailed in the next chapter. Don't forget to program for them;

this is a common mistake. Failure to trap them will give create very strange, unpredictable results.

Even though you don't think your code will ever make a mistake, take advantage of feedback that the Base Station provides. Failure to do so is a common mistake that eventually results in serious program failure, sometimes due to hardware problems that go undetected.

- **Parse the Returned Strings thoroughly.** Don't assume anything about the next response from the Base to your program and look only for the partial string such as the ID only; parse the string returned completely and be sure you are examining every possibility. Failure to do so is a common mistake.
- **Plan for expansion.** You may start small (1 base/1 Terminal) but try to create an application that will allow for easy expansion and addition - especially of Terminals.
- **Use the Demo Programs.** The demo programs can at least allow you to see how the system functions and whether you can anticipate any system-wide problems. The demo programs should also be used as a response-time benchmark.

Failure Planning

Hardware Failures

Let's assume that each part of the system has failed. How are you going to know what has happened and how are you going to recover?

- The most frequent failures are at the Terminal level. If a Terminal has a hardware failure, it will not be able to SIGN OUT. It is possible for the Terminal operator to press the ON/OFF key or the F1 key by accident, forcing the Terminal to SIGN OUT - sometimes in the middle of a transaction. This happens at battery-charging time also. You need to plan for partial transactions - do you trash the data you do have and start over, or pick up where you left off?
- Keep in mind that if a Terminal has SIGNED OUT in mid-transaction, the Base Station clears any pending message for that Terminal before it will allow it to SIGN ON again. Make allowances to re-send messages or prompts that were cleared upon SIGN ON if necessary.
- If a Base Station has a hardware failure, neither the Terminal nor the host computer will be able to communicate with it. When the Base Station comes back on-line, it sends a "Base Station Initialized" message back to the host, letting the host know that it must re-initialize all Terminals and pick up any incomplete transactions.

Operator Errors

- Plan on your operator walking out of range and going to lunch in the middle of a transaction. What do you do with the data you do have, and where are you going to start up again?
- Let's say your operator is SIGNED ON and decides it's time to take a break. Instead of pressing the F1 key to SIGN OUT, he presses the OFF key. Pressing the OFF key is OK (it will SIGN him OUT) but there is a delay until the SIGN OUT is acknowledged. Because of the delay, the operator might think he didn't press the key hard enough and press it again - this time actually powering down the Terminal *before* the SIGN OUT was complete. If this happens, you need to plan to *re-send* the last prompt to the Terminal when he SIGNS ON again.

Programming for the RF Terminal

The three levels of programming support offered for the RF Terminal are:

- Low Level ASCII sequences sent to and from the Base Station by the user program reading/writing to the serial port.
- Active X drop-in components. Every necessary function is defined. You just complete the code for each function.
- TCP/IP Active X drop-in components used by the “Server” computer to communicate with the “Client” computer that has the Base Station(s) attached.

Low-Level Direct To Serial Port Programming

Planning

Remember, plan for every error that the Base Station might return including:

Sequence Errors detected
Illegal Command detected
Base Station Initialization detected
Addressing a Terminal Not Signed In detected
Command without an ID

Programs can be written in any language that has access to the serial port (reading/writing), regardless of the platform. No more than one Base Station is allowed for each serial port.

Host to Terminal Programming

The basic format of a message that is transmitted from Host to Base to Terminal is fairly simple:

Byte position	Function	Possible values
1	RF Terminal ID	0-9, A-Z, a-z, - =
2+	Command(s)	**
Last	Termination of message	EOT (ASCII 4)

The **RF Terminal ID** is always the first byte and always only 1 character in length. There are 64 different possible values - 0-9 , A-Z, a-z, - and =.

The **Command(s)** section of the message always starts with the second byte and can consist of one or more commands - including data to be displayed or voice messages to be broadcast.

The last byte is always ASCII 4 (**EOT**) to terminate the message.

Here is a listing of valid commands and examples:

Command characters	Command function
*@	Reinitializes all terminals
3@	Reinitializes Terminal #3
1@B <i>n</i>	Make Terminal #1 beep <i>n</i> (1-9) times
2@C0 *	Clears the entire screen (4, 6 or 15 lines) on Terminal #2. *See more about 4 and 6 line displays on page 6-4.
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
3@C5 *	Clears line 5 on Terminal#3 (if 6 line display), Clears all lines if 4 line display. *See more about the two display types on page 6-4.
1@C6 *	Clears line 6 on a 6 line display. Will do nothing on a 4 line display. *See more about 4 and 6 line displays on page 6-4.
1@C7- 1@CF	Clears lines 7 through 15 on a 15 line display. Will do nothing on a 4 or 6 line display. *See more about 4 and 6 line displays on page 6-4.
1@CX	Clears screen (same as @C0) and sets SMALL font, 15 lines with 26 characters per line
1@CY	Clears screen (same as @C0) and sets MEDIUM font, 10 lines with 20 characters per line
1@CZ	Clears screen (same as @C0) and sets LARGE font, 7 lines with 13 characters per line
1@D <i>n</i>	Displays date and time on line <i>n</i> (1-4) in US (mm/dd/yy, hh:mm:ss) or Euro (dd/mm/yy, hh:mm:ss) format on Terminal #1
1@V <i>nn</i>	Play voice message # <i>nn</i> (01-99) on Terminal #1
1@S <i>dataxxxx</i>	Output <i>dataxxxxxx</i> to serial port on Terminal #1 -max 231 chars

NOTE: The 15-line terminal defaults to small font on Sign-In.

Color Display Programming

New commands have been added to take advantage of the larger color display on the LT7001. You now have the ability to define the color and font size on a line by line basis.

There are 16 possible text and background colors available to choose from. They are the same 16 colors used in HTML programming.

The @C command has been expanded to set the foreground and background colors for the entire display and within the same command you can also set the font size for the entire display to all be the same or split up the display using different size fonts for each line.

The command structure is as follows:

@C[f₁f₂f₃...][\cb]

Where:

@C are the 2 header bytes

f: is the font size and can be either S, M or L for small, medium or large

n: is the number of lines being defined

\cb: defines the user default colors, c=text color, b=background color

The \cb command can also change the active text/background color within a prompt at any time.

All screen formatting and color commands are dynamic and not stored in the unit so they will need to be sent at every sign-in.

The color codes are:

0 = AQUA	1 = BLACK	2 = BLUE	3 = FUCHSIA
4 = GRAY	5 = GREEN	6 = LIME	7 = MAROON
8 = NAVY	9 = OLIVE	A = PURPLE	B = RED
C = SILVER	D = TEAL	E = WHITE	F = YELLOW

Here are some examples:

@CS2M2L2

will clear the screen and set the first two lines of the screen to be small fonts, the next two lines to be medium fonts, and the next two lines to be large fonts. The remaining undefined lines will be small font with the default colors. The default colors will be used since there is no \cb at the end of the command.\

followed by:

@1,1,0,\BEWarning@3,1,0,\21Invalid Data@5,1,1,\ACData<EOT>

will display “Warning” on the first line in small font with RED text on a WHITE background, “Invalid Data” on the third line in medium font with BLUE text on a BLACK background and “Data” on the 5th line in large font with PURPLE text on a SILVER background. The cursor will be positioned after the “Data” on the 5th line and entered text will be in the last color combination, PURPLE on SILVER.

Remember that if you only define 6 lines then the remaining lines on the screen will be defined as small font with the default colors.

When you are defining the font size for each line of the screen be aware that the total pixel count of all the lines defined cannot exceed the height of the screen.

The total height of the screen is 240 pixels. A small font is 16 pixels tall, a medium font is 24 pixels tall and a large font is 32 pixels tall.

If you define 2 lines with small fonts, 2 lines with medium fonts and 2 lines with large fonts you will be using $(2 \times 16) + (2 \times 24) + (2 \times 32) = 144$ pixels out of a maximum of 240 pixels. The top 144 pixels of the display will be used, the bottom 96 pixels will be divided into 6 lines $(96/16=6)$ of small font..

If you attempt to define a combination of fonts that exceeds 240 pixels total, a ? will be returned to the host for invalid command.

Here are some more examples:

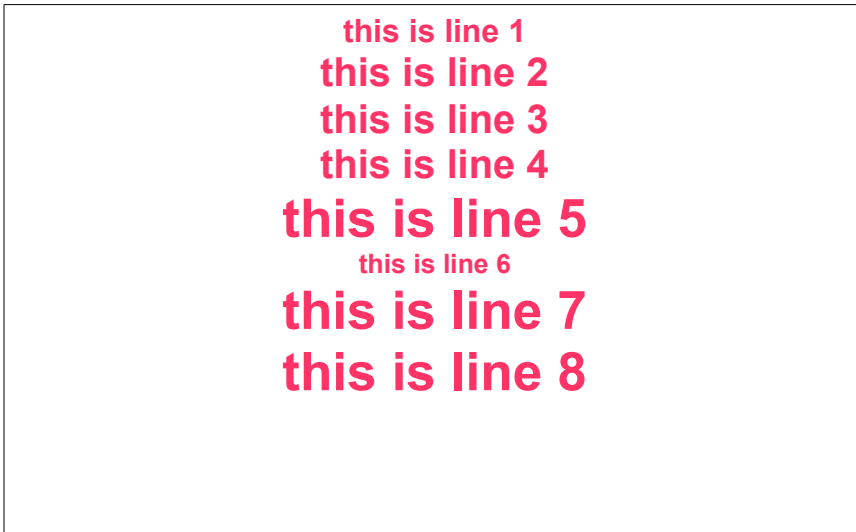
@C\E1

will clear the screen and set the default colors to WHITE text on a BLACK background. In concept, @C\E1 is the same as @C0\E1; however, @C0\E1 is an invalid command. The change of user colors is always embedded in a Clear Screen Command.

@CS1M3L1S1L2\BE

will clear the screen and set the first line to be small font, the next 3 lines to be medium font, the next line to be large font, the next line to be small font and the last two lines to be large font with RED text on a WHITE

background for all lines. The total height of the lines will be $(1 \times 16) + (3 \times 24) + (1 \times 32) + (1 \times 16) + (2 \times 32) = 200$ pixels:



The active colors change whenever \cb is received in a prompt. The user default will be used to display all the prompts unless \cb changes the colors. All prompts will start with the user default. The active colors from the last prompt will NOT be carried over to the next prompt.

A typical “prompt” command sequence follows the format below:

0@n,m,o,data

<i>where</i>	<i>n</i>	is the line number (1-4) you want the prompt displayed on
	<i>m</i>	is the character position (1-20) where you want the prompt displayed
	<i>o</i>	is the character that determines whether the prompt is for <i>display only</i> (0) or is <i>waiting for data input</i> (1) See the table below for valid characters for this position.
	<i>data</i>	is the data you want displayed

For example, the command **@1,1,1, Enter Quantity** would display **Enter Quantity** starting at position 1 on line 1, then wait for the operator to enter their data.

These are valid entries for the third position character:

0	No data input for this Command, Display ONLY
1	Data input required from the keypad or scanner
2	Only keypad input allowed, start un-shifted
3	Only keypad input allowed, start SHIFTED
4	Only scanner input allowed
5	Only accept YES (Enter key or C key) or NO (0 key or B key) keypad response. (Terminal sends 1 for YES, 0 for NO). C and B key are there to facilitate YES/NO keypad entry while scanning with integrated laser.
7	Single key entry required. Only one keystroke is accepted with the following exceptions: F2 – replays last voice prompt, DELETE and CLEAR are ignored, STATUS – displays status, SHIFT – toggles shift mode as usual, ENTER – transmits an empty string, F1 – exits.
A	same as 1, but time stamped as prefix (hhmmss)
B	same as 2, but time stamped as prefix (hhmmss)
C	same as 3, but time stamped
D	same as 4, but time stamped
E	same as 4, but can press END key to break-out of scanner-only input mode. Terminal ID + CR is sent to host
S	SHIFTED keypad input or scanner input
p	un-shifted keypad entry with no display (for passwords)
P	SHIFTED keypad entry with no display (for passwords)
R	Data input required from the RS-232 serial port (waiting for serial input can be bypassed by pressing the ENTER key which will send a NULL data string back to host computer.) Uses for this are PDF 417 Serial Scanners, and the Cameo Printer's magnetic stripe input. A POS terminal becomes possible. Scan the credit card and print the receipt, all on the RF Terminal.
K	Data input from an external serial keyboard that attaches to the serial port. As data is keyed, the characters are displayed on the RF Terminal LCD display.
M	This command is for a printer initialization and magstripe input on the Zebra Cameo printer equipped with the magstripe option.

Here are some rules and useful tips for creating messages (one or more commands per message):

- Re-initialize commands ***@**, or **n@** (where **n** is the Terminal ID 0-F) clear the buffer for terminal(s) in the Base Station. Following a re-initialization, the host program should re-display of all the screen data necessary to start the application.
- 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, display **QTY** on line 2, and then wait for data input. All 6 lines can be filled with one message.
- Messages can be a combination of multiple commands, (i.e. voice messages, initialization, clearing lines, requesting data entry), up to 1000 characters in length. A message cannot though, contain an **@S** command in combination with any other command. A message also ***should not*** contain more than 1 request for data entry (third character in command is **1**). For example:

@1,1,1,ITEM@2,1,1,QTY

has two data entry “prompt” commands combined. If this message were sent to the RF Terminal, the first data entry prompt (**@1,1,1,ITEM**) would be executed, but any and all commands after the first data entry

prompt in that statement would be ignored without warning – there will be no display or indication of an illegal command.

The **@S** command (for serial output) statement *cannot* be combined with any other command - even clear (**@Cx**) commands. After a **@S** command is successfully completed, the Base Station sends back to the host the RF Terminal ID followed by a CR (ASCII 13). There is a 231 character limit on data for this command. If you send a command of more than 231 characters, you will get an Illegal Command returned, (ID ? CR). If you need to send 300 characters of data, send the first part, wait for the acknowledgement (ID CR), and then send the remaining part. If you are using the **@S** command with a printer *other* than the Zebra Cameo or QL3, you may have to change the **Protocol** parameter in the RF Terminal to **XON/XOFF**. This will allow the RF Terminal to deal with the character buffer limitations of your particular printer. If you are using the O’Neil MicroFlash Printer, you must send a **NULL** character before the valid data to wake up the printer. See your printer manual for details and see **Chapter 6** for details on printer protocol.

