Series 3100/3500

Product Reference Guide

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Symbol Technologies, Inc. One Symbol Plaza, Holtsville N.Y. 11742

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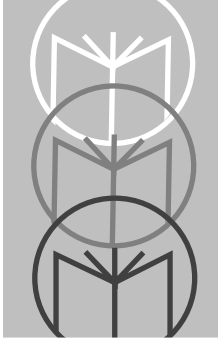

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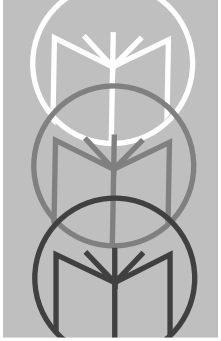

About This Manual

The *PDT 3100/3500 Product Reference Guide* provides general instructions for setup, initialization, operation, troubleshooting, and maintenance.

Notational Conventions

The following conventions are used in this document:

- "Operator" and "User" refer to anyone using an application on a PDT 3100/3500 terminal.
- "PC" refers to the IBM personal computer or compatible system that you are using to develop applications.
- "Terminal" refers to a PDT 3100/3500 terminal.
- "You" refers to the administrator who is using this manual as a reference aid to install, configure, operate, maintain, and troubleshoot the PDT 3100/3500 terminal.
- **<Bracketed Bold>** type indicates keystrokes on the terminal or PC. For example:

  Select the <**F1**> key on the PC to access on-line help.

- **Bold** type is used to identify menu items and input or text fields on a terminal screen
- *Italics* are used:
  - for the names of parameters in function prototypes and variable names in usage and syntax descriptions
  - to highlight specific items in the general text
  - to identify chapters and sections in this and related documents
- Square brackets [] in a command line enclose optional inline parameters.
- The piping symbol | has the effect of "or" when it is used to separate inline parameters on a command line; i.e., it separates alternative values for parameters.
- Bullets (•) indicate:
  - action items

  - lists of alternatives
  - lists of required steps that are not necessarily sequential
- Sequential lists (e.g., those that describe step-by-step procedures) appear as numbered lists.

Related Publications

The following is a list of documents and publications that you may find useful if you want to know more about the PDT 3100/3500 terminal itself or about the tools and utilities that are available for writing applications for the terminal.

Documents Available from Symbol Technologies

- *PDT 3100 Quick Reference Guide*
  p/n 70-35895-01
- *PDT 3500 Quick Reference Guide*
  p/n 70-16646-XX
- *Series 3000 Application Programmer's Guide*
  p/n 70-16308-XX
- *Series 3000 Application Programmer's Reference Manual*
  p/n 70-16309-XX
- *Series 3000 System Software Manual*
  p/n 70-16310-XX
- *CRD3100-1000, 3100-4000 Quick Reference Guide*
  p/n 70-11313-XX
- *3115 Communications/Charger Adapter Inst. Instructions*
  p/n 70-11314-XX
- *Spectrum 24 Access Point User's Guide*
  p/n 70-12057-XX
- *Spectrum24 Flash Disk Addendum*
  p/n 70-31437-XX

Service Information

If you have a problem with your equipment, contact the Symbol Support Center for your region. See page ix for contact information. Before calling, have the model number, serial number, and several of your bar code symbols at hand.

Call the Support Center from a phone near the scanning equipment so that the service person can try to talk you through your problem. If the equipment is found to be working properly and the problem is symbol readability, the Support Center will request samples of your bar codes for analysis at our plant.

If your problem cannot be solved over the phone, you may need to return your equipment for servicing. If that is necessary, you will be given specific directions.

Symbol Support Center

For service information, warranty information or technical assistance contact or call the Symbol Support Center in:

United States
Symbol Technologies, Inc.
One Symbol Plaza
Holtsville, New York 11742-1300
1-800-653-5350

Canada
Symbol Technologies Canada, Inc.
2540 Matheson Boulevard East
Mississauga, Ontario, Canada L4W 4Z2
905-629-7226

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If you purchased your Symbol product from a Symbol Business Partner, contact that Business Partner for service.

Warranty

Symbol Technologies, Inc ("Symbol") manufactures its hardware products in accordance with industry-standard practices. Symbol warrants that for a period of twelve (12) months from date of shipment, products will be free from defects in materials and workmanship.

This warranty is provided to the original owner only and is not transferable to any third party. It shall not apply to any product (i) which has been repaired or altered unless done or approved by Symbol, (ii) which has not been maintained in accordance with any operating or handling instructions supplied by Symbol, (iii) which has been subjected to unusual physical or electrical stress, misuse, abuse, power shortage, negligence or accident or (iv) which has been used other than in accordance with the product operating and handling instructions. Preventive maintenance is the responsibility of customer and is not covered under this warranty.

Wear items and accessories having a Symbol serial number, will carry a 90-day limited warranty. Non-serialized items will carry a 30-day limited warranty.

Warranty Coverage and Procedure

During the warranty period, Symbol will repair or replace defective products returned to Symbol's manufacturing plan in the US. For warranty service in North America, call the Symbol Support Center at 1-800-653-5350. International customers should contact the local Symbol office or support center. If warranty service is required, Symbol will issue a Return Material Authorization Number. Products must be shipped in the original or comparable packaging, shipping and insurance charges prepaid. Symbol will ship the repaired or replacement product freight and insurance prepaid in North America. Shipments from the US or other locations will be made F.O.B. Symbol's manufacturing plant.

Symbol will use new or refurbished parts at its discretion and will own all parts removed from repaired products. Customer will pay for the replacement product in case it does not return the replaced product to Symbol within 3 days of receipt of the replacement product. The process for return and customer's charges will be in accordance with Symbol's Exchange Policy in effect at the time of the exchange.

Customer accepts full responsibility for its software and data including the appropriate backup thereof.

Repair or replacement of a product during warranty will not extend the original warranty term.

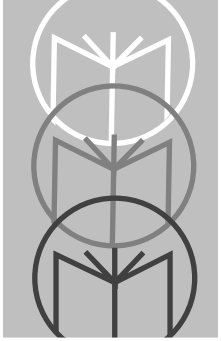
Symbol's Customer Service organization offers an array of service plans, such as on-site, depot, or phone support, that can be implemented to meet customer's special operational requirements and are available at a substantial discount during warranty period.

General

Except for the warranties stated above, Symbol disclaims all warranties, express or implied, on products furnished hereunder, including without limitation implied warranties of merchantability and fitness for a particular purpose. The stated express warranties are in lieu of all obligations or liabilities on part of Symbol for damages, including without limitation, special, indirect, or consequential damages arising out of or in connection with the use or performance of the product.

Seller's liability for damages to buyer or others resulting from the use of any product, shall in no way exceed the purchase price of said product, except in instances of injury to persons or property.

Some states (or jurisdictions) do not allow the exclusion or limitation of incidental or consequential damages, so the proceeding exclusion or limitation may not apply to you.



Chapter 1
The Series 31XX/35XX System

Chapter Contents

Introduction

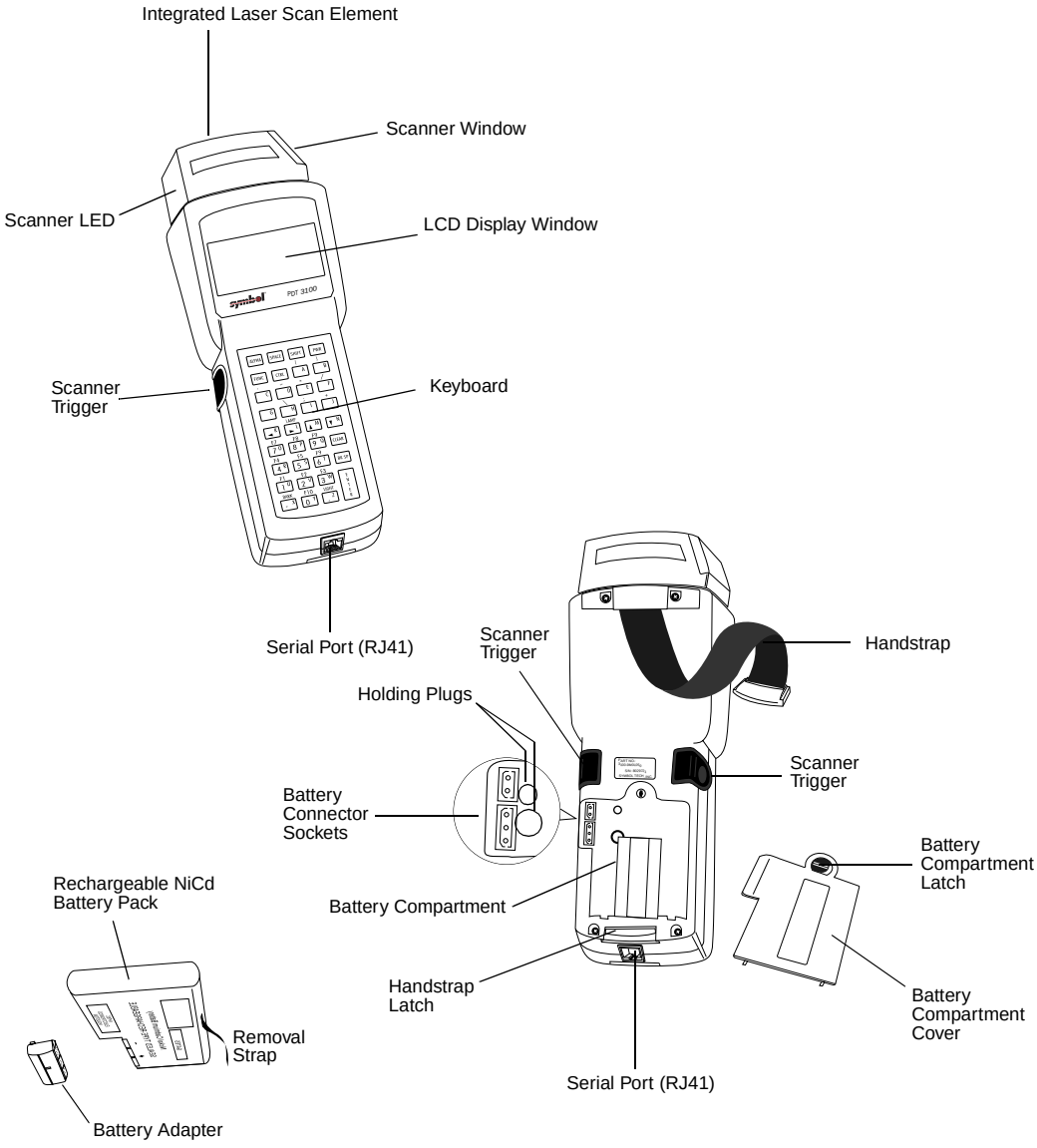
The Series 31XX / 35XX terminals are lightweight, battery powered, hand-held portable data collection devices. Data is entered from the keyboard, an integrated laser scanner, or an attached laser scanner.

As remote terminals, the PDT 31XX, and PDT 35XX collect and store data that is later uploaded to a host computer. The 31XX and 35XX are batch terminals (no radio). Radio terminals include the 3110, 3510, and 3124 for use in a Spectrum One® radio network; the 3140 and 3540 operate in a Spectrum24™ radio network environment.

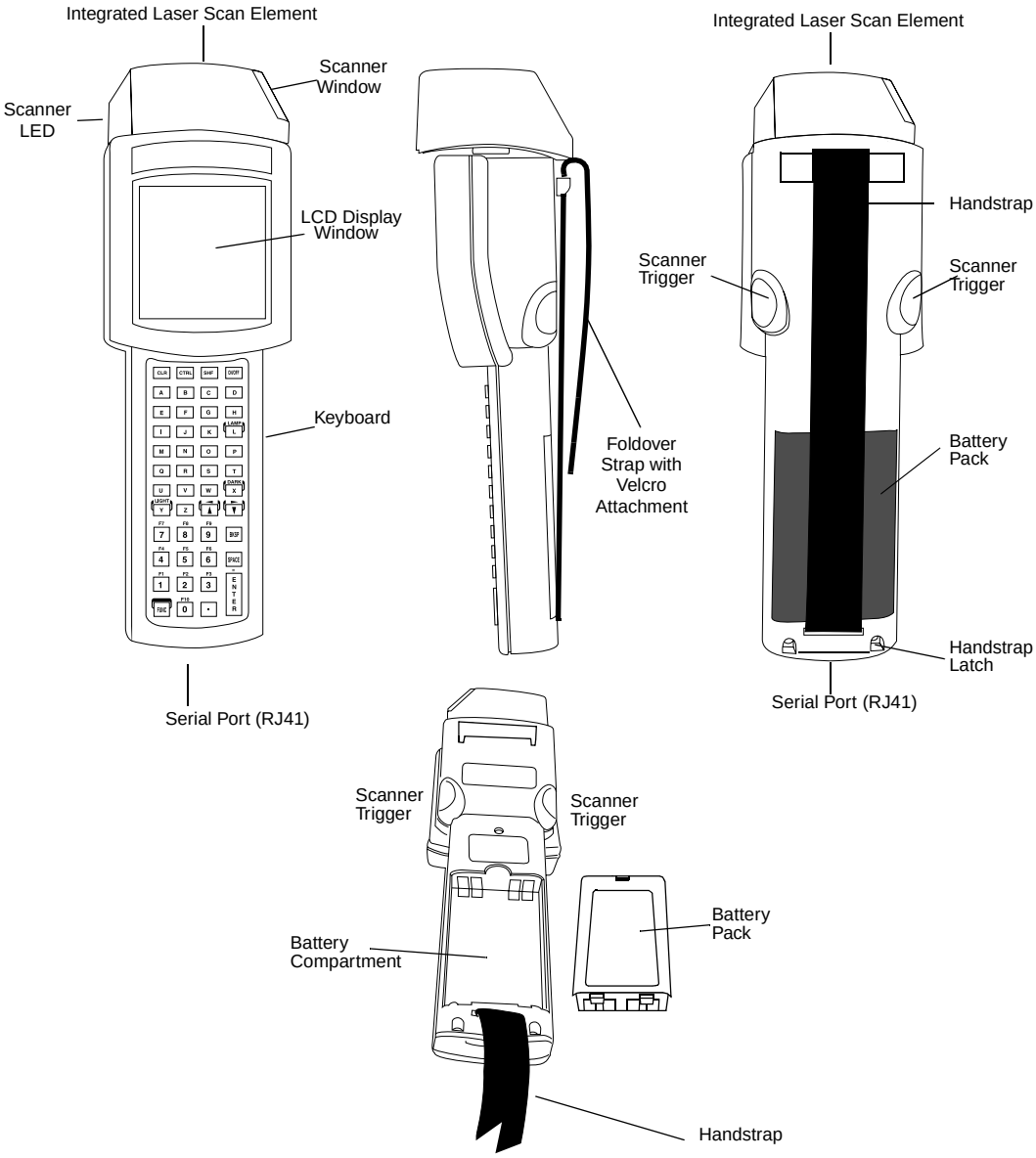
The operating system is DR DOS™. It is compatible with and extends the industry-standard IBM PC-DOS™. DR DOS provides access to a number of commercially available programming tools. Additional programming tools are available from Symbol for easier system programming and access to special features.

Power saving features of the Series 3100 / 3500 include auto-off and power save modes, which reduce power consumption until an operator provides input. These features conserve battery power, lengthening the time between charges or replacement.

Parts of the Series 3100



Parts of the Series 3500



Accessories

The following accessories are available for Series 3100/3500 terminals.