- The **@M** command is similar to the **@S** command, except it *can* be combined with other commands because it is a data entry command too. This command is for a printer initialization and magstripe input on the Zebra Cameo printer equipped with the magstripe option. The format of the command is:

@Mdddatttta(EOT)

where dddatttta might be ! U1 MCR 80 T1 T2+ CR + LF

(Refer to the Cameo manual for the exact string sequence you need to send. The above example sends over an 10 second request for reading Track 1 and Track 2).

There is no reply to the host except the magstripe data. If the card cannot be read, pressing the ENTER key on the Terminal will send back ID+CR. This is the breakout method.

This command must be the last in a series of commands. For example, the following would be a typical multi-command statement:

@C0@1,1,0,Swipe Card@M! U1 MCR 80 T2 (CR)(LF)(EOT)

where:

CR is ASCII 13

LF is ASCII 10

EOT is ASCII 4

The statement causes the RF Terminal to transmit the string "!U1 MCR 80 T2 CR LF" to the Cameo printer. The printer then wakes up and blinks to indicate the magstripe input is ready to be swiped; when the swipe is complete, the Terminal sends back the data to the host computer as:

ID+T2:Data on Card+CR (the printer's CR LF stuff is stripped)

If the request is for Track 1 and Track 2, the data sent back is

ID+T1:data on 1+T2:data on 2+CR

- Every statement must end with a data entry “prompt” command, whether the statement is a single command by itself or several commands combined together. Any illegal statement will be ignored as a command but will be displayed on the addressed RF Terminal display exactly as written. If no Terminal ID was included in

the statement, it will try to display the invalid statement on ID 0. Once the ENTER key is pressed on the Terminal displaying the invalid statement, the terminal sends the Base Station a “?” character. The Base Station then in turn sends the message $n?CR$ (where n is the Terminal ID and CR is a carriage return) back to the Host computer.

- The “Clear lines” command (@Cx) for the 4 line displays differ slightly from the “Clear lines” command for the current 6 line displays.
- The following table shows the programming differences for 4 lines/6 lines:

Command	4 Line	6 Line	15 Line
@C0	Clears all lines	Clears all lines	Clears all lines
@C5	Clears all lines	Clears line 5	Clears line 5
@C6	No effect	Clears line 6	Clears line 6
@CA	No effect	No effect	Clears line 10

- In order to maintain compatibility with 4 line display terminals in an existing system, there is a new option in the RF Terminal Setup for 6 line display terminals. The LCD DISPLAY MODE allows the user to configure a 6 line display terminal as a 4 line display (centering the data on the display and conforming to the old programming command format, i.e. @C05 clears all lines). See Installation and Setup for details on how to get into LCD DISPLAY MODE.
- The SIGN ON character for a 6 line display RF Terminal operating in 6 line display mode (see the previous point concerning LCD DISPLAY MODE) is different than for a 4 line display. A 6 line display terminal operating in 6 line mode signs on using ASCII 22. If the 6 line terminal is configured for 4 line display, it signs on using ASCII 15. This allows you to use both types of display in the same system and be able to distinguish between the two terminal types. See page 6-6 for more information on SIGN ON.

CAUTION: All 6 line display terminals are by default, configured as 6 line display terminals and will try to SIGN ON using ASCII 22. If you are trying to SIGN ON to an existing 4 line display terminal system that has not had any changes in its programming to utilize the 6 line display terminals, the 6 line display terminal will NOT BE ABLE TO SIGN ON. Make sure to reconfigure the Terminal using the LCD DISPLAY MODE to operate as a 4 line display terminal.

Here are some sample command statements utilizing some of the programming tips offered above:

@2,1,1,ENTER ITEM NO	Display ENTER ITEM NO on line 2, position 1 and wait for data input. This is a valid single command statement – it ends with a data entry request.
@V23@1,2,1,WRONG ITEM	Play voice message 23, display WRONG ITEM on line1, position 2 and wait for data input. This is a valid multiple command statement – it ends with a data entry request.
@C1@1,7,0,PICKING	Clear line 1. Display PICKING at position 7 of line 1. This statement is illegal . To be a valid statement, it must end with a data entry request. For example: @C1@1,7,0,PICKING@2,7,1,ITEM
@1,1,1,ITEM@2,1,1,QTY	Since only one command can be a “prompt” data entry request, this is an illegal statement and would be ignored as a command. It would be valid if changed to @1,1,0,ITEM@2,1,1,QTY

Base Station to Host Formats

The basic format of a message that is transmitted from Base to Host is fairly simple:

Byte position	Function	Possible values
1	RF Terminal ID	0-9, A-Z, a-z, - =
2+	Data Transmitted	**
Last	Termination of message	CR (ASCII 13)

Typically, the Base Station is sending the “answer” to the hosts “question” - for example, if a Base sent a host message to a terminal #2 that said:

2@1,1,1,ITEM NUMBER + EOT

The RF Terminal would display ITEM NUMBER on line 1, position 1 and accordingly, the operator would then enter an item number by scanning or using the keypad. The RF Terminal transmits the data entered -say it's **123** - to the Base Station, which in turn transmits the following to the host:

2123+CR

Where **2** is the Terminal ID, **123** is the data and **CR** is the termination, (the plus sign is not transmitted). Besides data, there are other messages that the Base Station will send to the Host:

Serial Reply

After a **Serial** command (**@S**) has been successfully completed, the Base Station sends to the Host the Terminal ID followed by a CR. Serial commands are typically used for attached serial printers. Serial commands cannot be combined with other commands in a message to the Base Station/Terminal. Remember, you can only send 231 characters (including the ID + **@S** + EOT).

SIGN ON

To login to the host computer, the user presses a key on the RF Terminal at power-up to get to the SIGN ON screen. As the user SIGNs ON, the Base Station sends back the following SIGN ON message to the host:

Byte position	Function	Possible values
1	RF Terminal ID	0-9, A-Z, a-z, - =
2+	SIGN ON	SYN (ASCII 22) if 15 line display configured as a 6 line display.
		SI (ASCII 15) if 15 line display terminal configured as 4 line display.
		DC4 (ASCII 20) if 15 line display configured as a 15 line display.
Last	Termination of message	CR (ASCII 13)

After a terminal SIGNS ON, the host should be prepared to acknowledge the SIGN ON and give the terminal instructions, such as:

***Standby for Assignment, Press ENTER to acknowledge
Nothing to do, Press ENTER and See Supervisor
Pick Item 1234***

If there is something for the Terminal to do, the host should send instruction to the terminal (as in “Pick Item 1234” above). If there is nothing to do at the time of SIGN ON, the host should acknowledge the SIGN ON and tell the terminal to *Stand By* or *See Supervisor* (see lines 1 and 2 above). You will notice that in lines 1 & 2 above, there is a request for the operator to press the ENTER key. This is required for the message to be

a valid command - remember that all messages must end with a request for data input. The host should then expect a response from the terminal of **Terminal ID** + DATA (none if only pressing ENTER key) + **CR**.

SIGN ON is a good way for the terminal operator who has not received instruction from the host for several minutes to determine if he is still connected and if the host is still functioning. By SIGNing OUT and SIGNing back ON, the operator should receive a message that there is nothing to do. It is also a good idea for the host to keep track of elapsed time that a terminal has not had a message sent out to it. The host should then send a message periodically to re-assure the operator (remember to ask him to press ENTER) that instruction is coming or tell him to see his supervisor for re-assignment (or whatever makes sense for your application).

Ideally, if the operator is leaving the area (to go to lunch or move to another building) before he is out of range of the network, he should SIGN OUT, then SIGN ON upon his return.

A 6 line display terminal configured as a 6 line display (see Installation and Setup for LCD DISPLAY MODE) sends **ASCII 22** as its SIGN ON character. A 6 line display terminal configured as a 4 line display will transmit the ASCII 15 character for SIGN ON.

SIGN OUT

When a RF Terminal is powered down manually or the user presses the F1 key to exit data entry mode to go to one of the other modes (SETUP or ONE WAY), the host receives the following SIGN OUT message:

Byte position	Function	Possible values
1	RF Terminal ID	0-9, A-Z, a-z, - =
2+	SIGN OUT	SO (ASCII 14)
Last	Termination of message	CR (ASCII 13)

Base Station Error Feedback

The following are four different unexpected feedbacks that the Base Station can send back to your program: (Be sure to look for each of them to be sure your program doesn't blow up at an unexpected time.)

Addressing a Terminal not SIGNED ON

If the host attempts to send a message to a terminal that is not SIGNED ON, the Base Station sends back the following message to the host computer:

Byte position	Function	Possible values
1	RF Terminal ID	0-9, A-Z, a-z, - =
2+	Terminal NOT Signed In	DC1(ASCII 17)
Last	Termination of message	CR (ASCII 13)

The ASCII 17 character can be changed to ASCII 16 for XON/XOFF sensitive systems by changing the Base Station Setup. See **Chapter 2**; *RF System Setup* for details.

If the Base Station receives five **Addressing a Terminal not SIGNED On** messages in a row, it transmits the following message to the Terminal and shuts down: (it will recognize a reinitialize command (*@EOT) from the host though)

**Base Shut Down
Due to Host Logic
Error**

Check your program for the sequence error before starting again. The host program will have to reinitialize the Base Station or you will have to cycle power on the Base Station and have the Terminal Sign On again in order to continue.

Sequence Error Message

The host program must observe the one-for-one "host prompt/terminal response" protocol at all times. The host cannot send a second data entry prompt until it has received a response to the first data entry prompt. If it does, this is considered a **Sequence Error**. If the Base Station receives a command that is out of sequence, it sends the following message back to the host:

Byte position	Function	Possible values
1	RF Terminal ID	0-9, A-Z, a-z, - =
2+	Sequence Error	DC2 (ASCII 18)
Last	Termination of message	CR (ASCII 13)

If the Base Station receives five **Sequence Error** messages in a row, it transmits the following message to the Terminal and shuts down: (the only host command that it will receive is ***@EOT**)

Base Shut Down Due to Host Logic Error

Check your program for the sequence error before starting again. You will have to reinitialize the Base Station by host program control (***@EOT**) or manually cycle power on the Base Station and have the Terminal Sign On again in order to continue.

Illegal Command

When a terminal receives an illegal statement from the host, it will display the entire statement on the terminal. Once the ENTER key is pressed on the terminal, the terminal sends a "?" back to the Base Station.

Byte position	Function	Possible values
1	RF Terminal ID	0-9, A-Z, a-z, - =
2+	Illegal Command	?
Last	Termination of message	CR (ASCII 13)

For example, if Terminal #2 received an illegal command, the Base station would transmit to the host:
2?CR

If a command is sent from the host to the base station without a valid terminal ID character, such as:
@1,1,1,Scan Serial Number

since the command doesn't specify which terminal it is meant for, the base sends the following message back to the host:

***?CR**

If the Base Station receives more than 1000 characters, it treats that statement as an Illegal Command. If it sees more than 1000 characters five times in a row, it transmits the following message to the Terminal and shuts down:

Base Shut Down Due to Host Logic Error

You can re-initialize the terminal by sending ***@EOT** or by powering the base off and back on.

Automatic Check Back

When a terminal checks back in to see if there is a change in instructions, the host can send back the same prompt or send back a new prompt. The check back occurs according to the time specified in the Terminal's setup, (specified in increments of 5 seconds). When a check back occurs, the Terminal clears the screen of the current prompt, and sends back the following message:

Byte position	Function	Possible values
1	RF Terminal ID	0-9,A-Z,a-z,-=
2+	Check Back	BEL (ASCII 07)
Last	Termination of message	CR (ASCII 13)

Base Station Initialized Message

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

Byte position	Function	Possible values
1	BASE ID	* (<i>Base ID is fixed</i>)
2+	Base Initialization	DC3 (ASCII 19)
Last	Termination of message	CR (ASCII 13)

Since ASCII 19 is XOFF, the ASCII 19 character can be changed to ASCII 20 for XON/XOFF sensitive systems by changing the Base Station Setup. See **Chapter 2; RF System Setup** for details.

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 transmitted is often garbage. QBASIC handles the garbage character without incidence, but GWBASIC does not unless ON ERROR GOTO is used to trap the error. Be aware of this potential garbage-byte problem in your programming. To isolate and test for the problem, power up the Base *without* the serial cable connected. After you power the Base up, plug in the serial cable. You will *not* see the “**Base Initialized**” message but it should not matter when testing for the garbage data.

If a terminal is signed-on to the system, and the base station is re-initialized, the following message is sent to the terminal:

**Base Reinitialized X
Cycle Power on RF
Terminal and Sign-on
again to Restart_**

where *X* is either a **P** (base initialization was power-related) or **H** (base initialization was host-related).

Control Keys for Possible Programming

There are some keys on the RF Terminal keypad that when pressed, can transmit special ASCII characters back to the host program. This feature might be used by a programmer to allow the operator to review transactions. **You can use these keys for special program functions, such as scrolling through data, backing up steps, jumping, finishing a process, etc.** The keys are as follows:

Key	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)
SEARCH key	VT (ASCII 11)

The STATUS key is reserved to only display the Time and Date.

The Control keys can be used *without* pressing the ENTER key by using the **Control Keys Only** Terminal Setup parameter. See **Chapter 2; RF System Setup** for details.

ASCII Control Character and Extended ASCII Conversion (2D scanner only)

Since some ASCII characters are used to frame the RF packet all ASCII codes in the range 00h-1Fh and 80h-FFh are converted to %nn where the “nn” is the ASCII value. This only applies to 2D data packets.

PromptCOM/ActiveX

Drop-in components are tools that are added to your programming environment "tool kit". There are a variety of different technologies around for implementing a drop-in component such as VBX (for Visual Basic) and VCL (for Delphi and C Builder) and COM (ActiveX). Only the ActiveX variety are widely compatible with almost all development environments.

PromptCOM/ActiveX is a drop in COM component that allows programmers to easily add the ability to send prompts to and receive data from their RF Terminal via an RF Base Station. It is compatible with Visual Basic, Visual C++, Delphi, and most other 32-bit development platforms. See the help file for installation instructions.

Programming Considerations for ActiveX

Before making any method calls, make sure you :

- Set the COM port properties (device name, baud, parity, bits,) as desired. Make sure the port is closed (call **CloseDevice**) before making changes to any of the port settings.
- Call the **OpenDevice** method. This activates the COM port used by this instance of the **WDterm** control.
- Set the **ActiveTerminal** property to identify the terminal on which you desire to operate. You can change the **ActiveTerminal** at any time in order to direct commands to appropriate terminals.

Test For Good Communication – ActiveX Object

Implement an event handler for **OnTermBaseRegister** that causes a beep or displays a message when called. If communication between the host PC and the base station is good, your event handler will fire when your program is running and you power up an attached base station.

Multiple Base Stations

For installations using multiple base stations attached to a single host PC (these were called "channels" in PromptCOM/DLL) simply add a **WDterm** control to your application for each base station.

Terminal Tracking

Since you get one set of event handlers for each base station, you will need some scheme for keeping track of where each terminal (up to 64 per base station) is in its transaction sequence. One possible solution is to use a "state" variable for each terminal (perhaps stored in an array). Test the state variable to determine the next prompt for any given terminal. See the samples for more ideas.

It is very important to keep track of "login status" for each terminal. Every **SignOut** event should have an associated **SignIn** event and a given terminal should not be allowed to **SignIn** twice without an intervening **SignOut**. Multiple **SignIns** from one terminal without appropriate **SignOuts** indicate either:

A terminal going out of range and having its power cycled before returning within range OR
Two (or more) terminals using the same ID (terminal ID conflict).

Concepts - ActiveX Object Programming

When you use drop-in components in your program you will follow the standard object-oriented programming paradigm that uses properties, methods, and events to implement the functionality of the drop-in component.

- **Properties** are the various configuration variables used by the drop-in component. An example of a property is the **ComDeviceName** setting.

- **Methods** are function calls used to issue commands and access features of the drop-in component. An example of a method is sending an **Input** command to the terminal.
- **Events** are function definitions placed in your application's source code. The function definitions in your source code are called Event Handlers. The skeleton structure of the event handler's source code is automatically generated. The code in the Event Handler is called ("fired") by the drop-in component when a specific event occurs. An example of an event is when a terminal returns data and the **OnTermData** event is fired.

The details of how to access Properties/Methods/Events varies between development platforms. Details of how it works in some of the most popular platforms is illustrated in the samples included with the RF Utilities CD or available for download from our website at:

<http://www.barcodehq.com/downloads.html>

Properties – ActiveX Object

Properties are the various configuration variables used by the **WDterm** control. They are directly assignable in your application (e.g. "**WDterm.ActiveTerminal** = 5") and can be set in your development environment's object browser.

Important: Except for **ActiveTerminal** and **Quiet**, all properties require the serial port to be "closed" before they can be changed. Use the **CloseDevice** method before setting properties and then call **OpenDevice** to re-open the serial port.

Note that your development environment may show more properties for the **WDterm** control than are listed here. This is normal. You may ignore properties you see that are not listed here.

ActiveTerminal

Valid values: 0 -63

Definition: This is the terminal ID (0-63) to which method call instructions are directed.

ComDeviceName

Valid values: *COM1-COM16*

Definition: This is the serial port that this instance of the control will use. If you have more than one base station, drop in another **WDterm** control and set its **ComDeviceName** for your other COM port(s).

ComBaudValue

Valid values: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200

Definition: This is the serial port speed setting and must match the base station setting.

ComParity

Valid values: *None, Even, Odd.*

Definition: This is a serial port setting and must match the base station setting. **WDterm** may allow other settings but those listed here are the only ones compatible with current version base stations.

ComDataBits

Valid values: 7, 8

Definition: This is a serial port setting and must match the base station setting. **WDterm** may allow other settings but those listed here are the only ones compatible with current version base stations.

ComStopBits

Valid values: 1, 2

Definition: This is a serial port setting and must match the base station setting. **WDterm** may allow other settings but those listed here are the only ones compatible with current version base stations.

Quiet

Valid values: *True, False*

Definition: If **Quiet** is set to True then any status and error message generated by **WDterm** will be suppressed.

Methods – ActiveX Object

Methods are commands that you issue to the **WDterm** control. All of the "Inputxxx" commands cause the terminal to wait for operator input.

*Note that your development environment may show more available methods for the **WDterm** control than are listed here. This is normal. You may ignore methods you see that are not listed here.*

Important: When your application starts up, the serial port is "closed". You must call **OpenDevice** before other method calls will work.

Except for the **ReInitAll** method, all methods use the **ActiveTerminal** property to identify the terminal to use.

Color Codes for 7001 (15-line) Terminal	
0 - aqua	7 - maroon
1 - black	8 - navy
2 - blue	9 - olive
3 - fuchsia	10 - purple
4 - gray	11 - red
5 - green	12 - silver
6 - lime	13 - teal
	14 - white (white)
	15 - yellow

OpenDevice

Function: Opens the communications (serial) port. This must be called before any of the methods described below. Make sure to set all Properties as desired before calling this method (except **ActiveTerminal** or **Quiet**).

CloseDevice

Function: Closes the communications (serial) port. This must be called before changing any of the Property settings (except **ActiveTerminal** or **Quiet**). When your application starts up, the serial port is "closed". You must call **OpenDevice** before other method calls will work.

InputAny

Parameters: *line, position, prompt, shifted, timestamped*

InputAnyColor (15-line terminal only)

Parameters: *line, position, prompt, shifted, timestamped, FG, BG*

Function: This instructs the **ActiveTerminal** to display the prompt at line and position and wait for data to be entered from either terminal keypad or scanner. If shifted is set to "true", the terminal will start in shifted mode. Timestamped appends a (hhmmss) prefix to the returned data.

InputKeyBd

Parameters: *line, position, prompt, shifted, timestamped*

InputKeyBdColor (15-line terminal only)

Parameters: *line, position, prompt, shifted, timestamped,FG,BG*

Function: This instructs the **ActiveTerminal** to display the prompt at line and position and wait for data to be entered from the terminal keypad only. If shifted is set to “true”, the terminal will start in shifted mode. Timestamped appends a (hhmmss) prefix to the returned data.

InputExtKeyBd

Parameters: *line, position, prompt*

InputExtKeyBdColor (15-line terminal only)

Parameters: *line, position, prompt, FG, BG*

Function: This instructs the **ActiveTerminal** to display the prompt at line and position and wait for data to be received from the PS/2 keyboard attached using an adapter to the terminal serial port. Waiting for external keyboard input can be bypassed by pressing the enter key on the terminal which will send an empty data string to the host (fires the OnTermData event handler). External keyboards are supported by terminals using firmware version RFU1010 or later.

InputScanner

Parameters: *line, position, prompt, allowbreakout, timestamped*

InputScannerColor (15-line terminal only)

Parameters: *line, position, prompt, allowbreakout, timestamped,FG,BG*

Function: This instructs the **ActiveTerminal** to display the prompt at line and position and wait for data to be entered from the terminal scanner only. Setting allowbreakout to true allow user to "break out" of scanner only mode by pressing the end key on the terminal. A termID+CR will be sent to the host.

InputYesNo

Parameters: *line, position, prompt*

InputYesNoColor (15-line terminal only)

Parameters: *line, position, prompt,FG,BG*

Function: This instructs the **ActiveTerminal** to display the prompt at line and position and wait for a **Yes** (Enter key or C key) or a **No** (0 key or B key) from the terminal keypad.
Note: C and B keys are used to facilitate keypad entry while scanning with the integrated laser.

InputPassword

Parameters: *line, position, prompt, shifted*

InputPasswordColor (15-line terminal only)

Parameters: *line, position, prompt, shifted,FG,BG*

Function: This instructs the **ActiveTerminal** to display the prompt at line and position and wait for data to be entered from the terminal keypad only. The entered data is not displayed on the terminal.

InputSerial

Parameters: *line, position, prompt*

InputSerialColor (15-line terminal only)

Parameters: *line, position, prompt,FG,BG*

Function: This instructs the **ActiveTerminal** to display the prompt at line and position and wait for data to be received through the terminal serial port. Waiting for serial input can be bypassed by pressing the enter key on the terminal which will send an empty data string to the host (fires the **OnTermData** event handler).

OutputSerial

Parameters: *data*

Function: This instructs the **ActiveTerminal** to send data to the terminal's serial port. Data must be less than 231 characters in length for each call to **OutputSerial**.

SendDisplay

Parameters: *line, position, prompt*

SendDisplayColor (15-line terminal only)

Parameters: *line, position, prompt, FG, BG*

Function: This instructs the **ActiveTerminal** to display the prompt at line and position. Must be followed by an **"Input"** method call to take effect.

ClearScreen

Function: This instructs the **ActiveTerminal** to clear its display. Must be followed by an **"Input"** method call to take effect.

ClearLine

Parameters: *line*

Function: This instructs the **ActiveTerminal** to clear the specified line on its display. Line number is indicated by 1-9 and A-F Must be followed by an **"Input"** method call to take effect.

DefineFormat (15-line terminal only)

Parameters: *font, linecount*

Function: Adds a line formatting definition. This command is called multiple times to build a display formatting definition for multiple lines which is then sent to the **ActiveTerminal** by the **SendFormat** command.

If only one line is defined (that is DefineFormat is called only once), then after SendFormat is called, only one line will be available for display on the ActiveTerminal. There are a limited number of lines available depending on the font size(s) chosen. Each font has a defined height:

small: 16
medium: 24
large: 32

The total height of the defined lines cannot exceed 240. If it does, an error code is generated (see CheckError) and the SendFormat command is ignored.

There is limited display width available for text. Depending on the font you select for a line:

small: 26 characters
medium: 20 characters
large: 13 characters

If you try to send prompt or display text longer than this, it will be truncated and an error code is generated (see CheckError).

Must be followed by a **SendFormat** and then an **Input** call to take effect.

SendFormat (15-line terminal only)

Parameters: *FGcolor, BGcolor*

Function: Sends to the **ActiveTerminal** the current Format Definition as created by one or more calls to the DefineFormat method. It also sets the user-default display foreground and background colors.
Must be followed by an **Input** method call to take effect.

SendDate

Parameters: *line*

Function: This instructs the **ActiveTerminal** to display date and time on the specified line number.
Must be followed by an **"Input"** method call to take effect.

Beep

Parameters: *count*

Function: This instructs the **ActiveTerminal** to beep count times. Count may be a value from 1 to 9.
Must be followed by an **"Input"** method call to take effect.

PlayVoice

Parameters: *msgnum*

Function: This instructs the **ActiveTerminal** to play voice message number *msgnum*. *Msgnum* may be a value from 1 to 99. Must be followed by an **"Input"** method call to take effect.

Relnit

Function: This instructs the **ActiveTerminal** to re-initialize. Must be followed by an **"Input"** method call to take effect.

Base Stations use the message "Buffer Reinitialized..." to indicate a single terminal re-initialization.

RelnitAll

Function: Instructs all attached terminals to re-initialize.

GetErrCode

Returns code for the most recent error. Calling this method resets the Error Code to 0.

Error Codes

0. No Error
1. Command Data Too Long
2. Error on Close Device
3. Serial Out Data Too Long
4. Invalid Terminal ID On Last Command
5. Terminal ID Format Error
6. Display Formatting Error

Events – ActiveX Object

WDterm events occur when a specific condition is met. When an event is "fired", an event handler function in your application is called.

Though the details of exactly how it is done varies from one programming environment to the next, the source code skeletons for the various event handlers are automatically generated and inserted into your source code for you. See the samples for more specific information.

Each event passes relevant information to your event handler function. The only event that does not pass any data is **OnTermBaseRegister**. All others pass at least the Terminal ID on which the event occurred.

OnTermData also passes the data that was keyed or scanned into the terminal.

Terminal ID is always passed as 0-63. A Terminal ID value of 99 indicates an error.

Once you have the event handler skeletons, you can proceed to add whatever functionality you desire to each event.

You must call the **OpenDevice** method before any events can be fired.

OnTermBaseRegister

Event: An attached base station has successfully powered up and communicated with the host computer via the serial connection.

OnTermSignIn15

Data passed: *terminal*

Event: A 15-line terminal has signed in. Terminal ID is passed in terminal.

OnTermSignIn6

Data passed: *terminal*

Event: A six-line terminal has signed in. Terminal ID is passed in terminal.

OnTermSignIn4

Data passed: *terminal*

Event: A four-line terminal has signed in. Terminal ID is passed in terminal.

OnTermSignOut

Data passed: *terminal*

Event: A terminal has signed out. Terminal ID is passed in terminal.

OnTermData

Data passed: *terminal, data*

Event: A terminal has sent data in response to an Input method call.

OnTermNotSignedIn

Data passed: *terminal*

Event: A command has been sent to a terminal that is not signed in.

OnTermSequenceError

Data passed: *terminal*

Event: The one-for-one host prompt/terminal response protocol has been violated. The host cannot send a second Input command until it has received a response from the first **Input** command. If a base station receives 5 sequence errors in a row, a Host Logic error is generated and the base shuts itself down.

While PromptCom/ActiveX will intercept and prevent most logic errors, they are still possible so you should implement this event handler!

OnTermIllegalCommand

Data passed: *terminal*

Event: An illegal command has been sent to a terminal.

PromptCom/ActiveX is designed to prevent illegal commands but software is not always perfect and we may not have imagined all the ways in which our customers will want to use it!

OnTermUpArrow

Data passed: *terminal*

Event: The up-arrow button has been pressed on a terminal. You must issue another **Input**

method call before **WDterm** can respond to another keypress on the terminal.