Battery Chargers

Series 31XX/35XX terminals use any one of the following:

- alkaline batteries (PPT 31XX only)
- rechargeable Nickel Cadmium (NiCd)
- rechargeable Nickel Metal Hydride (NiMH) battery packs.

NiCd and NiMH batteries are charged using one of the charging accessories listed below.

Table 1-1. Battery Charging Accessories

Accessory	Part Number	Batteries Charged
Single-Slot Cradle	CRD3100-100U (US version) CRD3100-100I (International)	All
Four-Slot Cradle	CRD3100-400U (US version) CRD3100-400I (International)	All
Communications/Charger Adapter 15 Volt Adapter	3115-000 59915-00-00(US version)	KT-12596-01
Universal Four-Slot Charger	3004-xxx	KT-12596-01 KT-12596-02
UBC 1000 Charger	UBC1000-xxxx	All

Rechargeable batteries available from Symbol include:

For PDT 3100: 400 Mah (NiCd), 600 Mah (NiMH).

For PDT 3500: 800 Mah (NiCd), 1200 Mah (NiMH).

Scanners

PDT 31XX / 35XX terminals may use either integrated or attached scanners. A range of available integrated scanners gives a range of possible scanning performance.

- standard range 1-D scanning
- long-range 1-D scanning
- standard range 1-D and 2-D scanning.

For terminals without an integrated scanner, the following attachable scanners are available from Symbol:

- LS 2000 (1-D)
- LS 3000 (1-D)
- LS 4800 (1-D, 2-D)
- LS 9100 (1-D)
- LT 1700 (1-D)
- LP 1500 (wand, 1-D)
- PDF 1000 (1-D, 2-D)

Radio and Network Options

Spectrum One® Network

The PDT 3110 and 3510 includes an internal radio frequency transmitter / receiver for use in a Symbol Spectrum One network.

The PDT 3124 includes a 2.4 GHz radio for use in Europe.

Spectrum24™ Network

The PDT 3140 and 3540 include an internal radio frequency transmitter / receiver for use in a Symbol Spectrum24 network.

Flash Disk

The PDT 3140 and 3540 optionally include an additional 1 MB of non-volatile memory or “flash disk” which is compatible with a standard DOS disk.

Printers

The following printers can be used with Series 31XX/35XX terminals:

- Monarch Rascal
- Monarch Renegade
- ComTec 2-inch, 3-inch, 4-inch, and 3-inch receipt printers

Miscellaneous Other Accessories

Holsters are available for PDT 31XX and PDT 35XX terminals, and for tethered scanners.

Before You Use the Terminal. . .

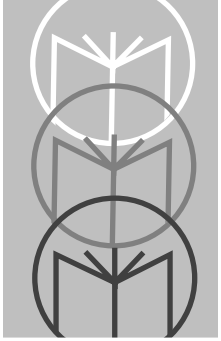
Install and Charge Battery

Prior to using the PDT 31XX/35XX for the first time, install the battery. If the terminal uses a Nickel Cadmium (NiCd) or Nickel Metal Hydride (NiMH) rechargeable battery, charge the battery before use (refer to Chapter 6).

Load the Appropriate Software

What software you load and how you load it depends on several factors:

- If this unit is intended for use in batch applications (3100/3500) or in a Spectrum One network environment (3110/3510), refer to Chapter 2 for information on loading the software.
- If this unit is intended for use in a Spectrum24 network environment (3140/3540), refer to Chapter 3 for general information on Spectrum24 and software loading procedures.



Chapter 2 Batch and Spectrum One Terminal Setup

Chapter Contents

Introduction

Before using a Series 31XX/35XX terminal, perform the following procedures:

- install the battery (Refer to Chapter 6)
- charge the battery, if using a Nickel Cadmium (NiCd) or Nickel Metal Hydride (NiMH) rechargeable battery (Refer to Chapter 6)
- Load the system files and application(s).

Programs are stored in the terminal's nonvolatile memory (NVM), also called the application EEPROM.

Hardware Requirements

The following hardware is required to initialize a batch or Spectrum One radio terminal:

- Terminal
- 1- or 4-Slot Cradle

  OR

  3115 Charging and Communications Adapter
- RS-232 Serial Null Modem Cable
- Power Supply
- Host PC

Communications

For terminals being used in a direct communications (batch) environment or a Spectrum One network environment, applications are transferred from a host computer to the terminal:

- over a communications line using a null modem connected to the cradle

  OR
- through the communications / charger adapter.

The procedure uses the SENDHEX command on the host computer and the Program Loader function (from Command Mode) on the terminal.

> **Note:** For details on the SENDHEX command, refer to the *Series 3000 Application Programmer's Manual*.

Other software may be used in place of SENDHEX.

Hardware Setup

Connect Host and Cradle

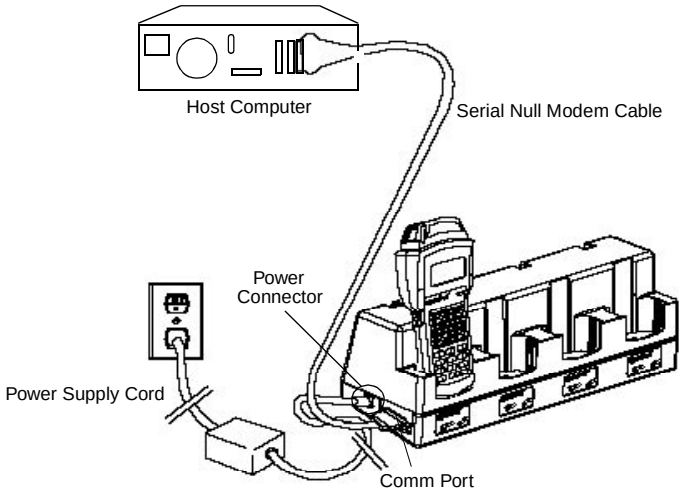


Figure 2-1. Cradle Setup for 3100/3110 and 3500/3510 Initialization

Note: The procedure for connecting 1- and 4-slot cradles is the same.

1. Plug the RS-232 serial cable's connector into the cradle's communication port.
2. Connect the other connector to the host computer's serial (COMM) port.
3. Connect the power supply cord's round plug to the power connector on the side of the cradle (3165: power supply p/n 59915-00-00 for domestic use, 60507-00-00 for international use; 3166: power supply p/n 60153-00-00 for domestic use and 60174-00-00 for international use).
4. Connect the power supply's AC plug to a standard electrical outlet.

   The green and red indicators light for about 3 seconds, blink for 3 seconds, then go out.
5. Place the terminal in the cradle.Verify that the terminal is OFF.
6. Go to *Loading the Program*.

Connect Host, 3115 CCA

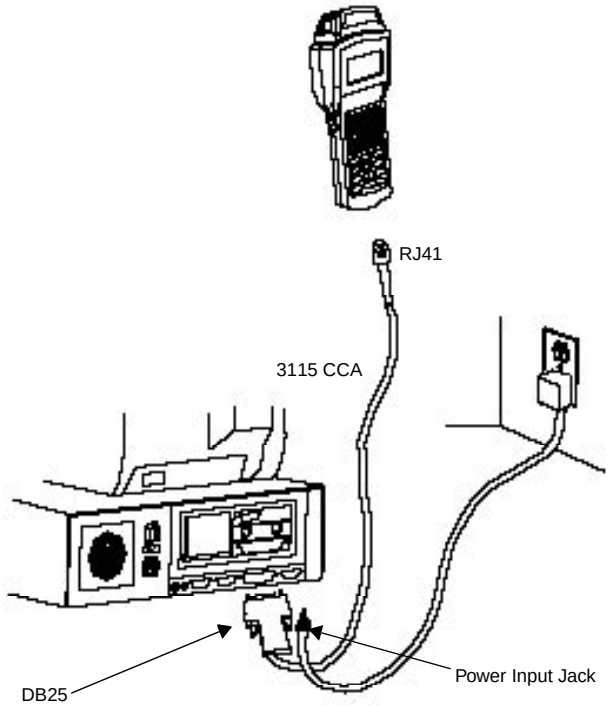


Figure 2-2. 3115 CCA Setup for 3100/3110 and 3500/3510 Initialization

1. Verify that the terminal is OFF.
2. Plug the 10-pin RJ-41 connector in the terminal base.
3. Plug the DB25 connector into the host's communications port.
4. Go to *Loading the Program*.

Caution

The 3115 CCA cable should be used to charge ONLY the KT-12956-01 NiCd battery pack.

Note: It is not necessary to connect to a power supply for communications.

Loading the Program

Note: To cancel communications at any time during the session, press **CLEAR** on the terminal. The session stops immediately.

To download the program, initiate the communications software on the host computer and terminal as described in the following sections.

Note: Communication parameters specified on the host and the terminal must match. These parameters typically are:

38400 bps
7 bit data
Odd parity
Xon / Xoff flow control

Note: To program the EEPROM, the terminal must be connected to the host through a cradle or the 3115 CCA.

Initiate Host Communications Software

1. Power on the host computer.
2. Start the communication program.
3. Enter the SENDHEX command.

   `sendhex` *`pgmname`* `38400 com2`

   where:

SENDHEX	is the command.
pgmname	is the application being loaded (.hex extension is optional).
parameters	Communications parameters follow the program name. Parameters include baud rate, communications port, data bits, parity, and flow control. To accept the default parameters, do not enter a value.

   In the example, the baud rate is set to 38400 bps and the communications port to COM2. The default values are accepted for the remaining parameters.

Note: Versions of SENDHEX earlier than 3.0 do not support flow control. If you use an earlier version and encounter communication errors, use a lower baud rate.

4. SENDHEX displays the prompt:

   Press <**Enter>** to begin communications.

5. Do NOT press **<ENTER>** yet. Before starting communications (refer to *Starting Communications*), set up the terminal as directed in *Initiate Terminal Communications.*

Initiate Terminal Communications

1. Boot the terminal to command mode. Refer to Chapter 4, *Operating the Series 3100/ 3500*, for a list of the boot-to-command mode sequences.

   The terminal displays the following:

   ```
   COMMAND MODE

   Select function
   Self test
   ```

2. Scroll through Command Mode options using <**UpArrow**> or **<DownArrow**> until "Program loader" is displayed. Press **<ENTER>**.
3. The terminal displays:

   ```
   Program loader
   WARNING: EEPROM
   WILL BE ERASED
   CONTINUE? <ENT>
   ```

   Before loading the new application, erase the NVM's original contents.

   Note: To cancel this operation, press **<CLEAR>**.

4. Press <**ENTER**> to erase the EEPROM.

   Wait while the EEPROM is erased. When complete, the program prompts for the communications parameters.

5. **Baud Rate**.The terminal displays:

```
Comm Parameters

Baud
4   9600
```

Scroll through the list using <**UpArrow**> or **<DownArrow**>. When the correct rate is displayed (38400 is recommended), press **<ENTER>**.

6. **Data Bits**. The terminal displays:

```
Comm Parameters

Data Bits
7
```

Press **<7>** (recommended) or **<8>** to specify data bits, or scroll through the list using <**UpArrow**> and <**DownArrow**>. Press <**ENTER**> when the correct value is displayed.

Note: If 8 data bits is selected, the program selects "No parity" and skips the next step.

7. **Parity**. If 7 data bits is selected, the terminal displays:

```
Comm Parameters

Parity
Odd
```

Press the first letter of a parity option (**E**ven, **O**dd, **N**one, **S**pace, or **M**ark), or scroll using <**UpArrow**> and **<DownArrow**> and press **<ENTER>** when the correct value is displayed.

8. **Flow Control**. The terminal displays:

```
Comm Parameters

Flow Control
None
```

Press the first letter of a flow control option (**N**one, **X**on / **X**off, or **R**TS / CTS), or scroll using <**UpArrow**> or **<DownArrow**> and press **<ENTER>** when the correct value is displayed.

9. The terminal ready to receive the program.

Starting Communications

1. The terminal displays:

```
Comm Parameters

Start? <ENT>
```

2. Press <**ENT**> on the terminal.
3. Press **<ENTER>** on the host computer. **SENDHEX** begins transmitting the program image. When communications are established, the terminal displays:

```
Program loader

Receiving: XXXX
```

   During program loading, the display shows the program segment address being transferred (XXXX).

4. When the transmission is complete, the terminal displays:

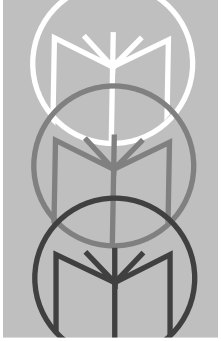
```
Program loader

Status 0000
```

   A status of 0000 (all zeros) indicates a successful transfer. Other status values indicate an error. These values are provided in Appendix C.

   If you received an error, press <**Clear**> on the terminal to return to the Command Mode main menu.

Ending Communications

1. Press **<Clear>** on the terminal.
2. Power down the terminal.
3. Detach any cables connected to the terminal.
4. Reboot the terminal using the appropriate cold boot sequence described in Chapter 4 in the section *Booting a Terminal*.



Chapter 3
Spectrum24 RF Terminal Setup

Chapter Contents

Introduction

Spectrum One Vs. Spectrum24 Terminals

In Spectrum One terminals, connectivity over the wireless network is effected through a proprietary protocol. A terminal was dedicated to a specific application using a hex image customized for the application (e.g., STEP or SVTP) that was loaded offline into the terminal's non-volatile memory (NVM). Any temporary files needed or created by the application were placed on the RAM drive which used part of the program execution space. The NVM appears to the application as a read-only disk drive (B:) containing up to 256 Kbytes. The RAM drive (D:) is both readable and writable and is sized by each application according to the application's needs.

In Spectrum24 terminals, the wireless connectivity is accomplished using standard communications protocols. Because they are standard, the protocols are generalized and take up considerably more space on the terminal's NVM. With less space available in NVM for application files, Spectum24 terminals operate as diskless computing workstations. The terminal's NVM contains system files required to connect to and download the application files from a network server and to provide network diagnostics and configuration. The application files are downloaded each time the terminal is booted.

The Flash Disk Option

The 3140 and 3540 terminals optionally can contain an additional megabyte of non-volatile memory or flash disk. This extra memory is used to reduce the time and resources required to load applications into the terminal and to offer the possibility of running multiple applications from the same terminal.

The flash disk is accessed via a driver, FLASHDSK.SYS, which makes the flash disk appear to a program as another disk drive (E:). The drive has characteristics of fast reading but slow writing (e.g., for even the smallest files, the write process takes 3-4 seconds).

If your 3140/3540 terminal includes a flash disk, you have options for setting the IP address and downloading software that are not available on the standard Spectrum24 terminals. For more information, refer to the *Spectrum24 Flash Disk Addendum*.

Standard Spectrum24 Installation

A standard Spectrum24 installation consists of LSL, SLAODI.COM, TCP/IP, and NET.CFG, and requires a BIOS version of 1.09 or later.

The system software is factory-loaded in the terminals. The default files cover most expected scenarios with minor changes, as detailed in this chapter. If your requirements are more sophisticated, refer to the *Spectrum24 Network Development Kit* documentation for more information on the Spectrum24 RF network, SLAODI.COM, the Symbol-provided ODI driver, and the configuration file setups required for various platforms.

> **Note:** The installation for Spectrum24 terminals with flash disk differs from a standard installation in the configuration file setup and in the options for obtaining addresses and downloading software. For more information, refer to the *Spectrum24 Flash Disk Addendum*.