OnTermDownArrow

Data passed: *terminal*

Event: The down-arrow button has been pressed on a terminal. You must issue another **Input** method call before **WDterm** can respond to another keypress on the terminal.

OnTermLeftArrow

Data passed: *terminal*

Event: The left-arrow button has been pressed on a terminal. You must issue another **Input** method call before **WDterm** can respond to another keypress on the terminal.

OnTermRightArrow

Data passed: *terminal*

Event: The right-arrow button has been pressed on a terminal. You must issue another **Input** method call before **WDterm** can respond to another keypress on the terminal.

OnTermBeginKey

Data passed: *terminal*

Event: The BEGIN button has been pressed on a terminal. You must issue another **Input** method call before **WDterm** can respond to another keypress on the terminal.

OnTermEndKey

Data Passed: *terminal*

Event: The END button has been pressed on a terminal. You must issue another **Input** method call before **WDterm** can respond to another keypress on the terminal.

OnTermSearchKey

Data passed: *terminal*

Event: The SEARCH button has been pressed on a terminal. You must issue another **Input** method call before **WDterm** can respond to another keypress on the terminal.

PromptNET TCP/IP Active X Controls

PromptNET/ActiveX is a drop in COM component that allows programmers to easily add the ability to send prompts to and receive data from their RF Terminal via an RF Base Station across a TCP/IP network connection.

PromptNET requires a "Client" computer on a TCP/IP network (to which up to 4 serial Base Stations can be attached) and a "Server" computer visible on the network to the Client.

The client computer runs the **PromptNET** Client Utility program as a background task. The server computer runs your application which uses the **PromptNET** ActiveX component to communicate with the Client.

The ActiveX component is compatible with Visual Basic, Visual C++, Delphi, and most other 32-bit development platforms. The client program requires Windows 98 or later. See the help file for installation instructions.

Programming Considerations

Network Setup

The network settings on both client and server must support TCP/IP communications.

It is critical that the client and server computers are "visible" to each other across your network. Both computers must have an IP address in the same subnet. The server requires a static IP address while the Client can either have a static address or use an assigned IP address via a DHCP server or equivalent. Refer to your Windows networking administration utility in the Control Panel to configure computer IP address settings.

PromptNET uses ports 54123 (server) and 54124 (client).

You can link server and client through a dial-up or DSL Internet link as long as the server has a static IP address and your router passes the above ports.

If you are unsure of how to set up your IP configuration properly, refer to your network administrator for help.

Client Utility

Make sure the Client Utility is properly installed on the client computer and communicating with at least one Base Station. Test the Client by cycling power on the Base Station. You should see a "Base SignOn" message in the monitor window.

Server Communications

Run the Server Test Utility on the server computer. Now go to the client computer, set the IP address for the server computer and a unique "Base Name" for the Client Utility and attempt to connect to the Server Test Utility. If the Client Utility connects, you are configured properly. Go to the server computer, shut down the Server Test Utility and begin work on your **PromptNET** server application.

For Client/Server communications, the Client Utility is required to be running on the PC that the serial Base Stations are attached to.

Before making any **WDIPterm** method calls in your application, make sure to set the **ServerOn** property to "true".

Test For Good Communication

Implement an event handler for **OnTermBaseRegister** that causes a beep or displays a message when called. If communication between the host PC and the base station is good, your event handler will fire when your program is running and you power up an attached base station.

Multiple Base Stations

For installations using multiple base stations attached to a single client PC, simply use the four "channels" provided by the Client Utility program.

Terminal Tracking

Since you get only one set of event handlers, you will need some scheme for keeping track of where each terminal (up to 64 per base station, up to 4 base stations per client) is in its transaction sequence. One possible solution is to use a "state" variable for each terminal (perhaps stored in an array). Test the state variable to determine the next prompt for any given terminal. See the samples for more ideas.

It is very important to keep track of "login status" for each terminal. Every **SignOut** event should have an associated **SignIn** event and a given terminal should not be allowed to **SignIn** twice without an intervening **SignOut**. Multiple **SignIns** from one terminal without appropriate **SignOuts** indicate either:

- A terminal going out of range and having its power cycled before returning within range OR
- Two (or more) terminals using the same ID (terminal ID conflict).

Concepts - TCP/IP COM

Drop-in components are tools that are added to your programming environment "tool kit". Only the ActiveX variety are widely compatible with almost all development environments. When you use drop-in components in your program you will follow the standard object-oriented programming paradigm that uses properties, methods, and events to implement the functionality of the drop-in component.

Properties are the various configuration variables used by the drop-in component. An example of a property is the **ServerOn** setting.

Methods are function calls used to issue commands and access features of the drop-in component. An example of a method is sending an **Input** command to the terminal.

Events are function definitions placed in your application's source code. The function definitions in your source code are called Event Handlers. The skeleton structure of the event handler's source code is automatically generated. The code in the Event Handler is called ("fired") by the drop-in component when a specific event occurs. An example of an event is when a terminal returns data and the **OnTermData** event is fired.

The details of how to access Properties/Methods/Events varies between development platforms. Details of how it works in some of the most popular platforms is illustrated in the samples included with the RF Utilities CD or available for download from our website at:

<http://www.barcodehq.com/downloads.html>

Properties - TCP/IP COM

Properties are the various configuration variables used by the **WDIPterm** control. They are directly assignable in your application (e.g. "WDIPterm.ServerOn = true") and can be set in your development environment's object browser.

Note that your development environment may show more properties for the **WDIPterm** control than are listed here. This is normal. You may ignore properties you see listed in your development environment that are not listed here.

ServerOn

Valid values: *True, False*

Function: Set to *True* to enable the server. Set to *false* to turn the server off. You should leave this off unless your program is actually running. Setting it to *True* at design-time can cause problems.

Quiet

Valid values: *True, False*

Function: If **Quiet** is set to *True* then any status and error message generated by **WDIPterm** will be suppressed.

LogFile

Valid values: *blank or a valid file name*

Function: If the file does not exist it will be created. If it exists, it will be appended to. If **LogFile** is blank, no log file is maintained.

ClientList

Valid Values: *Read Only.*

Function: Returns a formatted string listing all attached client **BaseNames** and associated IP numbers. Format is "basename CR/LF IP address CR/LF basename...".

Methods - TCP/IP COM

Methods are commands that you issue to the **WDIPterm** control. All of the "**Inputxxx**" commands cause the terminal to wait for operator input.

*Note that your development environment may show more available methods for the **WDIPterm** control than are listed here. This is normal. You may ignore methods you see that are not listed here.*

InputAny

Parameters: *basename, channel, terminal, line, position, prompt, shifted, timestamped*

Function: This instructs the terminal attached to client *basename* on channel to display the prompt at line and position and wait for data to be entered from either terminal keypad or scanner. If *shifted* is set to "true", the terminal will start in shifted mode. *Timestamped* appends a (hhmmss) prefix to the returned data.

InputKeyBd

Parameters: *basename, channel, terminal, line, position, prompt, shifted, timestamped*

Function: This instructs the terminal attached to client *basename* on channel to display the prompt at line and position and wait for data to be entered from the terminal keypad only. If *shifted* is set to "true", the terminal will start in shifted mode. *Timestamped* appends a (hhmmss) prefix to the returned data.

InputScanner

Parameters: *basename, channel, terminal, line, position, prompt, allowbreakout, timestamped*

Function: This instructs the terminal attached to client *basename* on channel to display the prompt at line and position and wait for data to be entered from the terminal scanner only. Setting *allowbreakout* to true allow user to "breakout" of scanner only mode by pressing

the end key on the terminal. A termID+CR will be sent to the host.

InputYesNo

Parameters: *basename, channel, terminal, line, position, prompt*

Function: This instructs the terminal attached to client *basename* on channel to display the prompt at line and position and wait for a Yes (Enter key or C key) or a No (0 key or B key) from the terminal keypad.

Note: C and B keys are used to facilitate keypad entry while scanning with the integrated laser.

InputPassword

Parameters: *basename, channel, terminal, line, position, prompt, shifted*

Function: This instructs the terminal attached to client *basename* on channel to display the prompt at line and position and wait for data to be entered from the terminal keypad only. The entered data is not displayed on the terminal.

InputSerial

Parameters: *basename, channel, terminal, line, position, prompt*

Function: This instructs the terminal attached to client *basename* on channel to display the prompt at line and position and wait for data to be received through the terminal serial port. Waiting for serial input can be bypassed by pressing the enter key on the terminal which will send an empty data string to the host (fires the **OnTermData** event handler).

OutputSerial

Parameters: *basename, channel, terminal, data*

Function: This instructs the terminal attached to client *basename* on channel to send data to the terminal's serial port. Data must be less than 231 characters in length for each call to **OutputSerial**.

SendDisplay

Parameters: *basename, channel, terminal, line, position, prompt*

Function: This instructs the terminal attached to client *basename* on channel to display the prompt at line and position. Must be followed by an **"Input"** method call to take effect.

ClearScreen

Parameters: *basename, channel, terminal*

Function: This instructs the terminal attached to client *basename* on *channel* to clear its display. Must be followed by an **"Input"** method call to take effect.

ClearLine

Parameters: *basename, channel, terminal, line*

Function: This instructs the terminal attached to client *basename* on *channel* to clear the specified line on its display. Must be followed by an **"Input"** method call to take effect.

SendDate

Parameters: *basename, channel, terminal, line*

Function: This instructs the terminal attached to client *basename* on *channel* to display date and time on the specified line number. Must be followed by an **"Input"** method call to take effect.

Beep

Parameters: *basename, channel, terminal, count*

Function: This instructs the terminal attached to client *basename* on *channel* to beep count times. Count may be a value from 1 to 9. Must be followed by an **"Input"** method call to take effect.

effect.

PlayVoice

Parameters: *basename, channel, terminal, msgnum*

Function: This instructs the terminal attached to client *basename* on *channel* to play voice message number *msgnum*. *Msgnum* may be a value from 1 to 99. Must be followed by an "Input" method call to take effect.

Relnit

Parameters: *basename, channel, terminal*

Function: This instructs the terminal attached to client *basename* on *channel* to re-initialize. Must be followed by an "Input" method call to take effect.

NOTE: Base Stations use the message "Buffer Reinitialized..." to indicate a single terminal re-initialization.

RelnitAll

Parameters: *basename, channel*

Function: This instructs all terminals attached to client *basename* on *channel* to re-initialize.

TestClient

Parameters: *none*

Function: This instructs the Server to "ping" all attached clients. Results are recorded in the log.

Events - TCP/IP COM

WDIPterm events occur when a specific condition is met. When an event is "fired", an event handler function in your application is called.

Though the details of exactly how it is done varies from one programming environment to the next, the source code skeletons for the various event handlers are automatically generated and inserted into your source code for you. See the samples for more specific information.

Each event passes relevant information to your event handler function. **OnTermData** passes the data that was keyed or scanned into the terminal.

Terminal ID is always passed as 0-63. A terminal ID value of 99 is used as a placeholder for logging purposes.

Once you have the event handler skeletons, you can proceed to add whatever functionality you desire to each event.

You must set the **ServerOn** property to true before any events can be fired.

OnTermBaseRegister

Data passed: *basename, channel*

Event: A base station on client *basename* has successfully powered up on *channel* and communicated with the host computer via the serial connection.

OnTermSignIn6

Data passed: *basename, channel, terminal*

Event: A six-line terminal has signed in on *channel* at client *basename*. Terminal ID is passed in *terminal*.

OnTermSignIn4

Data passed: *basename, channel, terminal*

Event: A four-line terminal has signed in on *channel* at client *basename*. Terminal ID is passed in *terminal*.

OnTermSignOut

Data passed: *basename, channel, terminal*

Event: A terminal has signed out on *channel* at client *basename*. Terminal ID is passed in *terminal*.

OnTermData

Data passed: *basename, channel, terminal, data*

Event: A terminal on *channel* at client *basename* has sent *data* in response to an **Input** method call.

OnTermNotSignedIn

Data passed: *basename, channel, terminal*

Event: A command has been sent to a *terminal* that is not signed in.

OnTermSequenceError

Data passed: *basename, channel, terminal*

Event: The one-for-one host prompt/terminal response protocol has been violated. The host cannot send a second **Input** command until it has received a response from the first **Input** command. If a base station receives 5 sequence errors in a row, a Host Logic error is generated and the base shuts itself down.

*While **PromptNET/ActiveX** will intercept and prevent most logic errors, they are still possible so you should implement this event handler!*

OnTermIllegalCommand

Data passed: *basename, channel, terminal*

Event: An illegal command has been sent to a terminal.

PromptNET/ActiveX is designed to prevent illegal commands but we may not have imagined all the ways in which our customers will want to use it!

OnTermUpArrow

Data passed: *basename, channel, terminal*

Event: The up-arrow button has been pressed on a terminal. You must issue another **Input** method call before **WDIPterm** can respond to another keypress on this terminal.

OnTermDownArrow

Data passed: *basename, channel, terminal*

Event: The down-arrow button has been pressed on a terminal. You must issue another **Input** method call before **WDIPterm** can respond to another keypress on this terminal.

OnTermLeftArrow

Data passed: *basename, channel, terminal*

Event: The left-arrow button has been pressed on a terminal. You must issue another **Input** method call before **WDIPterm** can respond to another keypress on this terminal.

OnTermRightArrow

Data passed: *basename, channel, terminal*

Event: The right-arrow button has been pressed on a terminal. You must issue another **Input** method call before **WDIPterm** can respond to another keypress on this terminal.

OnTermBeginKey

Data passed: *basename, channel, terminal*

Event: The BEGIN button has been pressed on a terminal. You must issue another **Input** method call before **WDIPterm** can respond to another keypress on this terminal.

OnTermEndKey

Data passed: *basename, channel, terminal*

Event: The END button has been pressed on a terminal. You must issue another **Input** method call before **WDIPterm** can respond to another keypress on this terminal.

OnTermSearchKey

Data passed: *basename, channel, terminal*

Event: The SEARCH button has been pressed on a terminal. You must issue another **Input** method call before **WDIPterm** can respond to another keypress on this terminal.

Portable Printers

Cameo and QL 3 Common Information

Both of these printers are stocked by Worth Data for the convenience of our users who need portable printing.

These printers do **not** require any special protocol; they do not require the “wake-up byte” as do other printers. They do require a special cable that can be ordered from Worth Data (part #C13); cable pin-outs are available in **Appendix C: Cable Pin-outs**.

Shipped with every Cameo or QL 3 printer ordered is a CD ROM with the Programmers Manual in PDF format and a label design program – **LabelVista**. This program allows you to design the program and create multiple format files that can be sent to the printer where they become resident in flash. Variable fields are defined and can then be filled in by the program when in operation.

Keep in mind the following information when using these versatile printers:

- The printer turn on ("Wake-up") is accomplished by the RF Terminal toggling the DSR line on the printer, so only the @S command and the data you are sending to the printer is needed.
- Once the RF Terminal has turned on the printer, it stays on until the host program turns it off using the POWER OFF COMMAND "ESC(0x1b)`p'(0x70)" described in the **Printing Systems Programming Manual**, or until the automatic shut-down takes place (2 minute default).
- The 231 character limit applies to your command string. See your **Portable Printing Systems Programming Manual** for details on programming your printer.

Zebra Cameo Printer

The Zebra “Cameo ” Printers are portable direct thermal receipt printers, (**not** label printers – the QL 3 below prints labels). Bar codes can be printed on the receipts, but you can’t print labels.

One model of the Cameo printer is available with a magnetic stripe reader, allowing magnetic stripe input to the RF Terminal using the @M (magstripe input) command.

The Cameo printer with magstripe input is capable of reading Track 1, Track 2 or Tracks 1&2. See your **Portable Printing Systems Programming Manual** for the correct character string to send in the @M command to turn on the magstripe reader. (see page 6-2 for details).

When the Terminal sends data to the host, it sends it in the following format:

RF Terminal ID + DATA + CR

Typically, the data is simply a string of characters, but in the instance of data coming from the magstripe reader, there are some additional characters you need to be aware of. The magstripe reader sends its data in the following formats:

Track 1:	T1: DATA
Track 2:	T2: DATA
Track 1&2:	T1: DATAT2: DATA

So, when the RF Terminal transmits the data to the host, it will be in the following format:

RF Terminal ID + T1: DATA + CR
OR
RF Terminal ID + T2: DATA + CR
OR
RF Terminal ID + T1: DATA + T2: DATA + CR

For further information, see your **Printing Systems Programming Manual** on the CD ROM shipped with the printer.

Zebra QL 3 Printer

The QL 3 Printer is used for label printing. It doesn't have Magstripe input. The classic application is for printing shelf labels during shelf price verification:

- The operator scans a shelf label.
- The Terminal transmits scanned data to the host computer.
- The host computer looks up the price, description, etc. and transmits the computer price back and sends the necessary commands to the attached QL 3 printer to prints a new shelf label with the correct price.
- The terminal operator then peels off the label and applies it to the shelf.

Each printer is shipped with a no charge roll of thermal paper that can be used for development, including determining the exact label size that best fits you needs and the capabilities of the printer.

We stock the 2" and 3" QL 3 printers with several label sizes immediately available including:

Part Number	Description	Price/Roll
E2L1	2"x1" Vinyl Shelf Adhesive Labels	\$3.50
E2L2	2"x1.25" Paper Permanent Adhesive Labels	\$2.50
E2L3	2"x2" Paper Permanent Adhesive Labels	\$2.50
E2L4	2"x1.25" Vinyl Shelf Adhesive Labels	\$3.00
E3L1	3"x1" Vinyl Shelf Adhesive Labels	\$7.50
E3L2	3"x1.75" Paper Permanent Adhesive Labels	\$5.00

Shelf adhesive labels are designed for ease of removal to facilitate replacement. Permanent adhesive labels are designed to stick and stay stuck, making removal difficult without leaving a residue.

Voice Message Operations

The RF Terminal's exclusive use of voice prompts allows you to overcome problems such as literacy, language and lighting. With proper planning, voice prompting can enhance your RF Terminal application, making it faster and simpler. Voice messages are recorded (or imported from existing sound files) and uploaded to the RF Terminal using the 7000 RF Terminal Voice Prompts Manager program included on the Utility CD. Playback of a voice prompt is triggered by a prompt from the host computer.

Why Use Voice Messages and Prompts?

- Voice messages can be in *any* language.
- The operator does not have to be able to read to perform some jobs.
- Voice Prompts can be very helpful in dimly-lit or extremely-cold environments.
- The data collection process is faster because the operator does not have to continually look at the screen for instructions. This is especially useful when you do not want or need to enter data from the keypad. Scanning bar coded numbers from a Quantity BARPAD can make keying unnecessary.
- Voice messages and prompts are a good way to keep the operator's attention focused on the job at hand. Audible error messages and warnings also help to limit mistakes and downtime.

Voice Prompts and the 7000 RF Terminal Voice Prompts Manager program

The 7000 RF Terminal Voice Prompts Manager program (which can be installed from the RF Terminal Utilities CD) makes it easy to manage your RF Terminal system's Voice Prompts:

- Record custom RF Terminal voice prompts using your computer's built-in or external microphone.
- Import custom RF Terminal voice prompts from existing sound files.
- Edit RF Terminal Voice Prompts to trim off any extra seconds of silence or noise before or after the actual words of the Voice Prompts.
- Increase the volume of RF Terminal Voice Prompts that aren't loud enough.
- Delete unwanted RF Terminal Voice Prompts.
- Rename RF Terminal Voice Prompts to correct or update the descriptions you had entered for them.
- Renumber RF Terminal Voice Prompts to change the Voice Prompt numbers assigned to them.
- Restore Default RF Terminal Voice Prompts you had replaced or edited.
- Send Voice Prompts to one or more RF Terminals.

See the 7000 RF Terminal Voice Prompts Manager program help file for complete instructions on using the 7000 RF Terminal Voice Prompts Manager program.

Tips for Using Voice Prompts

Up to 99 voice messages can be recorded and stored in the RF Terminal. Here are some tips on making your voice prompts user-friendly:

1. **Short messages** are preferable for prompts; most English prompts can be stated in ½ second. Instead of saying, “Enter the Item Number,” say “Item”. The typical RF Terminal operator does not want to hear long messages thousands of times. Error messages are typically longer because they are the exception and need to provide more precise instruction to the user.
2. **Record your voice prompts calmly.** A frantic sounding voice can become irritating, especially when heard repeatedly.
3. **Speak clearly.** Correct pronunciation will make the voice prompts easier to follow for all users. Use common words that all users will understand.
4. **Vary the tone of your voice for different prompts.** Using a different tone of voice or even a different voice for consecutive prompts or error messages will make it easier for the user to distinguish between them.
5. **Don't be discouraged** if your first attempts at recording Voice Prompts don't sound very good. Again, practice speaking clearly and calmly, and you'll soon get the hang of it.
6. **Be sure to record error messages for *all* possible problems** that the user may encounter during a session. Once the operator becomes accustomed to listening to the voice prompts, it may become easy to overlook a “display only” error message.

Assigning Error Messages

The RF Terminal comes from the factory with some voice prompts and error messages pre-recorded. You can change any of these messages but keep in mind that the error conditions are hardware-related and that the voice error messages they are linked to are fixed. For example, the “**Low Batteries**” message is located at message #98. Whenever the RF Terminal detects very low batteries, it will play message #98, regardless of what is recorded there. You could record “Happy Birthday” and the RF Terminal would broadcast it any time it detected the low battery condition. To avoid confusion, try to keep the error messages somewhat related to the error condition they represent.

Default Voice Messages

Here are the default messages and the numbers they are recorded under:

Message Recorded	Message #
Prompt	
ITEM	#01
QUANTITY	#02
Error messages	
LOW BATTERIES	#98
TRANSMISSION FAILED	#99

Troubleshooting

General Considerations

Site Test

The most basic tool for troubleshooting is the Site Test at 50 feet range. (See *Chapter 4* for the details on how to do a Site Test). If the Site Test fails at close range (50 feet), you have found the problem. The radio on either the Base Station or the RF Terminal is defective. A Terminal may operate poorly at a distance of less than 10 feet from the Base due to high transmitter power. Make sure to Site Test at least at 50 ft. range.

If you have multiple terminals and multiple Base Stations, after site test failure, you can determine if the failure is with the Terminal or the Base by substitution. If you have only one Terminal and Base, you have no way of knowing which has failed; you must call us and get an RMA for both units to be checked out at the factory in Santa Cruz or in Ireland.

If the Site Test passes, there is nothing wrong with the radios.

Changing the Battery

For RF Terminals, the most frequent cause of problems is a low battery that has either been ignored or undetected. The real test for the battery is to remove battery from a working unit and place it into a suspect unit.

Most of the time the battery becomes the problem as a result of:

- The operator ignores the **Low Batteries** message and doesn't finish up the transaction and immediately charge the battery. If you turn the unit off and turn it on again, the battery may have had time to "almost" recover. Unfortunately they will have so little reserve power that they will likely operate just long enough to produce some very screwy behavior on the RF Terminal. Intermittent laser beams, continuous beeping, a blank screen, etc. are just a few of the disastrous symptoms that can be exhibited.

Problems with a new installation:

"**Waiting for Base to Acknowledge**" is a normal message, generated when you first try to establish radio contact. If your Terminal continues to generate this message and it ultimately results in a "**Transmission Failed**" message, your radios are not communicating. Be sure they're on the same channel and try again. If you have multiple terminals, try another terminal. If the 2nd terminal also fails on the same channel, the base station is bad. If the 2nd terminal passes the Site Test, the first terminal is bad.

If the Terminal displays the "**Waiting on Host Prompt**" message, the host program is not communicating with the Base Station. There is no radio problem, because the Base Station has already acknowledged the Terminal's Sign In. The Terminal is waiting on the Host to tell it to do something. Try the demo program; if it works the problem is your program.

If using the Active X program with XP, be sure "connection pooling" is disabled.

If the demo program fails, the problem is one of the following:

- The cable between the Base Station and host computer is bad. Try the test with extension cables removed.
- The host COM port is bad or assigned to another device driver installed. Try another COM port or try another computer.
- RARELY!!! The RS232 chip on the Base Station is bad.

Terminal Error Messages

Message	Meaning – Action Required
Relay n Cannot be Heard by the Base Notify Supervisor	The terminal has established contact with Relay Station x. Relay Station x has attempted to communicate with the Base Station through the 422 cabling with no success. Cable is bad.
Transmission Failed To Retry, Move Closer And Press Enter	The terminal has tried 10 times to get its message through to the Base Station with no success. Could be result of bad radio in base or terminal. Could be the operator has gone out of range of the base- if so, move closer and press any key. Could also be that there are too many terminals competing for radio time on one base station.
One Way Not Allowed Base in Other Mode Press <Enter> Key	One-Way is not allowed if the Base is already in some other mode such as Two-Way or Site Testing which was not properly concluded. Also, if you are SIGNEd IN in One-Way mode and someone else SIGNs IN in Two-Way mode, the person in One-Way mode will be kicked out of the system with this message. Two-Way mode ALWAYS supersedes all other modes.
Site Testing Not Allowed, Base in Other Mode Press <Enter> Key	Site Testing is not allowed if the Base is already in some other mode such as Two-Way or One-Way which was not properly concluded. Also, Two-Way mode ALWAYS supersedes other modes. If you are Site Testing and someone SIGNs IN in Two-Way mode, you will be kicked out of the system with this error message.
No Firmware Detected 1 – Download Firmware 0 – Power off Terminal Press 0 or 1 now	The firmware has somehow been wiped out – probably from an interrupted firmware download. Press 1 to Download Firmware or press 0 to power off the terminal.
Duplicated Terminal ID, Notify Supervisor Press Any Key to Turn off Terminal	With one ID already SIGNEd IN to the host, a second terminal with the same ID tried to SIGN IN. Every terminal requires a unique ID for proper system operation.
RED LED	The Pick processor cannot communicate. Call for RMA.
GREEN LED	Base operating as a Base (default configuration)
YELLOW LED	Base operating as a Relay

Message	Meaning – Action Required
“Waiting for Base to Acknowledge...”	This is a normal message, generated when you first establish radio contact. If you continue to get this message and it results in a "Transmission Failed" message, your Radios in Base and Terminal are not communicating. Be sure they are on same channel. They may need repair.
“Waiting on Host Prompt”	Problem is between Host computer and Base station. Check to see if host application is running. Check serial parameters and eliminate any extension cables. Run the Demo program. Try another COM port or another computer.
“Base Station Shut Down Due to Host Logic Error, Cycle Terminal Power”	Problem is in host program. Notify programmer! If the Base Station receives 5 Sequence Errors in a row, it transmits the message to all terminals signed in and shuts down. Check your host program for the sequence error before starting up again. OR If the Base Station receives 5 messages addressed to a Terminal not Signed ON, it transmits this message to the all terminals signed in and shuts down. You will have to cycle power on the Base Station or you can send a command (*@EOT) from the host and have the Terminal Sign On again to continue. See Chapter 6, page 6-8 for more information on Sequence Errors .
“ Base Reinitialized X Cycle Power on RF Terminal and Sign-on again to Restart_ ”	Base Station has been reinitialized. If message reads “Base Reinitialized P”, then reinitialization is due to a power problem. If “Base Reinitialized H” then the reinitialization was initiated by the host program. Fix problem (cycle power on Base or re-initialize from host program).
“ Buffer Reinitialized Cycle Power on RF Terminal and Sign-on again to Restart_ ”	The host program has reinitialized the buffer in the Base Station for this terminal only. The Base is still operational and ready for you to power off your terminal, power on, and SIGN ON again. Other terminals are not affected.
LOW BATTERY Finish, Sign Off Charge Battery	Finish the transaction you have started. The Press F1 to Sign Out. Then turn off the Terminal and charge the battery. This is an early warning that the battery is getting low and should be charged soon.
CHARGE BATTERY UNIT SHUT DOWN	The terminal will display this message for 20 seconds, sign out, and turn off. The unit will not operate until the battery is charged.