Decision: Internet Addressing

Each terminal requires a unique internet address, or IP address, allowing messages it sends and receives to be correctly routed over networks conforming to the TCP/IP protocol standards. These addresses can be administered and entered manually, or administered and allocated by a server on the network. Two protocols are defined for the IP address allocation on the network, BOOTP and DHCP. BOOTP is commonly used in UNIX and OS/2; DHCP is the protocol for Windows NT servers.

By default, Symbol's Series 3000 Spectrum24 terminals use the BOOTP protocol to obtain an IP address. To allocate IP addresses manually or to use the DHCP protocol, you must change the "boot" parameter in the [**Spectrum24 Control**] section of the NET.CFG file that is loaded on the terminal. The format of the entries to NET.CFG is discussed in the section *Editing NET.CFG*.

Editing NET.CFG

The terminal is controlled by entries in the NET.CFG file. After you decide how to allocate IP addresses, edit NET.CFG to include the [**Spectrum24 Control**] section necessary to set the IP addressing mode.

If you intend to make any changes to the terminal's out-of-box default setup, you must add the [**Spectrum24 Control**] section, which specifies parameters that apply to all Spectrum24 uses, to NET.CFG.

[Spectrum24 Control]

This section includes the parameters for indicating the preferred method of obtaining the IP address (over the air or manual), as defined in Table 3-1, *Parameters in [Spectrum24 Control] Section*.

Table 3-1. Parameters in [Spectrum24 Control] Section

Parameter	Description
bootp	By default, the terminal issues a BOOTP request on startup. If no Spectrum24 Control Section appears in NET.CFG, BOOTP is assumed.
noboot	If this parameter is set to noboot, the terminal does not issue a BOOTP request. The terminal IP address must be entered in the [TCPIP] section of NET.CFG or manually using CFG24.
dhcp	For a Windows NT environment, the terminal uses DHCP protocol to access the network.
Note: The DHCP, BOOT, and NOBOOT modes are mutually exclusive.	

Examples

Entries to a NET.CFG setup:

```
Spectrum24 control
  DHCP
```

OR

```
Spectrum24 control
  Noboot
```

If you change NET.CFG, the default HEX image must be rebuilt.

How Application Files Are Downloaded to the Terminal

To download application files requires having a Trivial File Transfer Protocol (TFTP) server on the network. If your site has more than 3-4 terminals, running a TFTP server on a DOS-based machine is impractical because the operating system restricts you to downloading to one terminal at a time. More sophisticated operating systems, e.g., UNIX, OS/2, or Windows NT, allow downloads to multiple terminals simultaneously. The server is needed infrequently to load new applications or update existing applications.

Downloading over the airwaves cannot be done until *after* the Internet addressing decision is resolved, and any required edits to NET.CFG are entered because the IP address is required to perform the file transfer.

Loading the Software

Hardware Required for Download

- Terminal
- Spectrum24 RF Network Boot Server
- Spectrum24 Ethernet Access Point

Note: No hardware connections (cradle or CCA) are required to load the software over the Spectrum24 network. The terminal must be within the coverage area of a Spectrum24 Ethernet Access Point linked to a host computer. The initialization software is factory installed.

Hardware Setup

Refer to the Spectrum24 RF Network documentation listed in *Related Publications* in *About This Manual* for information on the Spectrum24 network and equipment.

Verify Existence of Application Files

The application files to be downloaded to the terminal must be installed on a network host before you initiate the network connection. For more information on setting up the files on a host, refer to the Spectrum24 documentation listed in *About This Manual*.

Download Over the Network: BOOTP (Default)

Initiate Network Connection

1. Cold boot the terminal.

   Note: Verify that terminal is OFF before cold booting.

   a. Press and hold <**A**+**B**+**D**>.

   b. Press and release <**PWR**>.

   c. Release <**A**+**B**+**D**>.

   The terminal boots DR-DOS and loads the radio driver while displaying a series of boot messages.

2. Enter a new Net Id, obtained from the Network Administrator, in the Configurator (DFG24).

   Note: This process should only be required on the first-time, out-of-box network connection.

   On first boot , the terminal automatically brings up the Configurator screen for entering a new Net Id:

   ```
   CONFIGURATOR 1.XX
   View config params
   Net Id
   Subnet Mask
   Default Router
   Terminal IP Address
   Exit
   ↑↓, Clear, Enter
   ```

3. To enter the new Net Id:

   a. Use the <**UpArrow**> and **<DownArrow**> to cursor to Net Id.

   b. The default Net Id appears in hex format. Backspace over the existing value, type a new value in the range 102-1FE (in hex, not case sensitive), and press <**ENTER**>.

   c. If you are using a BOOTP or DHCP server, cold boot the terminal and proceed to the section, *Terminal Attempts to Associate with Access Point*.

4. If you are not using a BOOTP or DHCP server, enter the following parameters:

   - Subnet Mask

- Default Router
- Terminal IP Address

and press <**ENTER**> after each entry.

Note: Your changes are saved in the nonvolatile area on the radio card. The values just entered are not lost if you reboot the terminal.

5. Select Exit from the Configurator Menu and press <**ENTER**> to exit the Configurator to continue the connection process.

Terminal Attempts to Associate with Access Point

The terminal attempts to associate with an Access Point (AP) using the default Net Id.

If Terminal Association with AP Is Not Successful

If the terminal is unable to associate with the AP (the Net Id is wrong or forgotten), it displays the message:

```
STAT24 Ver 1.XX
NOT Associated
```

for a few seconds. A second message follows:

```
Terminal cannot associate with AP. You're
out of range or not configured. Ctrl+C to end
or other key to retry. Strike any key when ready.....
```

The terminal continues trying to connect until attempt is cancelled.

To cancel and set up a new Net Id (obtained from the Network Administrator):

1. Press <**Ctrl**+**C**> to end the attempt. The terminal displays the message:

   ```
   Halt Batch process Y/N?
   ```

2. Type **Y** to exit to the DOS prompt (D:).
3. At the DOS prompt, type **CFG24** and press <**ENTER**> to initiate the Configurator and bring up the Configurator screen:

   ```
   CONFIGURATOR 1.XX
   View config params
   Net Id
   Subnet Mask
   Default Router
   ```

```
Terminal IP Address
Exit
⇑⇓, Clear, Enter
```

4. Use the <**UpArrow**> and <**DownArrow**> to cursor to Net Id.
5. The current Net Id appears in hex format. Backspace over the existing value, type a new value in the range 102-1FE (in hex, not case sensitive), and press <**ENTER**>.
6. Power the terminal off.
7. Cold boot again.
8. The terminal attempts to associate with an AP.

If Terminal Association with AP Is Successful

If the association is successful, the terminal obtains an IP address and bootfile name, displays the message:

```
BOOTP 1.XX
```

and begins downloading files from the server. As the download runs, the terminal displays a series of application-defined messages. If the download is successful, the terminal displays messages indicating success and the application logon screen. Begin operating the terminal application.

> **Note:** For flash disk terminals, if the terminal is not downloading files over the air, the files are extracted from flash disk and executed.

If Association Is Successful But Download Fails

The download may fail due to one of the following reasons:

Terminal Cannot Find BOOTP Server. If the terminal cannot find the BOOTP or DHCP Server for download, it displays the message:

```
Cannot find Boot Server, time out

You have no boot server or it has problems
```

and returns to the DOS prompt. Contact the Symbol Support Center for assistance.

File Transfer Fails. If the file transfer fails, the terminal displays the message:

```
TFTP retry counter exceeded, Receive timeout.
Error <filename>
Ctrl-C to end or other key to retry.
```

where **<filename>** is the file being transferred that was not fully downloaded. The terminal may be out of range of the AP and cannot find the files to transfer.

1. Press <**Ctrl**+**C**> to exit and request help from the Symbol Support Center.

   OR

2. Press a key to retry the file transfer.

If File Transfer Succeeds

If the file transfer retry is successful, the terminal displays messages indicating success and the application logon screen. Begin operating the terminal application.

If not, contact the Symbol Support Center for assistance.

Download Over the Network: DHCP

To use the DHCP protocol requires editing NET.CFG and rebuilding the HEX file before initiating the network connection.

1. Edit NET.CFG (refer to the section *Editing NET.CFG* for a more detailed discussion). Add the section header and DHCP parameter line:

   ```
   Spectrum24 Control
     DHCP
   ```

2. Save the new NET.CFG on the network host in the \LWPnnn\KIT directory.
3. Working from the \LWPnnn\KIT directory, rebuild the HEX file. Use the command:

   ```
   USRCFG @LWPNFL
   ```

   which builds a LWPNFL.HEX file in the KIT subdirectory.
4. Download the new HEX file. Refer to the *Series 3000 ADK* for instructions on downloading a HEX file to the terminal.
5. Proceed with the network connection as described in the section *Initiate Network Connection*.

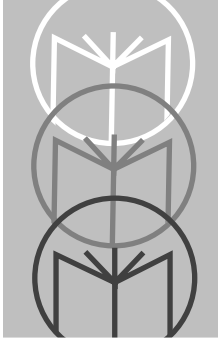
Download Over the Network: Neither BOOTP or DHCP

If a BOOTP or DHCP server is not used, the information these servers provide must be obtained in other ways (i.e., the IP address is entered manually using CFG24).

1. Edit NET.CFG (refer to the section *Editing NET.CFG* for a more detailed discussion). Add a control section and noboot parameter:

   ```
   Spectrum24 control
     Noboot
   ```

2. Proceed with saving the NET.CFG file, building and downloading a new HEX file, and connecting to the network as described in *Download Over the Network: DHCP*.



Chapter 4
Operating the Series 3100/3500

Chapter Contents

Introduction

This chapter describes how to operate a Series 3100/3500 terminal, including:

- Powering the terminal on/off
- Booting the terminal
- Adjusting the display
- Using the keyboard
- Entering data via the integrated scanner or attached scanners
- Communicating with other devices using one of the following options:
  - Connecting the terminal to a PC, printer, or modem using the 3115 Communication/Charging Adapter
  - Connecting the terminal to a printer using the passive cable
  - Connecting the direct connect and acoustic modems.

Powering a Terminal On and Off

Because the terminal is battery powered, it is important to save power whenever possible. You can minimize power loss and increase battery life by turning the terminal off when data is not being entered.

While the terminal's processing and display are off, programs or data in the system's memory are retained. Before the terminal powers up, it checks the batteries for enough power to ensure reliable operation and data storage. Power-up restores the display, and processing continues from where it was before power-down.

Powering the terminal on does not boot the system or initialize either the program or data. For more information on initialization, refer to Chapter 2.

Normal Power

Note: If the terminal uses a NiCd or NiMH battery for power, charge the battery before use!

To power the terminal on or off, press **<PWR**>.

Automatic Power

Depending on the application, a number of other events may turn a terminal on or off. Some of these are:

Power On

- The system powers on when a key other than **<PWR>** is pressed.
- The system powers on when a scanner trigger is pressed.
- The program powers on the system at a preset time to perform unattended operations, such as an overnight communications session.
- The program powers on the system in response to a modem ring or an RS-232 device connected to the RJ connector.

Power Off

If not used for a specific period of time, as determined by the application, the system powers off automatically to conserve power.

Forcing Power Off

If a terminal freezes in the middle of operation, pressing **<PWR>** does not power it off. You can force the system to power off, which reduces the drain on the batteries until you can download any collected data to the host system.

To force the system to power off, press and hold **<PWR>** for 15 seconds.

Since the terminal is still frozen at this time, turning the power back on does not solve the problem. To recover the data held in memory, perform a Warm Boot (refer to *Booting a Terminal*).

Restarting After a Forced Power Off

If an operator is forced to power down a terminal because of defective software, the System Administrator should restart the system using the warm or cold boot procedures in the following section.

Note: Do not use the power key to restart if the terminal was forced off due to defective system or application program software in NVM. Pressing **<PWR>** only causes the program to resume where it left off, trying to perform the same unsuccessful operation.

Booting a Terminal

Powering the terminal on does not boot the system or initialize the program or data. To initialize the terminal, perform either a warm or cold boot.

Warm Boot

A warm boot resets the operating system while preserving the program and data on the RAM disk. This process is similar to pressing the <Ctrl+Alt+Del> keys on a PC, except that it does not clear the system's memory.To perform a warm boot:

21-Key Terminal:

1. Power off the terminal.
2. Press and hold <**DownArrow**> and <**.**>.
3. Press and release <**I/O**>.
4. Release **<DownArrow**> and <**.**>.

35-Key Terminal:

1. Power off the terminal.
2. Press and hold </> and <**+**>.
3. Press and release <**PWR**>.
4. Release </> and <**+**>.

46-Key Terminal:

1. Power off the terminal.
2. Press and hold <**4**> and <**5**>.
3. Press and release <**PWR**>.
4. Release <**4**> and <**5**>.

47-Key Terminal:

1. Power off the terminal.
2. Press and hold <**4**> and <**5**>.
3. Press and release <**PWR**>.
4. Release <**4**> and <**5**>.

The terminal displays a copyright message, RAM size, expanded memory RAM size, etc., depending on the system's configuration.

Note: If the batteries are replaced and the supercap is discharged, the terminal cold boots.

Cold Boot

A cold boot fully resets the system and clears memory, including the RAM disk. Any programs and data stored in memory or on the RAM disk are deleted. Nonvolatile memory (NVM — the Application EEPROM) is not affected.

Caution

This procedure erases all data and programs residing in dynamic memory and RAM Disk. All contents of the RAM disk are lost.

To perform a cold boot:

21-Key Terminal:

1. Power off the terminal.
2. Press and hold <**UpArrow**>, <**4**>, and <**ENTER**>.
3. Press and release <**I/O**>.
4. Release <**UpArrow**>, <**4**>, and <**ENTER**>.

35-Key Terminal:

1. Power off the terminal.
2. Press and hold <**Space**>, <**Func**>, and <**UpArrow**>.
3. Press and release <**PWR**>.
4. Release <**Space**>, <**Func**>, and <**UpArrow**>.

46-Key Terminal:

1. Power off the terminal.
2. Press and hold <**A**>, <**B**>, and <**D**>.
3. Press and release <**PWR**>.
4. Release <**A**>, <**B**>, and <**D**>.

47-Key Terminal

1. Power off the terminal.
2. Press and hold <**A**>, <**B**>, and <**D**>.
3. Press and release <**PWR**>.
4. Release <**A**>, <**B**>, and <**D**>.

The terminal displays a copyright message, amount of RAM, and expanded memory. Other messages are displayed as well, depending on the system configuration.

Cold-Boot Failure

During a cold boot, the system briefly displays a status line for each driver as it loads in the format:

```
0: Driver     #.##
```

The line shows a status value, usually 0, followed by the name and version number of the driver. If the system halts at one of these lines and displays a status value other than 0, the displayed device driver failed to load properly.

If such a failure occurs, the terminal may need to be cold booted. If this does not solve the problem, call Symbol Support Center.

More troubleshooting information is found in the publications listed at the beginning of this manual.

Boot to Command Mode

Command Mode provides functions for:

- Running the Self-Test program to verify that the hardware is operating properly (refer to Chapter 5)
- Performing a Memory Transfer to upload data from a terminal to the host system (refer to Chapter 5)
- Performing a Program Download to transfer an application program from the host system to a terminal (refer to *Loading the Program* in Chapter 2).

21-Key Terminal:

1. Power the terminal off.
2. Press and hold **<send>** and **<9>**.
3. Press and release **<I/O>**.
4. Release **<send>** and **<9>**.

35-Key Terminal:

1. Power the terminal off.
2. Press and hold **<BackSpace>** and **<Shift>**.
3. Press and release **<PWR>**.
4. Release **<BackSpace**> and **<Shift>**.