- Two or more terminals with the same ID can generate all kinds of strange messages including those shaded

above.

- **Two bases on the same channel are big trouble.**

Sometimes you get an error message and after checking, everything on the Base seems to be set OK. Drop power on the suspect Base and try signing in again. If you get the same message, there is another Base answering which should not be on the same channel.

Troubleshooting specific problems

I can't communicate at all...

- First, check the communication link from the Base Station to the host. Use the following command to test the transmission of data from host to Base and back again to the host:
- @@*Edataaaaaaaa<EOT>
- where *dataaaaaaaa* is any string of data, terminated by EOT. This string should be sent from the host to the Base Station. If the data is received by the Base, it echoes it back to the host in the format:
- dataaaaaaaa<CR>
- where *dataaaaaaaa* is the data string from the original transmission, terminated by a CR (ASCII 13). This test verifies communication in both directions (host to Base, Base to host).
- If the data isn't echoed back, either your host COM port or the Base Station has a problem.
- Once you know the Base Station is communicating with the host correctly, compare the channel of the Base Station with the channel of the Terminal. Use Site Testing to check the communication of the Terminal to the Base and back. Make sure no other Terminals are in use, and go to Site Test mode on the Terminal. You should get 96-100% on first try at greater than 10 feet. If you don't, it's a good chance your radios need repair. Call Worth Data for an RMA.
- If you are using PICK or UNIX as your operating system, make sure the Base Station is set to "XON/XOFF Sensitive".

My response time is poor...

- First, do Site Test 50 feet from the Station. If it's not 90+%, the Radio in the Terminal or the Base Station is the problem.
- Second, run one of the demo programs. If the demo runs fast, it is your program that is slow.
- If you have good response time everywhere but on the outer fringe area you may need to relocate your Base Station.

I'm not getting the distance I need...

To maximize range, the Base Station and Relay(s) should be located:

- At the center of the area of intended coverage, and
- As high as possible - mounted on the ceiling of a room with the antenna pointing downward works the best. Sometimes just raising the Base Station to 12 feet will dramatically increase the distance, especially in warehouses or grocery stores with tall shelving. A Base Station mounted on the wall with the antenna parallel

to the floor is the worst position.

- In an unobstructed outdoor area a range of 3.3 miles or greater “line-of-sight” is possible but indoor “obstructed” range will be much less. Reflections and obstructions, depending on the density and material, can reduce the range to a few hundred feet indoors. Far better than typical WiFi systems.
- To accurately determine the hardware required to cover a particular area, you should use the Site Test mode built into the RF Terminal.

I can't communicate with the RS-232 port on my host CPU...

- This is one of the biggest problems called in. If you are not using our cables, check your cables first. If you have an extension cable, remove it for testing. If you have an extension cable of 80 feet or more attached to a Windows host, you need to be sure certain pins are not attached in the DB9 or DB25. See **Appendix C**; *RF Serial Pin-outs*.
- If you are using the PICK or UNIX operating systems, be sure you have set the Base Station to be "XON/XOFF Sensitive". You need to do this to prevent the XOFF code being sent as a "Base Initialization" message.
- Windows 95,98,2000,ME, NT; COM port setup should also be changed to turn off XON/XOFF. XON/XOFF is the default for Windows. You set these through the control panel, *System, Device Manager, Ports (COM & LPT), COM Port, Port Settings, Flow Control*. Set *Flow Control* to None.

RF Terminal Problems

When laser is triggered, it cycles power by itself – 1st screen

When a voice message plays, it cycles power by itself –1st screen

When I turn it on, it just beeps continually.

When I turn it on, the screen flashes continually.

- If the battery is very low, when turned on, the Terminal will just keep beeping; it is cycling power, over and over because the batteries are too low.
- If the batteries are at a specific low point, the laser triggering or playing a voice message will be just enough extra power draw to force the terminal to cycle power.
- Charge your Terminal for at least an hour and try again.

I get 6 beeps when the RF Terminal powers up...

- The unit needs repair. Call Worth Data for an RMA.

Problems reading Bar Codes

The reader won't beep when I try to read bar codes...

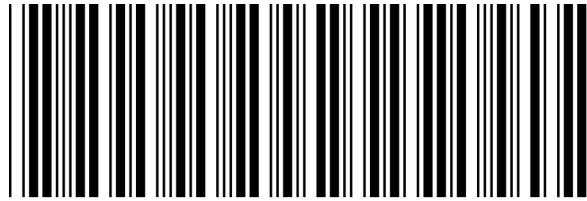
- Try reading a known good bar code - try the **1** on the Setup Menu bar pad table. Follow the steps for proper scanning technique discussed in **Appendix M**; *How to scan a bar code*.
- Make sure the reader is configured to read the type of bar code you are trying to scan. Most bar code types are *disabled* by default and need to be enabled using the Setup Menu or keypad while in Setup Mode.

I get extra characters at the beginning or end of my bar code data...

- Clear the Preamble and Postamble settings.

I have very poor read rates when scanning bar codes...

- Carefully follow the scanning instructions in **Appendix M; How to scan a bar code** when reading any and all bar codes. As straightforward as scanning may seem, many people who call with a complaint about poor read rates simply aren't doing it right.
- Try reading the following bar code below as an example of a known “good” bar code. This bar code is a Code 39 bar code and is readable by the RF Terminal set to its default settings.



TEST LABEL

- Make sure *your* bar codes have clearly defined dark bars and clean white spaces. If the bars are so light that they are gray instead of black or are so dark that they “bleed” into the white spaces, the printing of the bar codes is the problem. Whoever is printing the bar codes needs to make the necessary corrections.
- The bar code should also have a “quiet zone” of at least ¼” to the left of the first bar and to the right of the last bar. Make sure the beam covers the bar code completely and “overscans” a bit on each end.
- Check the laser beam window at the top of the unit and make sure it's not dirty or scratched.

Problems with Voice Prompts

- If you have any problems with RF Terminal Voice Prompts, read the “If you have problems” topic of the 7000 RF Terminal Voice Prompts program help file.

If you still have a problem...

- If you have a problem with your RF System, **consult the troubleshooting section of this manual FIRST**. As a last resort before calling for an RMA, you can follow the steps below to perform a diagnostic reset on your terminal. This resets everything back to the factory defaults, so be prepared to remake any setup changes (i.e. Terminal ID) you had made prior to the reset.
- Turn your terminal on, and press any key to bring up the Mode Menu.
- With the terminal displaying the Mode Menu, press the terminal's **2** key to select **Setup**.
- With the terminal displaying the RF Terminal Setup menu, press the terminal's **9** key to select **System Tools**.
- With the terminal displaying the System Tools menu, press the terminal's **3** key to reset all terminal settings to the factory defaults. Again, if you had made any setup changes (such as changing the Terminal ID, or enabling a bar code type) you will need to make those changes again following the reset.
- If you cannot find the answer here, or if doing a diagnostic reset does not help, call your Dealer or Worth Data for help.

- **Save the shipping box.** If you ever need to send the RF Terminal or any of its parts back for repair, use this box.
- Before you call your dealer or Worth Data for technical support, have your RF Terminal and related equipment in front of you and **be prepared to explain your problem in detail to the Technical Support Engineer.**
- The Engineer may ask you to go through some troubleshooting procedures while on the telephone. This will help them determine what is wrong and what the course of action should be. **Many problems can be resolved over the telephone and will not require that you return the equipment to us.** If you *do* need to return any of the RF equipment to Worth Data, the Engineer will issue an RMA number.
- If you do need to return the RF Terminal for ANY reason, **you MUST have an RMA number** first. Write the RMA number on the outside of the original shipping box and make sure to insure the shipment. All RMAs should be shipped back to the following address unless directed otherwise:

RMA #XXXXXX
Worth Data Inc.
623 Swift St.
Santa Cruz, CA 95060
831-458-9938

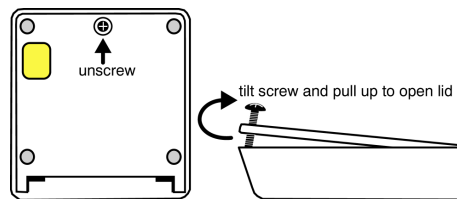
Appendixes

Channel and Jumper Changes

Opening a Base

As preparation for changing the Channel on a Base Station or changing the Base to operate as a Relay, the case must be opened to expose the circuit board with the switches and jumpers. Be sure you disconnect power before opening the case.

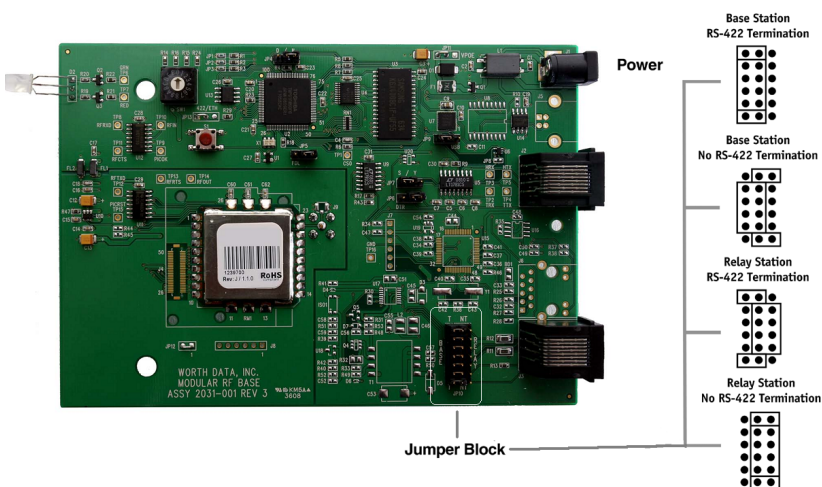
Turn your Base Station upside-down, and unscrew its single phillips head screw. If you don't completely remove the screw, you can use it as a lever to pull up on the cover.



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.

Changing a Base to a Relay

Moving the jumpers to any of the Relay positions causes the Base Station to operate as a Relay. A Base station blinks green on power up; a Relay blinks yellow on power up.



RS-422 Termination Jumpers

Refer to the circuit board diagram on page A-1 for details.

The Base can be jumpered to be 422 terminated or not terminated. By default, all Base stations are shipped as *terminated*. Use the following guidelines to change the termination for your system:

- If the Base has multiple strings of relays radiating from it, the Base would **not** be terminated.
- If the Base is first in a string, (not in the middle or end of a string), set the 422 jumpers to **Base w/RS-422 termination**.
- The last Relay in each string should have its jumpers set as a **Relay w/RS-422 termination**.

Channel Changes

To determine the current channel of a Base Station , power up the Base and watch the LED light on the front of the unit. On power UP, a Base LED will blink "channel +3" times. For example, a unit that blinks **5** times on power up is operating on **channel 2**. Channel 0 blinks 3 times, channel 5 blinks 8 times.

Changing the Channel on a Base/Relay

The Base Station and its related Relays must have their channel set to the same channel as the RF Terminals in their network. The channel is set on a Base or Relay by turning a rotary switch to the setting 0-5 (6 different channels to choose from). Use a very small flat head screwdriver to turn the switch to the desired number. See the circuit board diagram on page A-1 for location of the rotary switch.

Setting the Relay ID

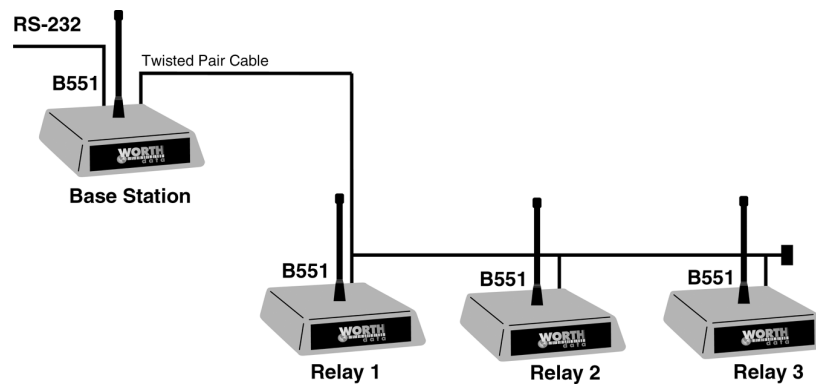
Each Relay must also have a unique ID, which is set by the RF Terminal Serial Configuration Utility.

Adding Relays

Connecting a Relay Station

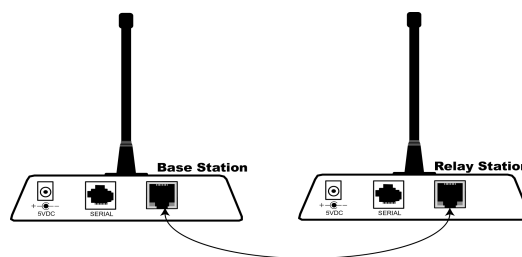
How it works...

A Relay station allows you to extend the area of your RF coverage. Relays are connected by cable to the Base station, acting as a remote antenna. More than one Relay can be added by “multi-dropping” additional Relays. Using a Relay requires changing the setup on the Base station in addition to added cabling. The diagram below shows how Relays are added:



Although Relays will extend your RF range, they do slightly slow down your response time. If response time is your problem, Relays may help *only* if the problem occurs on the *outer limits* of your range. Use **Site Testing** to help you determine if adding a Relay will help. If you are considering Relays, read **Chapter 4; Performance Issues** first.

If adding only one Relay, the cabling should run between the “Relay” port on the Base station and the “Relay” port on the Relay. In this example, both the Base Station and Relay should have jumpers set to “terminated”.