46-Key Terminal:

1. Power the terminal off
2. Press and hold **<F>** and **<I>**.
3. Press and release **<PWR>**.
4. Release **<F>** and **<I>**.

47-Key Terminal

1. Power the terminal off
2. Press and hold **<F>** and **<I>**.
3. Press and release **<PWR>**.
4. Release **<F>** and **<I>**.

Adjusting the Display

Backlighting

The terminal's backlight illuminates the display in dimly lit areas.

Note: Use of backlighting can significantly reduce battery life.

To turn the backlight on or off, press the following keys in sequence:

21-Key Keyboard:

<Func> then <**RightArrow**>

35-Key Keyboard:

<Func> then <**RightArrow**>

46-Key Keyboard:

<Func> then <**L**>

47-Key Keyboard:

<Func> then <**L**>

The backlight also turns off when a terminal is powered off or when a timeout set by the application occurs.

Display Contrast

The LCD display contrast is adjustable, making the display more readable in different lighting conditions, at various temperatures, with different attachments, and at other viewing angles.

To increase contrast (darken) by one step, press the following keys in sequence:

21-Key Keyboard:

<**Fn**> then <**DownArrow**>

35-Key Keyboard:

<**Func**> then <**X**>

46-Key Keyboard:

<**Func**> then <**X**>

47-Key Keyboard:

<**Func**> then <**X**>

To decrease contrast (lighten) by one step, press:

21-Key Keyboard:

<**Fn**> then <**UpArrow**>

35-Key Keyboard:

<**Func**> then <**Z**>

46-Key Keyboard:

<**Func**> then <**Y**>

47-Key Keyboard:

<**Func**> then <**Y**>

The Series 3100/3500 Keyboard

The keyboard is used for entering data and issuing commands to the terminal. Figure 4-1 illustrates the standard 35-key keyboard, while Figure 4-2 presents the standard PDT 3500 47-key keyboard. For the other Series 31XX/35XX keyboards, refer to Appendix B.

The keys on the keyboard are distinguished as modifier keys and character keys. Because terminal keyboards have fewer keys than PC keyboards, each character key can produce more than the usual one or two characters. The four modifier keys, **Shift**, **Alpha**, **Ctrl**, and **Func**, used individually or in combination, determine which character or special function the character keys produce.

Using the Keyboard

Except for during boot operations, the terminal expects the operator to press keys one at a time. If ERR3000 is loaded, and if two or more keys are pressed simultaneously, the system indicates a Double Key error.

The keyboard also has an optionally configurable auto-repeat function. If the application allows, a character repeats as long as the key is held down. If the key is pressed immediately following a modifier key, the modifier sequence affects only the first occurrence of the character key.

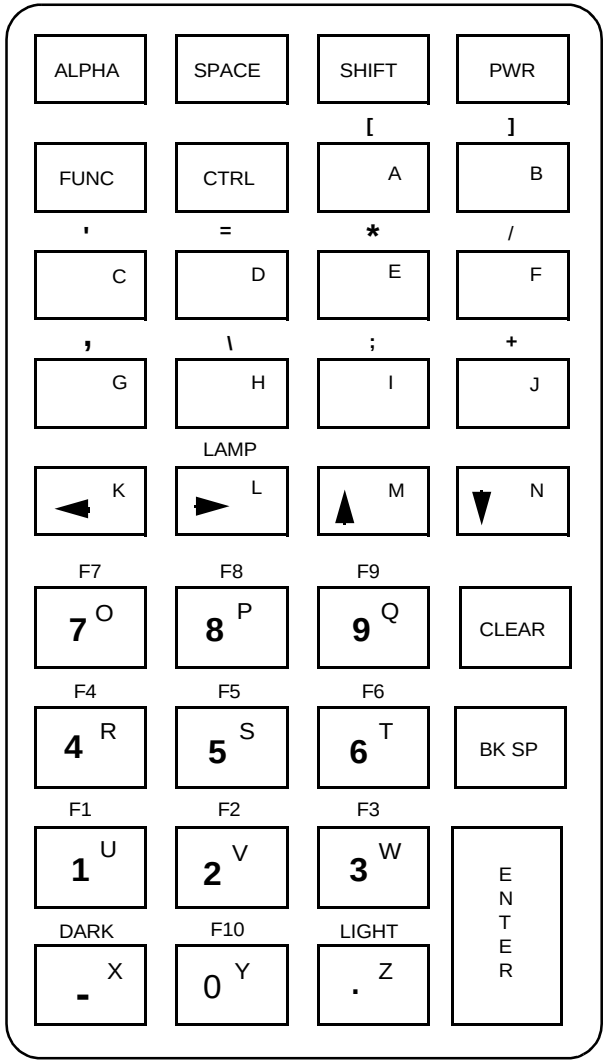


Figure 4-1. Series 3100 Standard 35-Key Keyboard

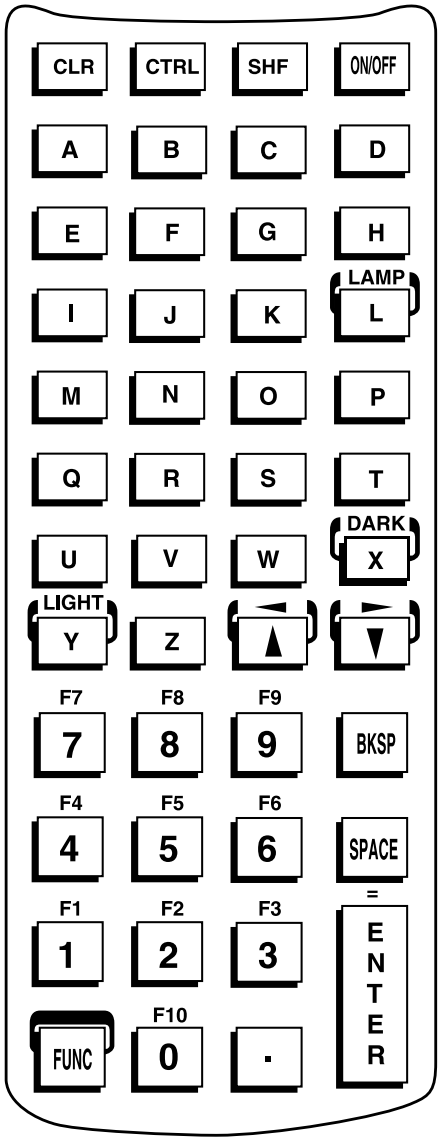


Figure 4-2. Series 3500 Standard 47-Key Keyboard

Modifier Keys

The **<Shift>**, **<Alpha>, <Func**>, and <**Ctrl>** keys are modifier keys. When pressed individually or in certain combinations, these keys change the keyboard state and possibly the character produced by the character key subsequently pressed.

For example:

- Pressing **<Alpha>** causes the numeric keys to produce letters. (Lower case letters are not available on the 35-key terminal, but they are available on the 46-key terminal.)
- Pressing **<Func>** followed by <**Ctrl>** produces Alt characters, with the same effect as pressing the Alt key on a PC.
- Pressing **<Func>** and a scanner trigger enables that trigger for scanning. (Refer to the section *Scanning* for more information.)
- The opposite trigger is another Alpha key (Alpha Shift), producing capital letters. It is active only when held down.
- The **<Alpha>** key on the keyboard affects all succeeding character keys until **<Alpha>** is pressed again. The other modifier keys affect only the next character key.

Refer to Appendix B for the characters and operations produced by pressing a sequence of modifier keys on the standard terminal keyboards. These key assignments can be changed by an application. Refer to your application documentation for any special key assignments.

Cancelling a Modifier Key

To cancel the effect of a modifier key, press it again.

Keyboard State

The cursor's shape indicates the current keyboard state, unless changed by the application. The standard cursor shapes are shown in Table 6-4, *Cursor Indicators*.

Key Descriptions

Most of the keys are self-explanatory. Letter keys produce letters, number keys produce numbers. Keys that perform special functions are described in Table 4-1, *Special Keys*.

Table 4-1. Special Keys

Key Name	Description
Shift	Changes letter and number keys to punctuation marks and symbols (e.g., pressing <**Shift** + 5> on a 35-key keyboard produces a % sign).
Alpha	Shifts the keyboard to produce alphabetic characters. Uppercase only on 35-key; upper and lowercase available on the 46-key terminal.
Alpha Shift (trigger key)	Shifts the keyboard to produce alphabetic characters when held down continuously. Selectable by the operator. The corresponding key on the other side key becomes the active scanner trigger.
Func	Function key. Invokes special keyboard functions.
Ctrl	Control key. Generates control characters.
Enter	Usually pressed after typing data or a command.
Lamp	Turns on the backlight
Clear (Escape)	Depending on the application, completely or partially escapes from an application level or screen, or clears data entered in a field.
Dark	Following **Func,** darkens the display (increases contrast).
Light	Following **Func**, lightens the display (reduces contrast).
Trigger keys	Activates the scanner. Selectable by the operator. The corresponding key on the other side key becomes the Alpha Shift.

Scanning

The 3100 / 3500 terminals support several scanning devices, including:

- Integrated scanning elements, such as:
  - 1-D Standard and Long Range Scanning Elements
  - 1-D and 2-D Scanning Element
- Tethered scanners, such as:
  - LS 2000
  - LS 3000
  - LS 4800
  - LS 9100
  - LT 1700
  - LP 1500

  If you use a tethered scanner with the terminal, follow its pertinent instructions for installation and operation.

  Note: Before scanning can actually occur, the application must implement routines to support bar code scanning. For information on scanning applications and on programming the scanner, refer to the *Series 3000 Application Development Kit*.

Integrated Laser Scanner

Setting the Trigger

The integrated scanner has a unique trigger that the operator can configure. To use the integrated laser scanner:

1. Power on the system and scanner by pressing <**PWR**> or the scanner trigger.
2. Lift up and turn the the scan element on the top of the terminal to the preferred orientation for scanning (refer to Figure 4-3). The scan head turns only toward the back of the terminal.

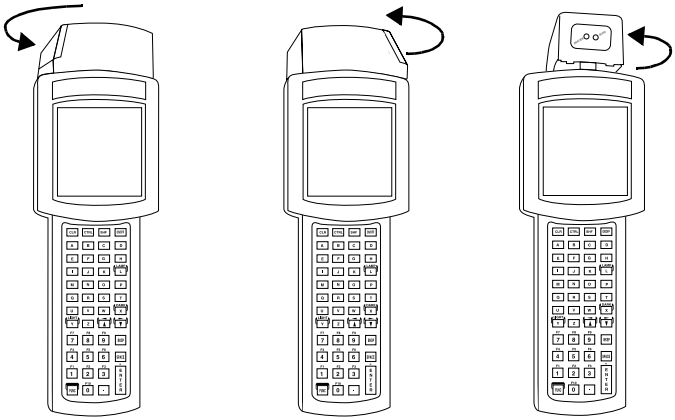


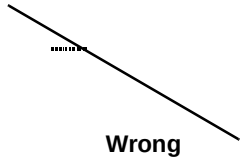
Figure 4-3. Positioning the Scanner

3. Lock the scan head in position, facing the side of the terminal.
4. To select the trigger, press the <**FUNC**> key and the trigger you are most comfortable using. The other trigger defaults to an ALPHA shift key. Depending on the application, the terminal may beep to indicate a trigger is selected.

Scanning 1-D Bar Codes

If using a tethered scanner, follows its instructions for operation. If you use an integrated scanner, follow this procedure.

1. Aim the scanning element at the bar code and press the selected trigger.
2. Adjust the aim so that the thin, red laser beam covers the entire length of the bar code.



Wrong

Right

Optimal scanning distance varies with bar code density and scanner optics, but most combinations work within 4 to 10 inches. Generally:

- The larger the symbol, the farther away you should hold the scanner.
- Move the scanner closer for symbols with bars that are close together.

Simple practice quickly shows what distances to work within.

3. If the decode is successful, the screen displays the code and the green LED flashes. The terminal may also beep.

Note: The procedure for your scanner may differ from the one listed above. Scanner use depends on the application.

Scanning Considerations

Usually, scanning is a simple matter of aim, scan, and decode, and a few quick trial efforts master it simply and intuitively. However, two important considerations can optimize any scanning technique — angle and range.

Angle

Scanning angle is important for promoting quick decodes. When laser beams reflect *directly* back into the scanner from the bar code, this specular reflection can actually "blind" the scanner.

To avoid this, scan the bar code so that the beam does not bounce *directly* back. But don't scan at too oblique an angle; the scanner needs to collect scattered reflections from the scan to make a successful decode. *Practice quickly shows what tolerances to work within*.

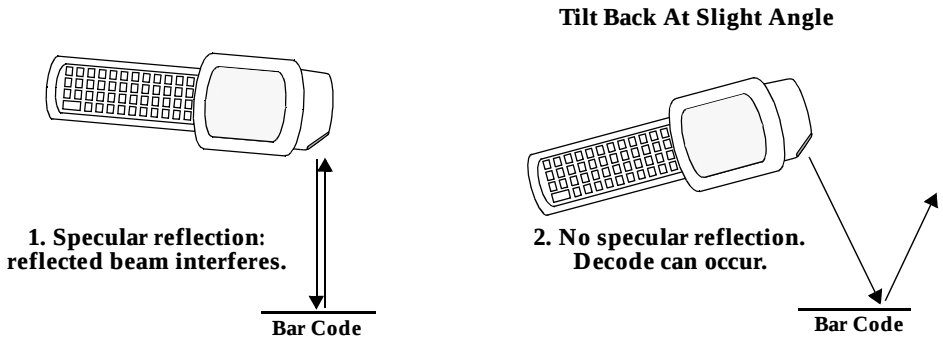


Figure 4-4. Scanning Angle and Specular Reflection

Range

Any scanning device decodes well over a particular working range — minimum and maximum distances from the bar code. This range varies according to bar code density and scanning device optics.

Scanning within range brings quick and constant decodes; scanning too close or too far away prevents decodes. You need to find the right working range for the bar codes you are scanning. The best general advice is:

- The larger the symbol, the farther away you should hold the scanner.
- Move the scanner closer for symbols with bars that are close together.
- Start scanning *at a distance* from the bar code — not from direct contact. If the bar code does not readily decode, move the scanner in closer.

However, the situation is complicated by the availability of multiple integrated scanning elements, some with specialized capabilities like long-range or 2-D decode capability. The best way to specify appropriate working range per bar code density is through a chart called a decode zone for each scan module. A decode zone simply plots working range as a function of minimum element widths of bar code symbols.