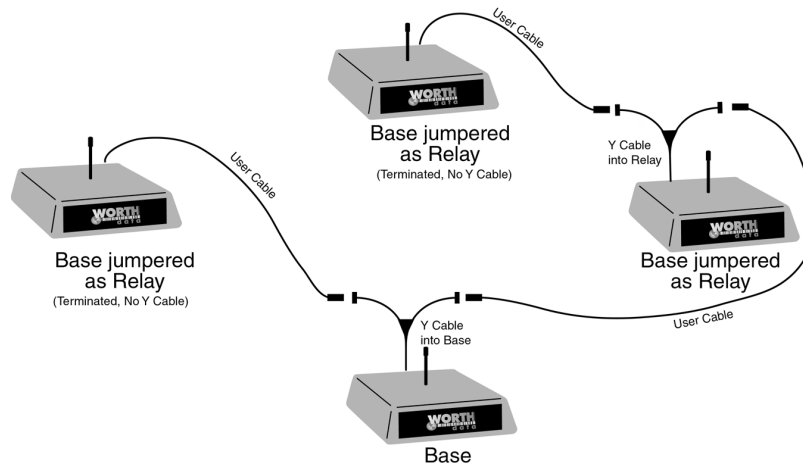


To add additional Relays, you must “multi-drop” them off a single bus line running from the “Relay” port on the Base station. See the section below for cabling requirements and pin-outs. It is very important to follow the pin-out directions carefully and to use the suggested cable type. The majority of problems we see are the result of incorrect wiring.

Each Relay requires it’s own power supply. There is no serial parameter setup required on a Relay as it is transmitting only to the Base station and not directly to a serial port.

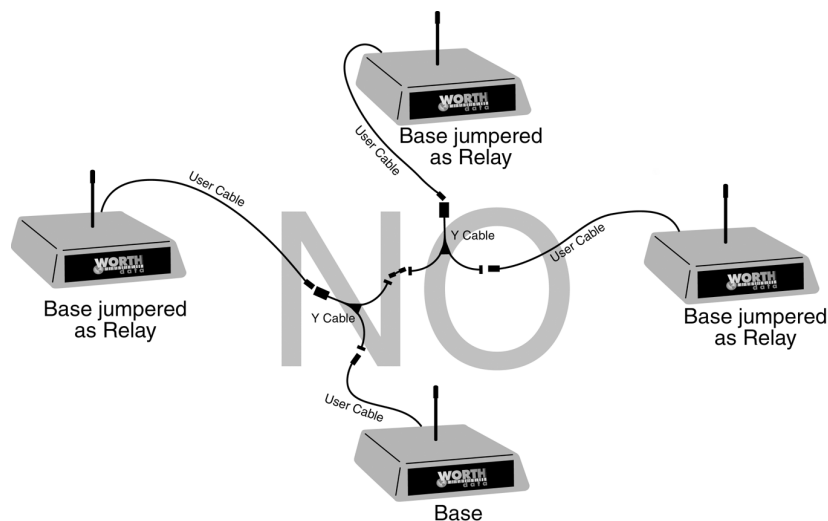
Routing the Wiring

The below diagram illustrates the **RIGHT** way to route your wiring and which units should be terminated. Notice this is the classical bus interface where the Base and Relays are connected to a “one-cable bus”. The bottom of the Y-Cables is connected into the unterminated base or relay(s). Notices that the two end units are terminated; the units in the middle are unterminated, including the Base in this example. Keep in mind that the maximum total cable length from end-to-end is 4000' for good quality twisted pair wire.



Correct Routing for Wiring

The next diagram illustrates the **WRONG** way to route your wiring and use the Y-cables. Sometimes people try to route everything through a panel or wiring closet – this will not work properly; it will generate excessive data noise and drag down the responsiveness of the Base and application. (With too much noise, the Base will stop working and issue a “Base Station Reinitialized” message to the terminals. If used, such a radial interface as below might appear to work most of the time, but it would be very sluggish and crash several times per day. Terminating or not terminating will be of no help. Do **Not** cable as shown below:



Incorrect Routing for Wiring

Relay Station RS422 Pin-outs

The **RF Relay Stations** are connected by twisted pair wire -- use **Belden 1227A1, Cat 5 wire**, or equivalent. The “Relay” port on the **Base Station** and the “Relay” port on the **Relay Station** are connected with a straight cable using the following pin-outs:

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

Make a cable with 5-5, 6-6, 2-2, and 3-3 (a straight cable); but, be careful that you select wires so that the 2 wire is in the twisted pair with the 3 wire, and the 5 wire is in the twisted pair with the 6 wire. **Do not use pre-terminated Ethernet cables since the pairing is different.**

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

Relay Test Plan and Failures

Relay Failure

Relay Station failures are often cable-related. If a Terminal puts out a “Who Can Hear Me?” message and a Relay that is for some reason *not* connected to the Base Station (bad cable, cut cable, broken connectors) hears it, it answers with the message:

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

At this point, it is up to the operator to notify someone that the Relay is not communicating with the Base and to check the cabling *first*. There is no message sent to the host, so it is very important that the operator that receives this message notify someone immediately.

Because relay cabling is often troublesome, we supply a test cable for isolating the user-made cable from the process. This test cable is so short that it doesn’t follow the rules of twists on the previous page – it is just a Ethernet patch cable for node, but adequate for testing the relay.

HINT: Use the suggested wire type, and if you’re doing your own crimping, be sure to use the expensive metal crimpers (\$100) and not the cheap plastic crimpers (\$15). Get someone familiar with making network (Ethernet) cables, but be sure to tell them **not** to use the Ethernet pin outs for the Relay Stations, (it has been tried more than once!).

Testing the Relay

To test communication with a Relay, first check out the radio by doing a Site Test on the offending Relay with all other Relays and Bases OFF. To check if a Relay is working with a Base Station, set the Base to a *different* channel than the Relay and set the Terminal channel to match the Relay channel. Then cable-connect the Relay to the Base (“Relay” port to “Relay” port).

Start your application on the host or use one of our demo programs provided with the Terminal (it’s a good way to test) - it takes 10 or more seconds for the Terminal to switch to the Relay. The delay is a result of the Terminal having to put out a "who can hear me" message when it doesn't get a response from the Base Station. The Relay responds to the Terminals "who can hear me" message and communication is established through the Relay. You will notice slightly slower throughput when working through the Relay.

Relay ID and Channel...

Relays should be set to the same channel as the Base station and RF Terminals that you will be using in your system. Determining the current channel is the same as on the Base station; power up the Relay and count the number of times the LED flashes (channel + 3). The default setting is channel **0** (3 flashes). Each Relay also requires a unique Relay ID; the default ID is **0**. A Relay will blink yellow; a Base blinks green.

Changing a Relay back to a Base

You can convert the Relay back to a Base Station by setting the Base/Relay jumper to the Base position. You can check the outcome by simply powering up the unit - a Base blinks green; a Relay blinks yellow.

Changing the Channel on a Relay

The Relay must have their channel set to the same channel as the RF Terminals in their network. The channel is set on a Relay by turning a rotary switch to the setting 0-5. Use a very small flat head screwdriver to turn the switch to the desired number.

Setting the Relay ID

If you only have one relay, there is no need to set the Relay ID which is shipped default as relay 1. If you need to change it or you have multiple relays, it must be changed using the *RF 7000 Base Serial Configuration Utility*.

RS-422 Termination

When adding Relays to a system, the last Relay(s) in the line(s) must be terminated. By default, all Base stations are shipped as terminated. Use the following guidelines to change the termination for your system: Refer to the circuit board diagram on the previous page for details.

- If the Base has multiple strings of relays radiating from it, the Base would **not** be terminated but each Relay would.
- If the Base is first in a string, (not in the middle or end of a string), set the 422 jumpers to **Base w/RS-422 termination**.
- The last Relay in each string should have its jumpers set as a **Relay w/RS-422 termination**. Any Relay that is *not* the last relay in the string would *not* be terminated.
-

Relay Station failures are often cable-related. If a Terminal puts out a “Who Can Hear Me?” message and a Relay that is for some reason *not* connected to the Base Station (bad cable, cut cable, broken connectors) hears it, it answers with the message:

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

At this point, it is up to the operator to notify someone that the Relay is not communicating with the Base and to check the cabling first. There is no message sent to the host, so it is very important that the operator that receives this message notify someone immediately.

RF Serial Pin-outs

Base Station to Host Pin-outs

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

F34 DB25 Null Modem Cable

These are the pin-outs for Cable F34, a DB25 Female to 8 pin modular RJ45 with pins 2 and 3 crossed, used for a Base connected directly to a 25 pin male host serial port.

Mod 8 RJ45	Function	DB25 Female
1	Frame Ground	1
2	Transmit Data	3
3	Receive Data	2
4	Signal Ground	7

F34 Null Modem Cable

Modular Pins 5-8 are connected to DB25 pins 5,6,8,4 but not used by the RF Base.

If you are planning to use a serial extension cable of 80 feet or more, you need to open the DB25 shell of our cable and be sure that only pins 1,3,2, and 7 are connected. All others should be cut. This is necessary to keep Windows from following noise transitions as handshaking transitions that can severely degrade the application or even crash Windows.

F36 DB9 Straight Cable

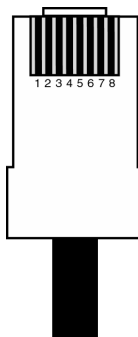
These are the pin-outs for Cable F36, a DB9 Female to 8 pin modular RJ45. This cable is used to connect the Base to a 9 pin Male host serial port.

Mod 8 RJ45	Function	DB 9 Female
1	Shell (chassis ground)	Shell
2	Transmit Data	2
3	Receive Data	3
4	Signal Ground	5

F36 9 pin cable

If you plan on building your own extension cables, you **must** use well shielded cable and you **cannot** use twisted-pair cable. You can order custom length RS-232 extension cables from Global Computer Supplies - phone 800-845-6225, part number ZCC4912X. Many other companies sell 10 ft., 25 ft., and 50 ft. DB9 Extension Cables including Radio Shack.

For all RJ Cable pin numbers, number from left facing you and the cable running to the down



to right with the metal pin side of the connector position

Relay Station RS422 Pin-outs

The **RF Relay Stations** are connected by twisted pair wire -- use Belden 1227A1, Cat 5 wire or equivalent. The *Relay Port* on the **Base Station** and the *Relay Port* on the **Relay Station** are connected with a straight cable using the following pin-outs:

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

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

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.

Firmware Upgrades

Updates are occasionally available for the *RF Terminal System* when new features or improvements are added.

RF Terminal Firmware Upgrades

The RF Terminal firmware can be upgraded by downloading new firmware into the RF Terminal from your computer.

Normal Firmware Download for a Terminal

The RF Terminal firmware can also be upgraded by downloading a file with the current firmware into the RF Terminal's flash EPROM using the 7000 RF Terminal Firmware Loader Windows program found on the RF Terminal Utilities CD.

If you have received a CD with the latest firmware or have downloaded the firmware from our website, <http://www.barcodehq.com>, download the firmware into the RF Terminal by following the instructions on the screens of the program for a normal Terminal firmware update.

Failsafe Firmware Download for a Terminal

If a terminal's firmware gets completely wiped out (the terminal's battery or power adapter are tested to be good, but the screen stays blank screen or only displays a cursor when you press the power button) you will need to do a "Failsafe firmware upgrade" to restore the firmware.

To do a Failsafe firmware upgrade on a terminal that has had its firmware completely wiped out, run the 7000 RF Terminal Firmware Loader program (it can be installed from the RF Terminal Utilities CD), select the "Failsafe" option, and follow the program's instructions as it walks you through the steps to perform a Failsafe firmware upgrade.

Base Station Firmware upgrades

You can download the latest firmware for the B5001 Base Station by going to our web page <http://http://www.barcodehq.com/downloads.html#7000rfterminal> and clicking the "B5001 Base Station Firmware" Download button.

To do a Base Station firmware upgrade, run the 7000 RF Terminal Firmware Loader program (it can be installed from the RF Terminal Utilities CD), select the "Base Station" option, and follow the program's instructions as it walks you through the steps to perform a Base Station firmware upgrade.

Code 39 Specifications

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



C39

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

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

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

American National Standards Institute
Customer Service
11 West 42nd St.
New York, NY 10036
<http://web.ansi.org>
document ANSI/AIM BC1-1995

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

Code 39 Advanced Features and Functions

Mod 43 Check Character

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

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		

Mod 43 Check character calculation for Code 39

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

Take the sum of the values assigned to each character:

$$1 + 2 + 3 + 33 + 34 + 35 = 108$$

1 2 3 X Y Z

Divide the sum by 43: (thus the name modulus 43)

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

Find the character corresponding with the remainder.

M (value 22) is the CHECK CHARACTER

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

Full ASCII Extension to Code 39

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

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

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

Full ASCII Table

Accumulate Mode

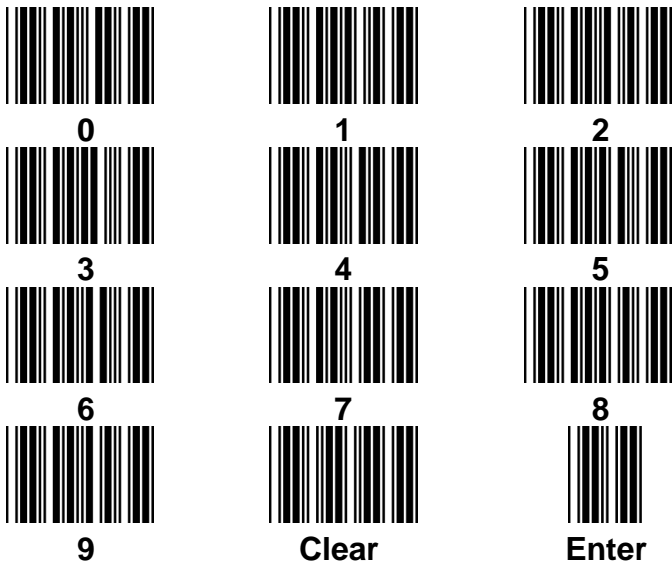
Accumulate Mode is an option allowing the RF Terminal to accumulate multiple bar codes in its buffer, then

transmit them to the computer as if they had been a single bar code. This is useful for entering quantities and other variable data.