Decode zones for available integrated 1-D scan elements follow:

Standard and Long Range 1-D Decode Zones

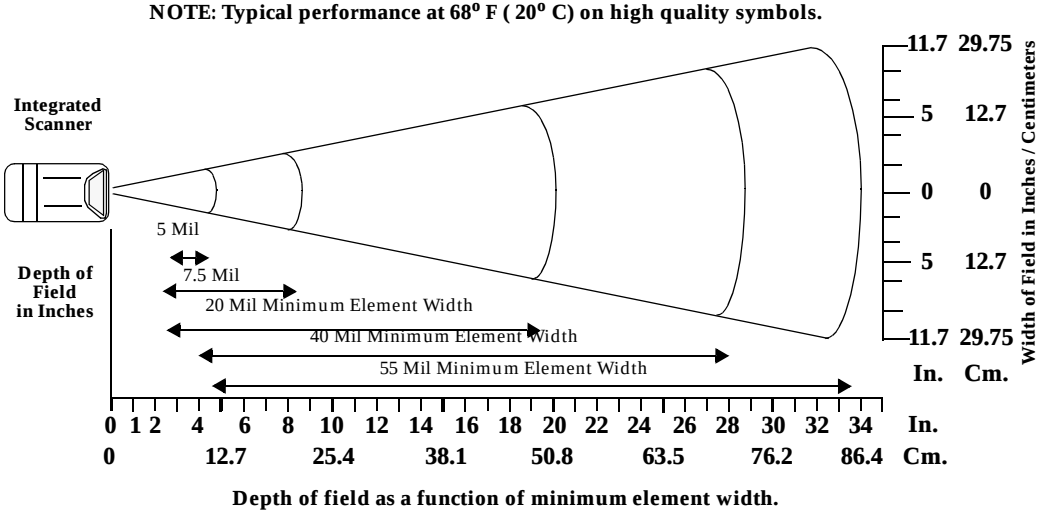


Figure 4-5. Decode Zone: Standard Range

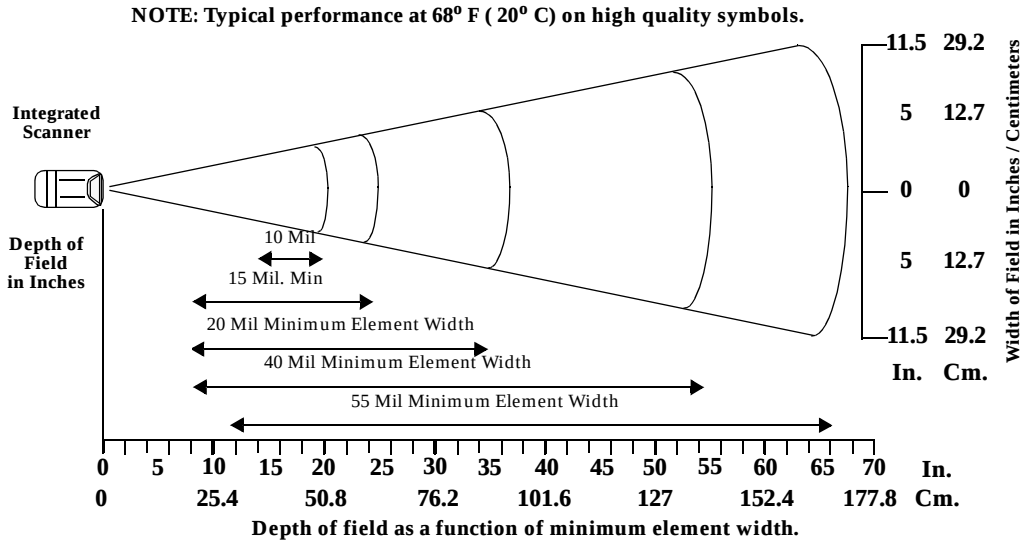


Figure 4-6. Decode Zone: Long Range

Note on IEC825/EN60825 Class 1

IEC825 / EN60825 Class 1 is an international laser safety standard that limits the amount of energy emitted by the laser over a period of time. IEC825 / EN60825 Class 1 limits the duration of laser scanner on-time, using an emission accumulator mechanism.

To conform to IEC825 / EN60825 Class 1 standards, the laser cannot be on for more than 60 seconds in a 1000-second time period. The terminal accumulates scan time while it is scanning bar codes, up to the maximum 60 seconds.

When it runs out of available scan time, the terminal emits a long, low-tone beep. When 2 seconds of scan time become available, the system emits another long, high-frequency beep. Refer to the *Series 3000 Application Programmer's Guide* for more information.

Scanning PDF417 Bar Codes

Smart Raster Capability

All integrated 1-D / PDF417 scan elements may be programmed for "Smart Raster" capability, which causes the scanner to emit a raster pattern dynamically optimized to the particular PDF417 bar code's shape.To increase scanning efficiency and optimize decode time, the scanner determines the geometry of the bar code and opens at a rate and size optimal for decoding that bar code.

In normal "Smart Raster" operation, a trigger pull causes a slab raster pattern to appear. If the target is a 1-D bar code, the pattern never gets beyond a slab raster. But if the target bar code is PDF417, the scanning patterns open up to a full, optimized raster pattern as soon as the scanner is properly aligned over the bar code, as shown in Figure 4-7.

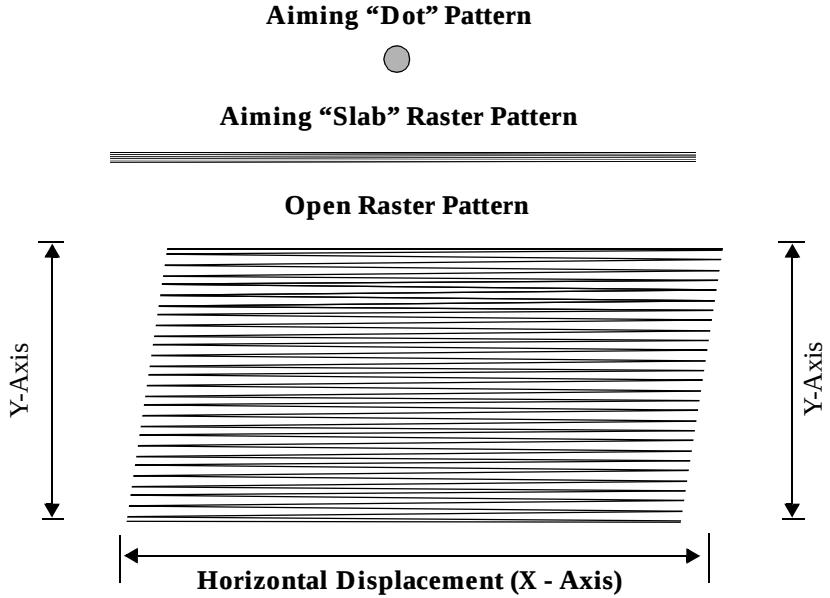


Figure 4-7. 1-D/PDF417 Scan Element Aiming and Scanning Patterns

For best operation in smart raster mode, keep the scan pattern as parallel to the symbol's rows as possible, keep the scanner as still as possible, and hold the scanner at an angle which does not give specular reflection (refer to the earlier section *Angle*). Likewise, the symbol should be in good condition.

1-D/PDF417 Scanning Mode Options

There are three main scanning options: aiming with a dot pattern, scanning with a slab raster pattern, or always raster.

Aiming Dot Option. A trigger pull creates the single dot aiming pattern, which lasts for a fixed interval. This dot easily can be seen in outdoor or high ambient light environments. A slab raster pattern or an open raster pattern appears next, depending on the programmed scanning option. There are two programmable timeout periods for this option — normal and extended.

Slab Raster Option. A trigger pull creates the slab raster pattern. If the target is a 1-D bar code, the pattern never gets beyond a slab raster. But if the target bar code is PDF417, the pattern opens up to an optimized raster pattern as soon as the scanner is properly aligned over the bar code.

Always Raster. When programmed to this option, the 1-D / PDF417 scan element directly opens to a full raster pattern whenever the trigger is pulled.

To Scan PDF417 Bar Codes

Make sure that the scanner has been programmed for a slab raster aiming pattern and smart raster mode.

1. Aim the scanner at the symbol. Try to keep the nose of the scanner parallel with the symbol's rows.
2. Ensure the symbol you want to scan is within the scanning range(refer to the 1-D / PDF417 decode zones in Figure 4-5 and Figure 4-6). Then pull the trigger to scan.

   The scan pattern first covers the symbol horizontally.

Figure 4-8. Slab Raster Pattern on a PDF417 Bar Code

   Make sure the scan pattern extends at least three-quarters of an inch beyond the edges of the bar code (refer to Figure 4-8).

   If the pattern is parallel to the symbol's rows, the pattern spreads vertically to cover the symbol. If the pattern does not cover the top and bottom of the symbol, pull the scanner back until it does (refer to Figure 4-9).

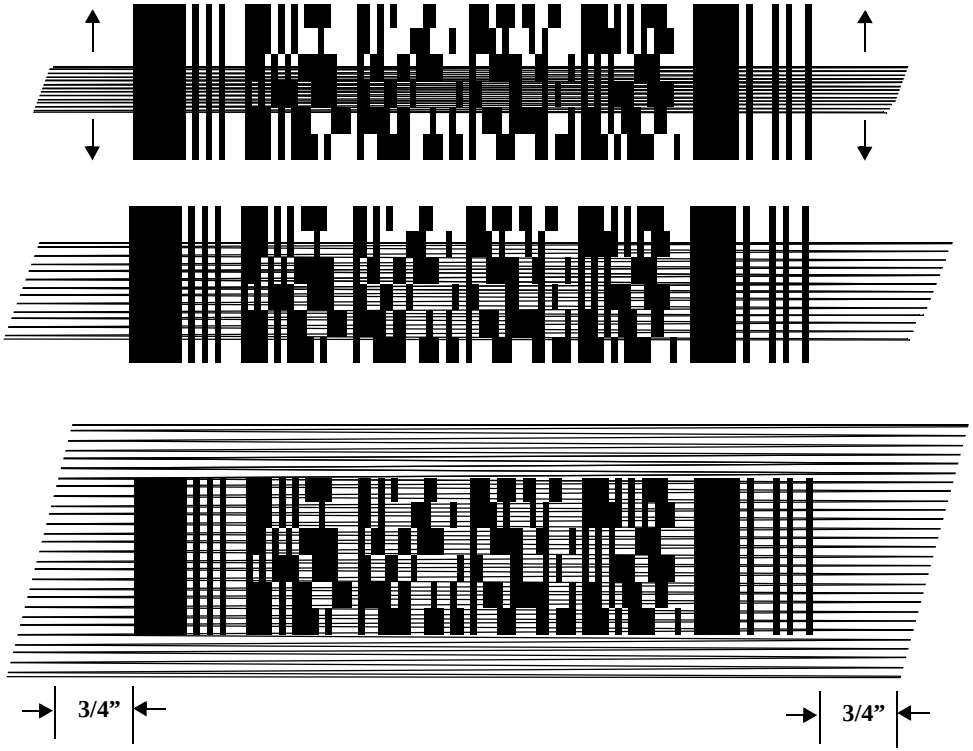


Figure 4-9. Scanning Pattern Spreading Over PDF417 Bar Code

The scanner has successfully decoded the symbol when:

- The green LED lights.
- You hear a short, high tone beep.

Scan the Entire Bar Code Symbol

- The larger the symbol, the farther away you should hold the scanner to permit the raster pattern to cover the symbol (but not more than 8 inches). Refer to *1-D/ PDF417 Scan Element Decode Zones*.
- Hold the scanner close for denser symbols (not less than 2 inches).
- In all cases, make sure the scan pattern extends *at least 3/4 inch* beyond each edge of the bar code.

- The PDF417 bar code symbol has multiple rows, but the raster pattern also has multiple scanning rows. For this reason, do three basic things as you scan (refer to Figure 4-10):
  1. Center the aiming pattern on the bar code, as illustrated before.
  2. Keep the pattern in the same horizontal plane as the bar code.

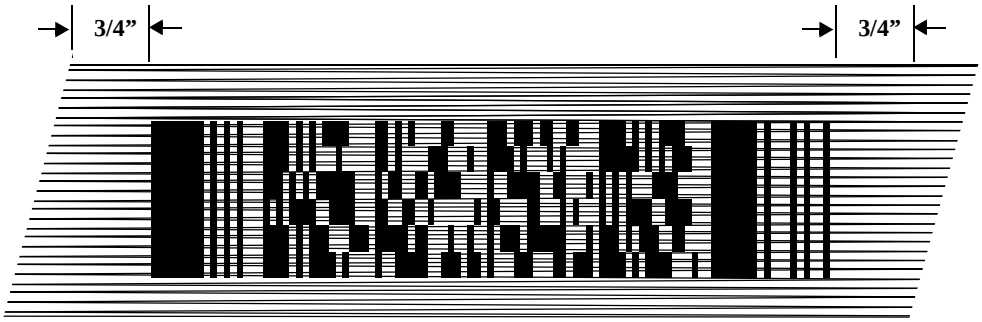


Figure 4-10. Orienting Scanning Pattern On PDF417 Bar Code

  3. If the vertical scan pattern is not high enough to cover a “tall” PDF417 symbol, it may be necessary to move the scanner slowly down toward the bottom of the symbol, keeping the beam horizontal to the rows, and then slowly back upward toward the top (refer to Figure 4-11).

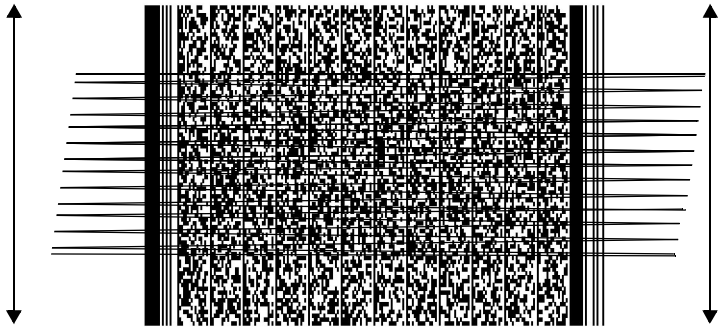


Figure 4-11. Moving Scan Pattern Upward and Downward on “Tall” PDF Symbol

- The scan beam does not have to be *perfectly* parallel with the top and bottom of the symbol (up to a 4^{o} tilt will work).

1-D/PDF417 Scan Element Decode Zones

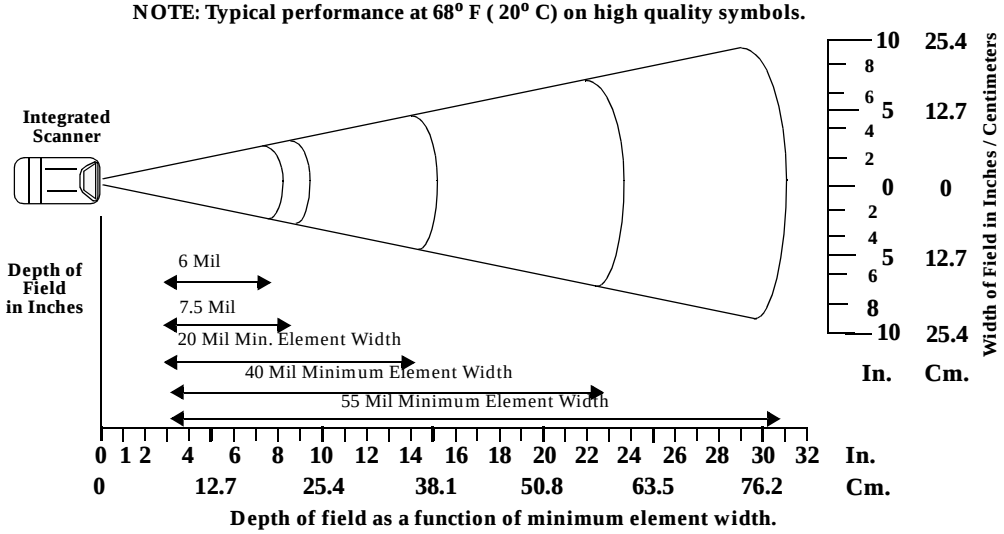


Figure 4-12. 1-D/PDF417 Scan Element 1-D Decode Zone

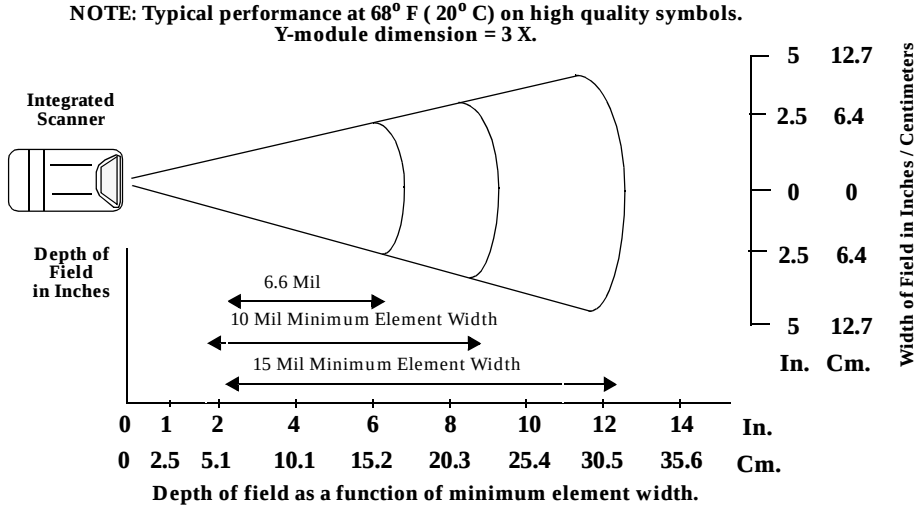


Figure 4-13. 1-D/PDF417 Scan Element PDF417 Decode Zone

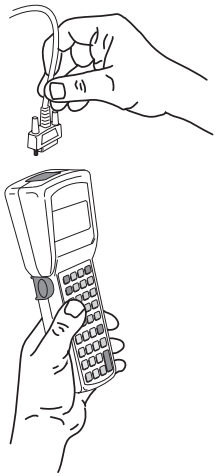


Figure 4-14. Attaching/Using a Scanner

Attaching a Scanner or Wand

To attach a scanner or wand to a terminal:

1. Power the system off.
2. Remove the end cap from the top of the terminal.
3. Plug the scanner into the top of the terminal (refer to Figure 4-14).
4. Power the terminal on or press the scan trigger to power the terminal on.
5. To use the scanner or wand, refer to the user documentation provided.

Note: The **<Enter>** key is often the default "soft trigger." Applications can designate another key as the "soft trigger." Refer to the *Series 3000 Application Programmer's Reference Manual* for more information on the STG3000.EXE program.

Communications

With a PC

3115 Communications/Charger Adapter

An optional communications / charger adapter (CCA) is available for communicating with a host PC when a cradle is not available.

> **Note:** It is not necessary to connect the terminal to a power source for communications.

To connect the 31XX / 35XX to a PC using the 3115 CCA:

1. Plug the 10-pin RJ-41 connector into the base of a Series 31XX / 35XX terminal (refer to Figure 4-15).
2. Plug the DB-25 connector into the host's communications port.
3. Start the communications program.

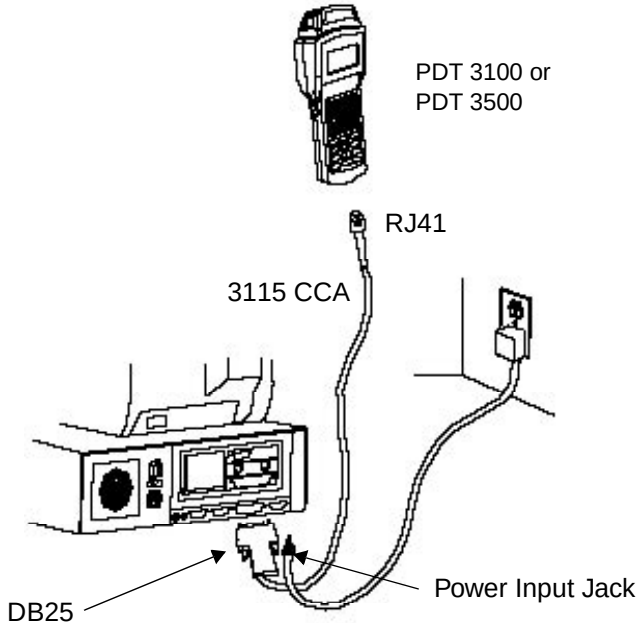


Figure 4-15. Connecting the 3115 CCA for Communications

With a Printer

The terminal has two accessories which provide communications with a printer, the 3115 CCA and the passive cable.

3115 CCA

To connect the 31XX / 35XX to a printer using the 3115 CCA:

1. Plug the 10-pin RJ-41 connector into the base of a Series 3100 / 3500 terminal.
2. Plug the DB-25 connector into the printer's communications port.
3. Start the communications program.

Note: The CCA is shipped set for RS-232 communications with a PC.To use the CCA with a printer may require changing the internal communications settings. Refer to the *Installation Instructions* (P / N 70-11314-XX).

Passive Cable

An optional cable is available for connecting the terminal to a printer (Figure 4-16) (P / N 20-11062-03).

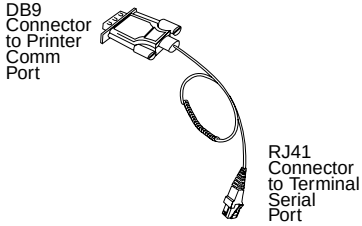


Figure 4-16. Passive Cable Connectors

To connect the terminal to a printer:

1. Plug the passive cable's 10-pin RJ-41 connector into the Series 31XX / 35XX terminal's serial port.
2. Plug the DB-9 connector into the communications port on the printer.
3. Start the communications program.

3115 CCA

To connect the terminal to a modem using the 3115 CCA:

1. Plug the 10-pin RJ-41 connector into the base of a Series 31XX / 35XX terminal.
2. Insert a female-to-male gender changer on the female DB-25 connector before plugging the connector into the modem.
3. Start the communications program.

Note: The CCA is shipped set for RS-232 communications with a PC. To use the CCA with a modem may require changing the internal communications settings. Refer to the *Installation Instructions* (P / N 70-11314-XX).

Integrated: Direct Connect (PDT 3100, 3110, 3124 only)

If the terminal is equipped with a direct connect modem, connect the modem as follows:

1. Power the terminal off.
2. Release the hand strap on the back of the terminal.
3. Detach the plug covering the modem jack on the back of the terminal

4. Attach one end of the telephone cable to the modem jack connection (Figure 4-17).

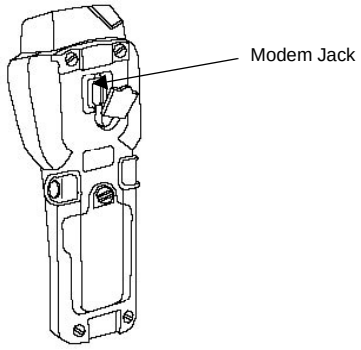


Figure 4-17. Modem Jack Location

5. Plug the cable's other connector into a telephone jack.
6. Power the terminal back on.
7. Start the communications program on the host and terminal.

Integrated: Acoustic (PDT 3100, 3110, 3124 only)

Some Series 31XX / 35XX terminals are equipped with a built-in acoustic modem which allows direct data transmission over a telephone line.

If the terminal is equipped with an acoustic modem, connect the modem as follows:

1. Power the terminal off.
2. Release the hand strap on the back of the terminal.
3. Place the telephone mouthpiece against the acoustic coupler.

4. Reattach the hand strap, securing the phone to the terminal, as shown in Figure 4-18.

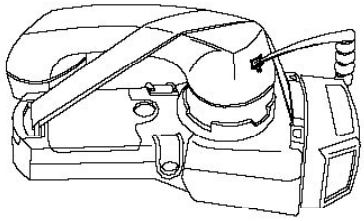


Figure 4-18. Connection for Acoustic Coupler

5. Power the terminal back on.
6. Start the communications program on the PC and terminal.

Connecting the Internal Modem

Some Series 3100 terminals and cradles use an optional internal modem that communicates at rates of up to 14,400 bps (with v.32 bis data compression). It can be connected directly to a telephone line through the RJ-11 port on the terminal (see Figure 4-17) or on the CRD 3100 (see Figure 4-19)..

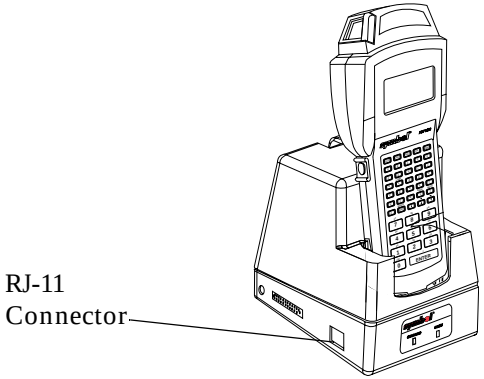


Figure 4-19. Internal Modem Connector: CRD 3100

Note: The four-slot cradle does **not** have an internal modem.

To connect the internal modem:

1. Connect the phone cord into the RJ-11 port on the back of the terminal or cradle.
2. Connect the other end of the phone cord into the wall phone jack.

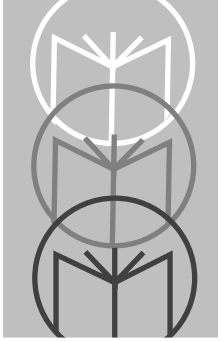
Caution

When connecting the internal modem to the phone line, always connect the phone line to the terminal or cradle first, then to the wall phone jack. When removing the connection, always remove the telephone line from the wall phone jack, then remove from the terminal or cradle.

There are specific firmware settings which are used to configure the modem's hardware and software for proper operation and regulatory compliance. The terminal's application can control these settings and enable you to view and amend the settings for country / region, pulse / tone dialing, or repeat dial timing. Incorrectly defining these settings can lead to illegal use of the modem and can create unreliable operation. The application developer should consult the Series 3000 Application Programmer's Reference Manual for correct settings.

Connecting to the Telephone Network

A compliant telephone cord is required with an RJ-11 plug connection to the modem, terminated with an appropriate and correctly wired local telecom connector compatible with the telephone network. Such a cable may be obtained from your local supplier. Alternately, compliant RJ-11 plugs to RJ-11 plug cables may be used with a range of adapters for locations such as Europe.



Chapter 5 Error Recovery and Troubleshooting

Chapter Contents

This chapter provides information to assist in basic trouble analysis and correction, including:

- Error messages
- Troubleshooting start-up failures
- Troubleshooting Spectrum24 terminals
- Running the self test function
- Self test summaries
- Keyboard test
- Running memory transfer
- Scanning problems

Error Messages

31X0/35X0

If ERR3000 is loaded in the system configuration, the terminal displays the following messages to indicate error conditions that affect system performance. A message is usually accompanied by one or more beeps, after which the system returns to its previous status.

The application can change the actual wording of the messages or disable messages. The messages listed in Table 5-1, *Error Messages* are representative. Refer to the application's documentation for further information.

Table 5-1. Error Messages

Message	Explanation
Double Key Error	Two or more keys were pressed at the same time. This does not include boot sequences (refer to Chapter 4, *Operating the Series 3100/3500*, for boot sequences).
Low Battery	The battery pack should be recharged or replaced as soon as possible.
Replace Battery	Replace or recharge the battery pack immediately. After this message is displayed, the system shuts off. You may not be able to power it on again until the battery pack is charged.
Power Fault	The last power off was caused by a power failure. This occurs, for example, if the battery pack is removed while the terminal is on or the batteries fail suddenly.

Troubleshooting

Start-up Failure: 31X0/35X0

Problems are most frequently start-up failures. If cold booting the terminal does not start the application successfully, either the application, the system software, or the system is malfunctioning. If you can boot the system to command mode, try the following:

- Use Program Loader to download a new version of the software to NVM. This procedure is described in Chapter 2, *Batch and Spectrum OneTerminal Setup*.
- Use Self Test to check whether system hardware is operational. The SelfTest procedure is described later in this chapter. After downloading new software, warm boot the terminal as described in Chapter 4, *Operating the Series 3100/3500*.

Boot Failure Messages

During a cold boot, the system briefly displays a status line for each driver as it loads, in the format:

```
0:Driver      #.##
```

The line shows a status value, usually 0, followed by the name and version number of the driver. If the system halts at one of these lines and displays a status value other than 0, the displayed device driver did not load properly.

If such a failure occurs, cold boot the terminal again. If this does not solve the problem, call Symbol Customer Support.

More troubleshooting information is found in the documentation listed in the *Related Publications*.

Out-of-Memory Errors: PDT 35XX

Out-of-memory errors may occur during PDT 35XX operation with applications that ran without difficulty on similarly equipped PDT 31XXs.

Why. These occur because the additional display lines on the PDT 35XX unit (16, as opposed to 4 or 8 on the PDT 31XX) use memory normally allocated to Transient Program Area (TPA). This situation involves the DEFNVM.HEX image supplied with the *Series 3000 Application Developer's Kit* (ADK).

Corrective Action. Use the BLDINIT utility found in the Series 3000 ADK to increase the TPA size of the NVM image by an additional 1K; then load the new NVM image into the terminal. Refer to the *Terminal Initialization* section of the *Application Programmer's Guide* for more information on BLDINIT.

Spectrum24 Terminals (3140/3540)

The command mode troubleshooting procedures utilized by 3100/3500 batch or Spectrum One terminals are not available to terminals operating in a Spectrum24 network environment. Typical initialization and operating problems and solutions for Spectrum24 terminals are listed in Table 5-2.

Table 5-2. Troubleshooting Spectrum24 Terminals

Problem	Explanation/Action
Boot process fails	Terminal is out of the AP's range. If you move the terminal during the boot process, terminal may be out range of the AP and unable to complete the process. Move back in range and repeat the boot process. OR Boot server doesn't exist. Verify that boot server is operating. OR Boot server not configured for this terminal. Refer to the Spectrum24 NDK documentation for more information.
File transfer process failed	Terminal is out of the AP's range. If you move the terminal during download, terminal may be out range of the AP and unable to complete the download. Move back in range and continue the download process. OR File transfer host is not set up with the boot file information or host is not available. Verify that all required files are available on the file transfer host. OR Segments missing from file transfer directory. Check directory for all required files.
Low Battery Message	Place the terminal in a cradle and recharge battery. OR Connect terminal to charger and recharge battery. OR Power terminal off and replace battery.

Table 5-2. Troubleshooting Spectrum24 Terminals (Continued)

Problem	Explanation/Action
Battery is dead	Battery not replaced after receiving low battery message or terminal left on for more than 24 hours. Replace the battery. *Note:* Terminal loses software when power is lost.To reload software, cold boot terminal and enter NetID manually. Associate with AP and reacquire boot files as described in *Initiate Network Connection*.
Terminal disassociated from Access Point	Application does not respond to interactive operations. Applications using internal batch mode continue to function until required to transmit via radio, then fail to work. No message displayed.

Self Test Function

Series 31XX / 35XX terminals include a series of self tests which verify that terminal hardware components are operating properly. Run self test if you suspect a problem with the hardware. Except for keyboard testing, no operator input is necessary after selecting a test screen.

Running the Self Test

Access the Self Test function from the Command Mode menu:

1. Boot to command mode (refer to Chapter 4 for boot sequences).
2. On the Command Mode screen, use the <**UpArrow**> or <**DownArrow**> to scroll through the options.
3. Highlight Screen Test and press **<Enter>**.

Self Test Summaries

The Self Test is divided into five functions or screens:

Config Screen 1 - Reports the terminal type and version, time, date, main battery status, current power source, and status of the serial ports when a loopback connector is used.

Config Screen 2 - Reports information on the keyboard and display. If a laser scanner is attached, the test reports if the trigger is pulled or not. If a wand scanner is attached, the test reports whether the wand is scanning black or white.