Accumulate Mode works with Code 39, Code 93 and Code 128 only and can't be used with a check digit. When the RF Terminal reads a bar code with a **space as the first character**, 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**. Once it reads this last bar code, the entire buffer (including that last code) is transmitted as one long bar code. A “double-minus” sign (--) bar code clears the buffer. The **ENTER** code on this Barpad is a Code 39 *Start/Stop Character* only.






Accumulate Mode must be turned on using the bar coded Setup Menu or by using the keypad. *Accumulate Mode* is located in the Code 39 parameters. Choose **4** to *Enable* or **5** to *Disable* this feature.

This numeric Code 39 "Barpad" illustrates ACCUMULATE Mode. Scan **5, 3, 8**, and **Enter**. The RF Terminal transmits a single message of “**538**”.



Code 93 Specifications

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

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

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

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

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

Codabar Specifications



Codabar is widely used in libraries, blood banks, the cotton industry and transportation industries. Its character set consists of numbers **0** through **9**, and punctuation characters **+**, **.**, **-**, **:** and **\$**. Symbols **a**, **b**, **c**, **d**, **t**, **n**, ***** and **e** are used as start and stop characters. Characters are constructed of four bars and three spaces.

a12345b

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

Codabar start/stop transmission

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

Code 128 Specifications

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

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

Code 128 has three subsets, A, B and C. Subset A contains alphanumeric characters and unprintable control characters, subset B contains alphanumeric characters plus printable control characters and subset C contains only numeric characters and uses a 2-character encoding scheme to create a more compact bar code. Code 128 uses an internal Mod 103 check character that is not displayed by the bar code reader. Code 128 bar codes can be made up of only one subset or may be a combination of several.

12345

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

UCC-128/ EAN-128

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

The RF Terminal outputs the following for the special function codes and start sequences:

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

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

The **UCC Serial Shipping Container Code** specification calls for a 19 digit UCC/EAN 128 code with an additional Mod 10 Check digit (20 digits in all). The Mod 10 Check digit is calculated the same as the *Interleaved 2 of 5* example in **Appendix D**. It is the data length as well as the MOD 10 check digit that distinguishes the **UCC Serial Shipping Container Code** from other UCC /EAN 128 bar codes.

Scanning the appropriate bar codes on the RF Terminal Setup Menu enables **UCC/EAN 128**; or you can use the keypad in the PROGRAMMING MODE "Change Setup" option. If UCC/EAN 128 is *enabled*, you will be able to read both standard Code 128 bar codes as well as the UCC/EAN 128 bar codes with the *Function 1* character and the Mod 10 check character.



UCC-128 Shipping Container Code

If UCC/EAN-128 is enabled on the RF 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	<i>not transmitted</i>
Function Code 1	<i>transmitted</i>
2 Digit Qualifier	<i>transmitted</i>
7 Digit Data Portion	<i>transmitted</i>
1 Digit Mod 10 Check Digit*	<i>transmitted-</i>
1 Digit Modulus 103	<i>not transmitted</i>
Stop Code	<i>not transmitted</i>

*Calculated using 19digits-UPC method

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

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

Many of the specifications are available online at:

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

Interleaved 2 of 5 Code Specifications

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

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

- **Use one length of I 2 of 5 code.** Using one length of data allows you to tell the RF Terminal to look for one length of I 2 of 5 code only. By default, the RF Terminal is set to look for a 6 digit I 2 of 5 code but you can set the length to something different using the RF Terminal Setup Menu. Setting the length to **00** digits allows variable length bar codes scanning. If you must use the **00** setting, we recommend that you then use the “*Minimum/Maximum*” data length field when creating a program in the RF Terminal to check each field for the proper length.
- **Use a check digit.** Worth Data's **LabelRIGHT** printing program automatically calculates and prints a check digit upon request using the method below:

Interleaved 2 of 5 Mod 10 check digit calculation

- Assume that the bar code data is **1987**.
- 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

- Take the sum of the odd digits:

$$8 + 1 = 9$$

- Multiply the sum of the even digits by 3:

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

- Add the results of steps 3 and 4:

$$9 + 48 = 57$$

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

$$60 - 57 = 3$$

- 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

UPC / EAN Specifications



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



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

The exact UPC/EAN symbol specifications are available from:

Uniform Code Council, Inc.
7887 Washington Village Drive, Suite 300
Dayton, OH 45459
937-435-3870

Specifications are also available via the Internet at:

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

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

- If you plan to use a "supermarket-type" in-counter scanner to read the codes, specify a bar code height of at least .9" for an optimal first read rate.
- Make it an early practice to observe the numbering conventions of the UPC Council. Do not label unmarked merchandise with a bar code whose numbers may conflict with those already assigned. If products with these numbers are not in your store now, they are likely to be in the future, causing conflicts in your inventory system.
- The leading Number System Character, (the first number of the 11 digits to be entered) should conform to these UPC assignments:

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

2 Store-marked random weight items of meat and produce.

3 Reserved for National Drug Code and Health Related Items.

4 Use this leading digit for in-store marking of non-food items.

5 Reserved for coupons. Do not use this today, or you will not be able to process coupons through your system tomorrow.

Supplemental codes

The UPC standards include the addition of a 2 or 5-character supplemental code as well as the Extended Coupon Code. To read the supplements, you



must first enable them using the RF Terminal Setup Menu.

NOTE: *Enabling the supplements disallows the reading of UPC codes from right to left to assure that the 2 and 5 digit supplements are not get missed. Coupon codes can be read from right to left or left to right.*

ISBN Specifications

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

The RF Terminal has the option of transmitting in the ISBN format.



ISBN specifications are available from:

**American National Standards Institute
Customer Service
11 West 42nd St.
New York, NY 10036
<http://web.ansi.org>
document ISO 2108:1992**

The UPC/EAN checksum character

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

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

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

18314589938

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

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

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

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

Multiply the result of step 1 by 3.

$$33 \times 3 = 99$$

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

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

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

$$99 + 26 = 125$$

Subtract the result from the next higher multiple of 10.

Next higher multiple of 10 over 125 = 130

$$130 - 125 = 5$$

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

183145899385.

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

UPC-E Checksum Calculation

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

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

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

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

1234500006

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

01234500006

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

5

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

01234565

MSI/Plessey Specifications

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

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

The example bar code data is:

82345

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

835

- Multiply the new number by 2

$$(835) \times 2 = 1670$$

- Add the digits of product

$$1 + 6 + 7 + 0 = 14$$

- Add the even digits of the original number to the result in 3

$$2 + 4 + 14 = 20$$

- Subtract the result from the next highest multiple of 10

$$20 - 20 = 0$$

- New Check Digit

0

- Data with check digit is:

823450

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

The example bar code data is:

943457842

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

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

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

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

- Divide the sum by 11

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

- Subtract remainder from 11

$$11 - 8 = 3$$

- New Check Digit

3

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

- Data with check digit is:

943457823

How to scan a bar code

The RF Terminal is available with an optional internal laser bar code scanner. This section will include information on different scanners as well as how to use each one. You can use this information to compare the built-in scanner with other types of bar code scanners that are also available from Worth Data.

Laser Scanners

If you are using a laser scanner, technique is not critical. The scanners are “point-and-shoot”; you can’t miss. Upon triggering the beam, the laser scans the bar code multiple times (100 scans per second) until it has a good read, at which point it automatically shuts off. These scanners are more expensive, but virtually foolproof. They read from a distance, so they are much more convenient for distance shelf scanning or scanning in tight spots. Different laser scanners have different distance capabilities. **Table M-1** shows the comparison of all the laser scanners available from Worth Data.

Table M-1. Scanner Comparison Chart

6 mil = high density 40 mil = low density 100 mil = very low density (with paper and retro-reflective label stock)

Scanner	Hi Density Code 39	UPC 100%	40 mil Code 39	Paper 100 mil Code39	Retro-Reflective 100 mil Code 39
LZ150 Laser	0.5" – 4"	0.5 - 7"	1" – 12"	na	20" – 40"
LZ400 Laser	0.5" – 9"	0 – 17"	3" – 44"	9" – 50"	18" – 9.5 ft.
Integrated Laser in Terminal	1" – 7"	0 – 10"	4" – 29"	10" – 32"	18" – 6.5 ft.
PSC Long Range	7" – 11"	7" - 31"	11" – 9 ft.	24" – 15 ft.	48" – 17 ft.

To scan a bar code using your laser

scanner, (whether it be a handheld or integrated)

- put your RF Terminal in One-Way mode with the host computer program not running; or even unplug the serial cable,
- point the laser scanner at the bar code at about 6" away.
- Pull the trigger (or push the button on an integrated model) and line up the beam on the bar code. If you don’t get a read, vary the distance of the scanner from the bar code by pulling up or moving down. The idea is to scan through the center of the bar code.

Laser Options

Several options are applicable to all laser scanners that are used with the RF Terminal. These options are: 1) Longer timeout on the laser reading, and 2) Double decode required.

Longer Laser Reading: A temporary solution to problem bar codes is sometimes to increase the length of the time the scanner attempts to read, from the default 2-second beam to a 4-second beam.

Double Decode: The default setting for the RF Terminal is one successful decode results in a “good read”. If you are getting incorrect reads, (due to defective bar codes), a temporary solution is to turn on make the RF Terminal perform two straight identical decodes before beeping, outputting data, and completing a “good read” read.

There are two **Setup Options** that do not apply to the LZ300. The two options are:

- “**Aiming Laser Dot**” for a predetermined time before the laser beam expands into a “line” for reading.
- “**Difficult Code 39 Reading**” for reading Vehicle Identification Numbers (VIN) through the automobile

windshield. This applies only to the external tethered LZ400 Laser Scanner.

Aiming the Laser Dot:

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

"Difficult Code 39 Reading":

This setting facilitates reading of difficult Code 39 bar codes such as the Vehicle Identification Number (VIN number) on automobiles, especially reading through a windshield. VIN numbers are long, often weathered, often dirty, and challenging to read.

To enable the more aggressive Code 39 algorithms necessary to read windshield VINs change the **Decode Option** to 1 or 2 in the **Code 39 Options** menu.

A clean windshield also makes reading bar codes easier.

ASCII Code Equivalent Table

The 128 ASCII codes, their 3-digit decimal equivalents and 2-digit hex equivalents are detailed in the below table.

char	hex	3 digit ASCII	char	hex	3 digit ASCII	char	hex	3 digit ASCII	char	hex	3 digit ASCII
NUL	00	000	SP	20	032	@	40	064	'	60	096
SOH	01	001	!	21	033	A	41	065	a	61	097
STX	02	002	"	22	034	B	42	066	b	62	098
ETX	03	003	#	23	035	C	43	067	c	63	099
EOT	04	004	\$	24	036	D	44	068	d	64	100
ENQ	05	005	%	25	037	E	45	069	e	65	101
ACK	06	006	&	26	038	F	46	070	f	66	102
BEL	07	007	'	27	039	G	47	071	g	67	103
BS	08	008	(	28	040	H	48	072	h	68	104
HT	09	009	)	29	041	I	49	073	i	69	105
LF	0A	010	*	2A	042	J	4A	074	j	6A	106
VT	0B	011	+	2B	043	K	4B	075	k	6B	107
FF	0C	012	,	2C	044	L	4C	076	l	6C	108
CR	0D	013	-	2D	045	M	4D	077	m	6D	109
SO	0E	014	.	2E	046	N	4E	078	n	6E	110
SI	0F	015	/	2F	047	O	4F	079	o	6F	111
DLE	10	016	0	30	048	P	50	080	p	70	112
DC1	11	017	1	31	049	Q	51	081	q	71	113
DC2	12	018	2	32	050	R	52	082	r	72	114
DC3	13	019	3	33	051	S	53	083	s	73	115
DC4	14	020	4	34	052	T	54	084	t	74	116
NAK	15	021	5	35	053	U	55	085	u	75	117
SYN	16	022	6	36	054	V	56	086	v	76	118
ETB	17	023	7	37	055	W	57	087	w	77	119
CAN	18	024	8	38	056	X	58	088	x	78	120
EM	19	025	9	39	057	Y	59	089	y	79	121
SUB	1A	026	:	3A	058	Z	5A	090	z	7A	122
ESC	1B	027	;	3B	059	[	5B	091	{	7B	123
FS	1C	028	<	3C	060	\	5C	092	|	7C	124
GS	1D	029	=	3D	061	]	5D	093	}	7D	125
RS	1E	030	>	3E	062	^	5E	094	~	7E	126
US	1F	031	?	3F	063	_	5F	095	DEL	7F	127

Full ASCII Equivalent Table

While the new 7000 series RF Terminals are fully software compatible with the older 70 and 700 series terminals, there are a few differences between them. The differences between this new generation of Worth Data RF Terminals and the generation referred to within this manual are:

- 64 Terminals per Base Station instead of 16. Valid Terminal IDs are 0-9,A-Z,a-z, and – =.
- Valid Channels are 0-5.
- Base Station parameters, (Baud Rate, Parity, ... Security Code) are not set through the Terminal, but rather are set with a Windows program, the Series 5000 Base Station Serial Configuration Utility, which is on the Utilities CD.
- The maximum number of characters that can be sent to a Base Station by a host program is 1000 instead of the old 247.
- Speaker and Headphone volume can be controlled by a change in the RF Terminal's Setup. Go to Setup Mode, choose RF Terminal, and then choose Speaker.

- The 7000 series RF Terminal does not have a choice of battery types. It comes with a built-in Li-Ion rechargeable battery. The 5000 series Base 5V power supply is now used to charge the battery on the Terminal as well. A full charge cycle takes 2-3 hours.
- Voice prompts are now recorded (and/or imported from sound files) on the PC and uploaded to the RF Terminal using the 7000 RF Terminal Voice Prompts Manager program provided on the Utilities CD. Up to 99 voice prompts can be stored in the Terminal with a total time of about 95 seconds.

There are other differences that are simply advantages:

- Greater distance (3.3 miles vs. 3000 feet)
- Longer battery life (12 hours instead of 10 hours)
- Optional “gun” handle with secondary battery
- Faster battery recharging (2-3 hours instead of 8 hours)
- Color TFT display standard
- Smaller and less weight
- Faster transaction times