Memory Screen - Tests ROM, RAM, and EMS (Expanded) memory, and reports the amount of RAM and EMS.

Fill Screen - Fills the entire screen with a test pattern to verify that the entire screen displays.

Set RTC Screen - Sets the time and date settings of the real-time clock.

Keyboard Test

Keyboard testing can be performed while the terminal displays Config Screen 1 results.

Test any keys except **Clear** and **PWR.** When you press a key, the corresponding key code is displayed on the top row to the right of the test name. Table 5-3 lists the codes for each key on the 21-key keyboard; subsequent tables list those for other keyboards.

Table 5-3. 21-Key Keyboard Test Codes

Key	Test Code	Key	Test Code
Left Arrow	00	6	14
Right Arrow	01	5	13
Up Arrow	03	4	12
Down Arrow	04	3	17
Func	05	2	16
Send	06	1	15
-	07	0	19
9	11	.	18
8	10	Enter	20
7	09		

Keyboard Test Codes

Table 5-4. 35-Key Keyboard Test Codes

Key	Test Code	Key	Test Code
Alpha	0	M	18
Space	1	N	19
Shift	2	9	22
Func	4	8	21
Ctrl	5	7	20
A	6	6	26
B	7	5	25
C	8	4	24
D	9	3	30
E	10	2	29
F	11	1	28
G	12	0	32
H	13	Backspace	27
I	14	X	31
J	15	Z	33
K	16	Enter	34
L	17		

Keyboard Test Codes

Table 5-5. 46/47-Key Keyboard Test Codes

Key	Test Code	Key	Test Code
Control	3	V	26
Shift	2	W	27
A	5	X	28
B	6	Y	29
C	7	Z	30
D	8	Up Arrow	33
E	9	Down Arrow	34
F	10	0	44
G	11	1	41
H	12	2	42
I	13	3	43
J	14	4	38
K	15	5	39
L	16	6	40
M	17	7	35
N	18	8	36
O	19	9	37
P	20	Backspace	31
Q	21	Space (47-Key Only)	47
R	22	Func	1
S	23	.	32
T	24	Enter	45
U	25		

Exiting Self Test

The test loop continues updating the time and battery status and processing keystrokes.

To end the test, press **<Clear>**.The display returns to the Command Mode menu.

Memory Transfer Program

Command Mode includes a memory transfer utility that transfers data from a terminal to a host PC for program troubleshooting. Programmers can analyze an application using tools provided in the Series 3000 Application Development Kit and described in the *Series 3000 Application Programmer's Reference Manual*.

Hardware Setup

1. Turn OFF the terminal and host PC. Disconnect or unplug the cradle, if used.

Caution

Always turn off the terminal before attaching or removing cables or adapters.

2. Connect the terminal and host PC using the 3115 communications/charger adapter:
   a. Plug the CCA's RJ41 connector in the terminal's base.
   b. Plug the CCA's DB25 connector in the host PC's communications port.

OR

Connect the host to a one- or four-slot cradle:

   c. Plug the null modem's connector in the cradle's communications port.
   d. Plug the other connector in the host's communications port.
   e. Place the terminal in the cradle.
3. Power on the host PC.
4. Plug in the cradle, if used.

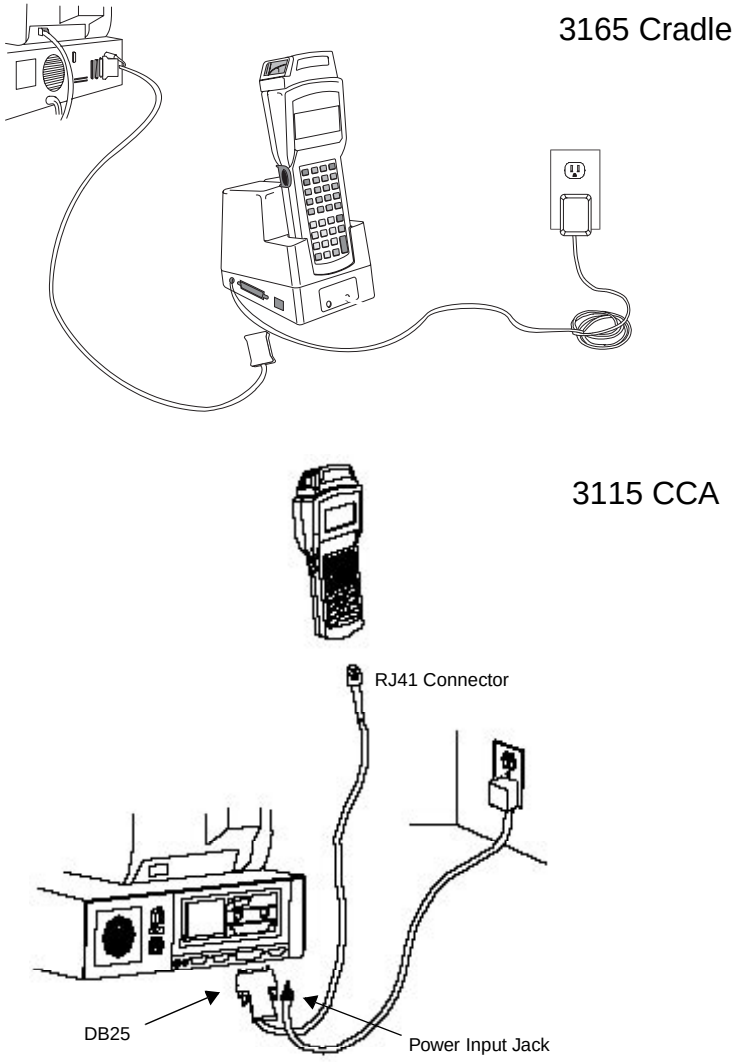


Figure 5-1. Connecting the 3100/3500 Terminal for Memory Transfer

Set Communications Parameters

Host

1. Start the Communications program on the host PC.
2. Set up the host communication parameters (these parameters must match the terminal's parameters). At the DOS prompt on the host, enter:

   ```
   RCVHEX <filename.hex> <baud rate> <comport#>
   ```

   Typical parameters are:

   38400 bps
   7 bit data
   Odd parity
   Xon / Xoff flow control

Terminal

1. Boot the terminal to Command Mode (refer to Chapter 4 for the appropriate key sequence).
2. Select the Memory Transfer function from the Command Mode menu. Use <**UpArrow**> or <**DownArrow**> to scroll through the command mode options until Memory Transfer is displayed, and press **<Enter>**.
3. Select the range of memory to transfer by pressing the first letter of the desired range (**A**ll, **R**ange, or **N**one), or use the <**UpArrow**> or <**DownArrow**> and press **<Enter>**.

   If you select **All**, the program skips to the range verification screen (step 7).

   If you select **Range**, the screen displays:

   ```
   RAM
   Use Arrow Keys
   Start       End
   00000      9FFFF
   ```

4. Specify a range of RAM by setting the Start and End addresses.
   - Use **<RightArrow>** and **<LeftArrow>** to move the cursor to the digit to be changed
   - Use **<UpArrow>** and **<DownArrow>** to change the values.

   Type a range and press <**Enter**>.

5. Specify a range of NVM to transfer. Choose All or None.
6. If the system has EMS installed, it prompts for the range to transfer (otherwise, the program skips this screen):

```
EMS

Use arrow keys
Start          End
```

   The range is specified in page numbers (16 KB per page). Use <**RightArrow**> and <**LeftArrow**> to move between the Start and End values. Use <**UpArrow**> and <**DownArrow**> to change the page number value.

   Set the range and press **<Enter>**.

7. The terminal displays a range verification screen. For example:

```
RAM 0000 3FFF
NVM C839 DFFF
EMS   None
Correct?
```

   If the values are correct, press **<Enter>**. If the values are not correct, press **<Clear>** to clear the fields and select new values.

8. Specify the baud rate. Use the **<UpArrow>** and **<DownArrow>** to scroll through the list of baud rates until the correct rate is displayed, and press **<Enter>**. (Flow control may be necessary at 38400 bps and higher.)
9. Specify the data bits. Press **<7**> or <**8>**, or use **<UpArrow>** and **<DownArrow>** to display 7 or 8, and press **<Enter>**.

   Note: If you select 8 data bits, the program selects No parity and skips the next screen.

10. Specify parity type. Use **<UpArrow>** and **<DownArrow>** to display a parity option, or press the first letter of a parity option (**E**ven, **O**dd, **N**one, **S**pace, or **M**ark) and press **<Enter>**.
11. Set flow control. Use **<UpArrow>** and **<DownArrow>** to display the flow control options, or press the first letter of an option (**N**one, **X**on / Xoff, or **R**TS / CTS) and press **<Enter>**.

Start Communications

1. The terminal is ready to send the data to the host PC and displays:

```
Comm Parameters

Start? <ENT>
```

2. Verify that the host is ready to receive data.
3. Press **<Enter>** on the terminal.

   While data is being transferred, the terminal displays a report of the 1 KB range being transferred:

```
Memory Transfer

Sending: XXXX
```

   The display is updated for every 1024 bytes (1 KB) of memory.

4. When the transmission completes or aborts, the terminal displays the transmission status screen:

```
Memory Transfer

Status  0000
```

A status of 0000 (all zeros) indicates that the transfer was successful. Any other status indicates failure. Refer to Appendix C for communications status codes which indicate the source of the error.

End Communications

To return to the Command Mode main menu, press **<Clear>**. Then take whatever corrective action is necessary, and reboot the terminal.

Internal Modem Problems

If you are having difficulties with your internal modem, please check the following before returning your product:

- Connection to the telephone network is correct.
- Any necessary special requirements such as dialing 9 and ignoring dial tone have been considered inthe event of using a PBX.

- Firmware settings described in the Series 3000 Application Programmer's Guide have been configured correctly.

Scanning Problems

What If ...

Nothing happens when you follow the operating instructions?

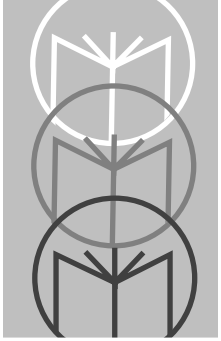
- Check the system power.
- Make sure the scanner is programmed to read the symbology you are trying to read.
- Check the bar code to make sure it is not defaced. A defaced 1-D bar code may not be readable by any scanner. Likewise, if a PDF417 symbol is damaged beyond its error correction capability, it will not decode.
- Check to see if you are scanning from the proper distance.
- Try scanning a test symbol of the symbology you are trying to read.

Your terminal operates but scanned data is not displayed correctly?

- Check the system power.
- Check that the communication parameters (baud rate, parity, stop bits, etc.) are set properly for the receiving device.

The laser does not activate?

- You may have exceeded the allowable amount of scanning activity within the limits of your laser class of operation; in this case, wait for a short interval until scanning can resume.
- You may be scanning in an inappropriately hot environment. If so, remove the equipment from that environment, or allow the laser to cool down.



Chapter 6 Maintaining the 3100/3500 Terminal

Chapter Contents

Batteries

The Series 3100 terminal's primary power is provided by a 9-Volt alkaline battery, a rechargeable nickel cadmium (NiCd), or nickel metal hydride (NiMH) battery pack. The PDT 3500 is powered by a single battery pack, which may be NiCd or NiMH.

Battery Life

Many factors affect battery pack life, including temperature, battery age, and data collection method. Uses and operating conditions which affect battery life are:

- scanning
- radio communications
- very high operating temperatures
- "power save" mode
- backlighting use
- very low operating temperatures

The approximate battery life between charges (NiCd, NiMH) or replacement (alkaline) is summarized inTables 6-1, 6-2, and 6-3. Note that these values vary with the application. Applications involving modem and radio communications shorten these times.

Table 6-1. Battery Life: PDT 31X0

Battery Type	Input Method	Approx. Operating Time: PDT 3100	Approx. Operating Time: PDT 3110
9V Alkaline	Keyboard	30 hours	x
	Laser Scanner	4500 + scans	x
	Wand Scanner	5000 + scans	x
400 MaH NiCd	Keyboard	40 hours	35 hours
	Laser Scanner	4300 + scans	4000 + scans
	Wand Scanner	4300 + scans	4000 + scans
600 MaH NiMH	Keyboard	50 hours	45 hours
	Laser Scanner	6400 + scans	6100 + scans
	Wand Scanner	6400 + scans	6100 + scans
** Power consumption is highly application-dependent. The figures above represent battery life of typical applications. However, battery life with individual applications will vary.*			

Note: Alkaline batteries are NOT recommended for use with the PDT 3110 or 3140.

Table 6-2. Battery Life: PDT 35X0, 1-D

Battery Type	Input Method	Approx. Operating Time: PDT 3500S	Approx. Operating Time: PDT 3510S
800 MaH NiCd	Keyboard	65 hours	55 hours
	Laser Scanner	6800 + scans	6400 + scans
	Wand Scanner	6800 + scans	6400 + scans
1200 MaH NiMH	Keyboard	80 hours	70 hours
	Laser Scanner	10,000 + scans	9500 + scans
	Wand Scanner	10,000 + scans	9500 + scans
** Power consumption is highly application-dependent. The figures above represent battery life of typical applications. However, battery life with individual applications will vary.*			

Note: Alkaline batteries are NOT recommended for use with the PDT 3510 or 3540.

Table 6-3. Battery Life: PDT 35X0, 2-D

Battery Type	Input Method	Approx. Operating Time: PDT 3500P	Approx. Operating Time: PDT 3510P, PDT 3540-P
800 MaH NiCd	Keyboard	44 hours	36 hours
	Laser Scanner	2500 + scans	2400 + scans
	Wand Scanner	2500 + scans	2400 + scans
1200 MaH NiMH	Keyboard	56 hours	48 hours
	Laser Scanner	3700 + scans	3600 + scans
	Wand Scanner	3700 + scans	3600 + scans
** Power consumption is highly application-dependent. The figures above represent battery life of typical applications. However, battery life with individual applications will vary.*			

When to Replace or Recharge Batteries

The Series 3100 and 3500 provide two types of indicators to notify you when battery power is running low: warning messages and modified cursors. These indicators may be changed or disabled by an application program.

- **LOW POWER** — When the battery is low, the cursor changes as shown inTable 6-4. If ERR3000 is loaded, the message LOW BATTERY also appears. At this level, the terminal continues to operate, but there is probably less than 1 hour of usable power left.

  Note: When the LOW BATTERY message is displayed on PDT 3500 terminals, the 2D scanner will not scan until the battery is recharged or replaced.

- **VERY LOW** — When the power is very low, the REPLACE BATTERY message appears and the system powers off. Replace or recharge the battery before attempting to use the terminal. If the battery is not immediately recharged or replaced, data may be lost.

Battery life varies between 500 - 1000 charge / recharge cycles. This variation depends on the depth of discharge. In general, replace batteries which exhibit less than 80% of their total rated capacity.

Table 6-4. Cursor Indicators

Keyboard State	Cursor Character	Low Battery
Unshifted		
Shifted		
Momentary Shifted		
Momentary Unshifted		
Control		
Alt		
Function		

Supercap Power Backup

To prevent data loss during battery replacement, the terminals have a supercap power backup. The supercap backup provides sufficient power to preserve memory contents for approximately 5 minutes while batteries are replaced. The supercap does **not** provide enough power to operate the terminal. On receiving a low battery message, replace or recharge the primary batteries immediately.

Replacement Batteries

For PDT 31X0

Rechargeable battery packs are available from Symbol Technologies:

- NiCd battery pack — 400 MaH — KT-12596-01
- NiMH battery pack — 600 MaH — KT-12596-02

9-Volt alkaline batteries vary slightly in size and some may not make a good electrical contact. The following batteries are known to be the proper size and are assured to work:

- Eveready #522
- Duracell #MN1604 and #MN1604-AS, or equivalent

For PDT 35X0

Rechargeable battery packs are available from Symbol Technologies:

- NiCd battery pack — 800 MaH — 21-14969-01
- NiMH battery pack — 1200 MaH — 21-14969-02

Battery Replacement

Alkaline (PDT 3100)

To replace the 9V alkaline battery (refer to Figure 6-1):

1. Turn terminal off.
2. Release hand strap.
3. Unlock and remove battery compartment door.

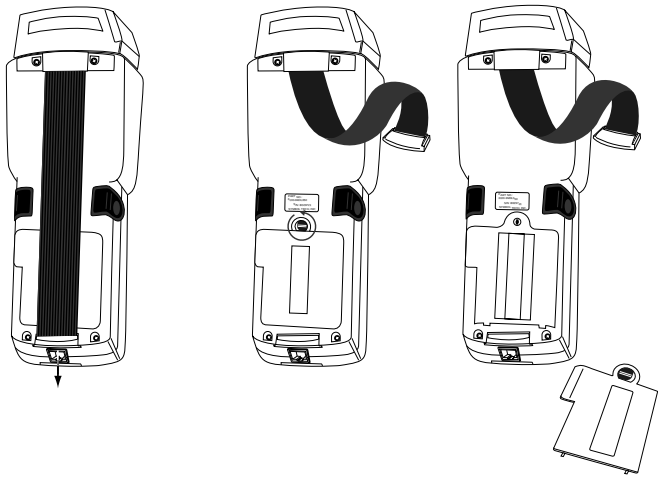


Figure 6-1. Opening the PDT 3100 Battery Compartment

4. Detach the battery from the 9V connector, and remove it from the compartment.

Caution

Dispose of dead batteries in accordance with battery label instructions.

5. Snap the replacement 9V alkaline battery to the connector and place it in the battery compartment.

6. Replace the battery compartment cover and reattach the hand strap.

Note: The following batteries are recommended for a good electrical contact: Eveready #522, Duracell #MN1604, or Duracell #MN1604-AS alkaline batteries.

To replace a NiCd or NiMH battery with an 9V alkaline battery:

1. Perform steps 1-3 above.
2. Remove the NiCd or NiMH battery and NiCd or NiMH battery connector.
3. Plug the 9V connector in the 9V socket (refer to Figure 6-2).
4. Perform steps 5-6 above.

Replacing NiCd or NiMH Batteries (PDT 3100)

To replace an alkaline battery with a rechargeable NiCd or NiMH battery pack, or to replace a NiCd or NiMH battery pack:

1. Power the terminal off.
2. Release the hand strap.
3. Unlock and remove the battery compartment door.
4. If the previous battery was an alkaline, gently remove the 9V connector fromthe 9V socket. Do NOT tug on connector wires. Store the connector.
5. Plug the battery connector in the rechargeable battery socket immediately below the 9V socket (refer to Figure 6-2).
6. Fit the NiCd or NiMH battery pack in the compartment next to the adapter.
7. Verify that the battery and connector are properly seated.

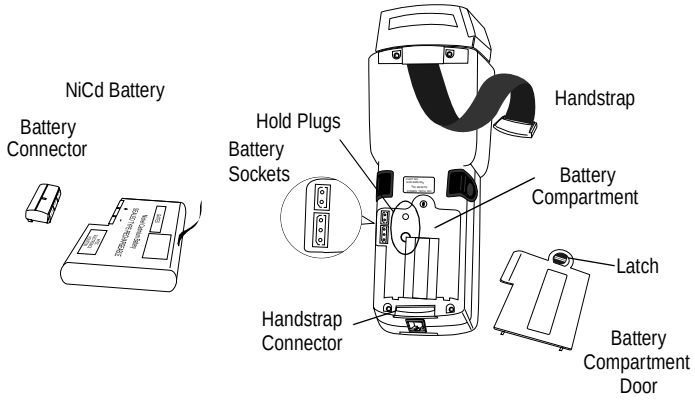


Figure 6-2. PDT 3100 Battery Replacement

8. Replace and lock the battery compartment cover.
9. Reattach the hand strap.
10. Recharge the battery pack (refer to *NiCd or NiMH Battery Recharging*).

Replacing NiCd or NiMH Batteries (PDT 3500)

For the PDT 3500, each type of battery uses a battery pack of the same physical form. Installation and replacement are the same for all battery types.

To Remove a PDT 3500 Battery Pack:

1. Power the terminal off.
2. Release the hand strap.
3. Grasp the tab (shown in Figure 6-3) at the top of the battery pack and pull back.
4. Lift the battery up from the compartment, tabbed edge first.

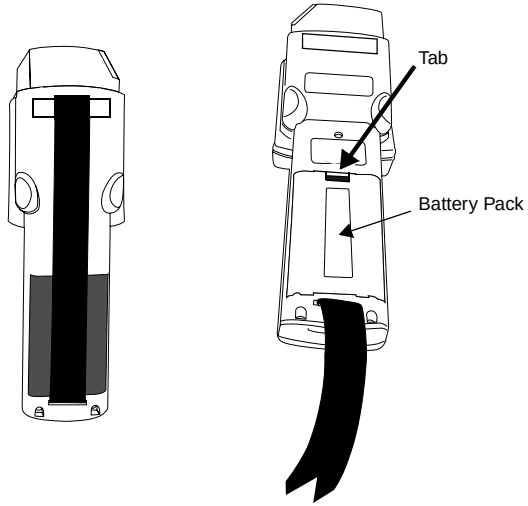


Figure 6-3. PDT 3500 Battery Pack Removal

5. If it is rechargeable, recharge the old battery pack. Refer to*NiCd or NiMH Battery Charging (PDT 3100 and PDT 3500).*

Caution

Dispose of dead batteries in accordance with battery label instructions.

To Install a New or Recharged Battery Pack:

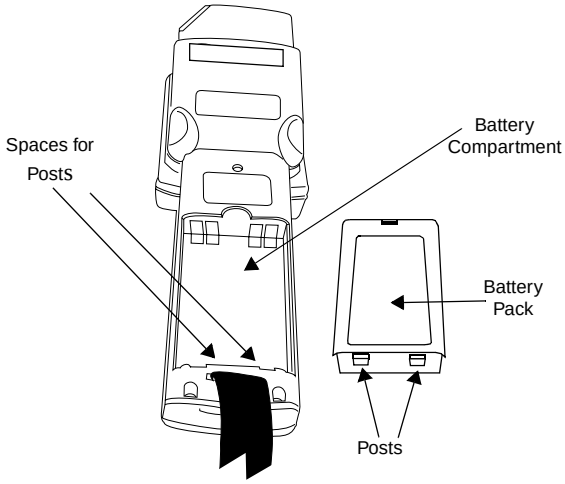


Figure 6-4. PDT 3500 Battery Pack Replacement

1. Insert the battery in the bottom of the compartment. Two posts on the battery pack must fit in corresponding spaces in the housing (refer to Figure 6-4).
2. Push the battery pack forward until it lies flat in the compartment, flush with the housing. When it lies in this position, the lift tab should snap in and the contacts should meet.
3. Reattach the hand strap.

NiCd or NiMH Battery Charging (PDT 3100 and PDT 3500)

Cradle

To charge a NiCd or NiMH battery using the one- or four-slot cradle:

1. Plug power connector in cradle's power socket.
2. Plug the wall cube in wall socket (refer to Figure 6-5).
3. Place terminal in cradle.
4. Verify that terminal is properly seated.
5. If the battery power is very low, press <**PWR**> to initiate charging.

   Depending on the type, the battery pack fully charges in approximately 1.5 to 2 hours (PDT 3100) or 3 to 5 hours (PDT 3500).

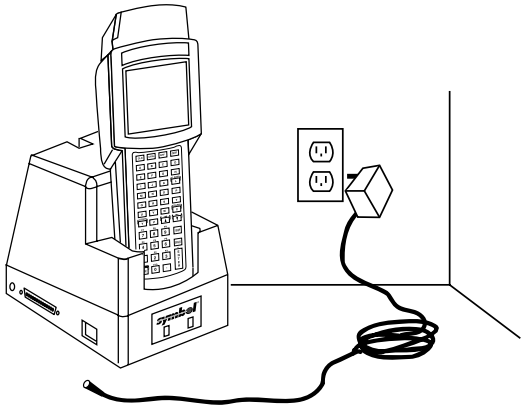


Figure 6-5. One-Slot Cradle Setup for Charging

Battery Charging Tips

For maximum capacity and battery life:

- Charge at temperatures between 0°C and 45°C (32°F and 113°F). Optimum charging occurs at room temperature (about 20°C to 25°C). Above or below that range, batteries may not charge to rated capacity.
- Recharge as soon as you see the "Low Battery" message.
- Charge NiCd or NiMH batteries after storage.

3115 Communications/Charger Adapter (PDT 3100 and KT-12596-01 Only)

The optional 3115 Communications / Charger Adapter (CCA) provides power from a wall-mounted power supply for recharging the NiCd battery while the terminal is in use.

To charge the terminal using the 3115 CCA (refer to Figure 6-6):

1. Plug the 10-pin RJ41 connector in the terminal base.
2. Plug the connector from the 15V power supply, P / N 59915-00-00 (US, 115V) or 60507-00-00 (International, 230V) in the CCA's power input jack.
3. Plug the power supply in a wall socket.

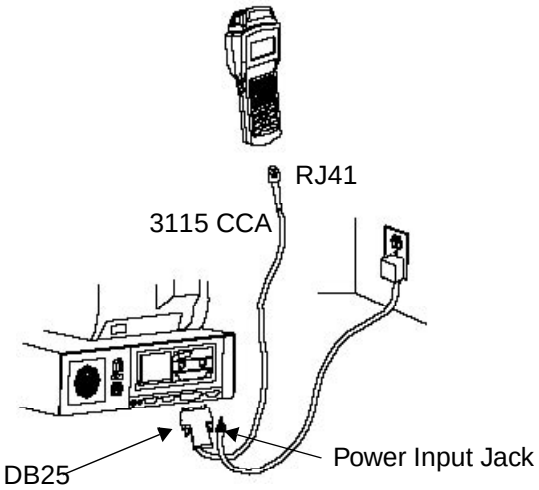


Figure 6-6. Connections for Charging with the 3115 CCA (PDT 3100 ONLY)

NiCd batteries recharge fully in 12 to 16 hours.

> **Note:** **For the PDT 3100**, you *may only* charge the battery KT-12596-01 in the terminal through the 3115 CCA.

Other Charging Options

Note that you can charge the KT-12596-01 battery pack using the Universal Four-Slot Charger (3004-xxx) or the UBC 1000 Charger. Use the UBC 1000 Charger to charge the KT-12596-01, 21-14969-01, and 21-14969-02 battery packs.

Cleaning

Series 3100 and 3500 terminals require a minimum amount of maintenance. However, keep the terminal clean to avoid problems and prolong the terminal's life.

To clean a terminal, use a clean, soft cloth dampened with a mild cleaner such as soap and water. Do not use abrasive paper, cloth, or abrasive / corrosive cleaners.

Wipe the entire terminal, except for the scanner window, with the damp cloth. Clean the keypad and scanner triggers.

Wipe the scanner window periodically with a lens tissue or other material suitable for cleaning optical material such as eyeglasses.

Caution

Do not pour, spray, or spill any liquid onto any part of the terminals, particularly the scanner or scan element components.

Appendix A
Port Pin-Outs

This appendix provides reference information for Series 3100 and 3500 ports and mappings for a null modem cable.

Scanner Port (DE-9)

The scanner port is located on the top of the Series 3100 and 3500. The pin descriptions are as follows (Table A-1):

Table A-1. Scanner Port Pin-outs

Pin	Name	Function	Direction
1	LASERDIR	Laser direction indicator*	input
2	BWD	Black / white data	input
3	SCANLED	Scanner LED control	output
4	no connection		
5	LASERTRIG	Laser trigger (active low)	input
6	SCANELC	Scanner electronics enable	output
7	GROUND	Logic / power ground	
8	GROUND	Logic / power ground	
9	SCANPWR	Scanner power (+5V)	output
* Must be grounded on contact wand scanners			

Pinouts for 3100 / 3500 Serial Devices

Terminal RJ41 Connector. Located in the base of the terminal.

Table A-2. RJ-45 Connector

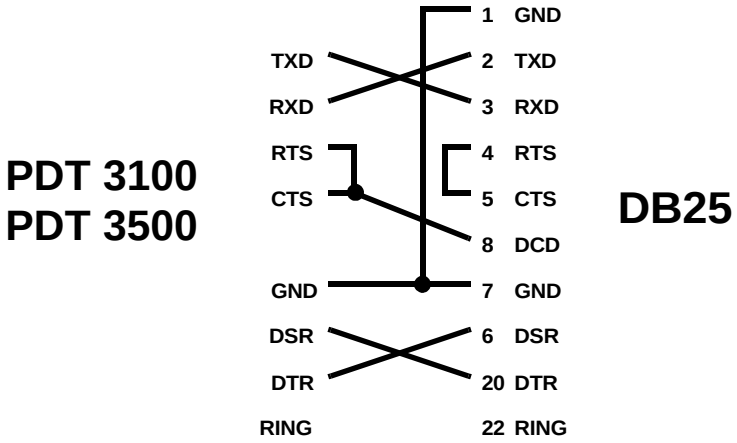
Pin#	Signal	Description
1	DSR	Data Set Ready input
2	DCD	Data Carrier Detect input
3	RXD	Received Data input
4	RTS	Request to Send output
5	TXD	Transmit Data output
6		Power (+12VDC)
7	RING	Ring input
8	GND	Ground
9	CTS	Clear to Send input
10	DTR	Data Terminal ready output

3115 Communications/Charger Adapter - Straight through. DTE device with a female DB25 connector.

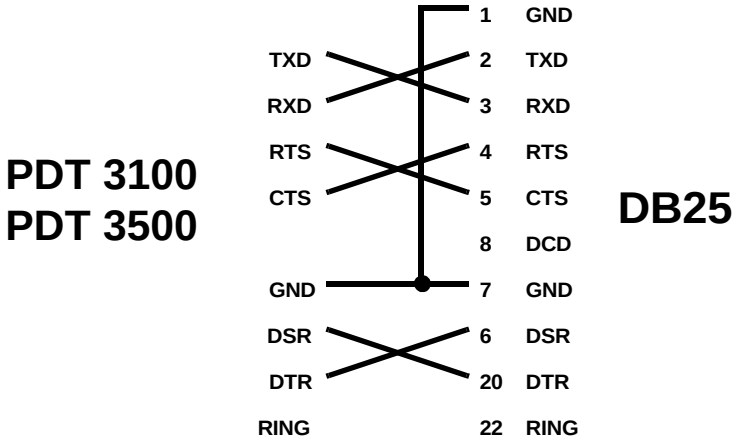
Table A-3. 3115 CCA

Pin#	Signal	Description
2	TXD*	Transmit Data output
3	RXD*	Received Data input
4	RTS	Request To Send output
5	CTS	Clear To Send input
6	DSR	Data Set Ready input
1,7	GND	Power and signal ground
20	DTR	Data Terminal Ready output
22	RING	Ring input
25	PWROUT	Optional regulated 5V output. Only active during communications, and only if enabled by adding a jumper inside the housing. Use with caution.

3115 Communications/Charger Adapter - Full Duplex Null Modem. Female DB25 connector.

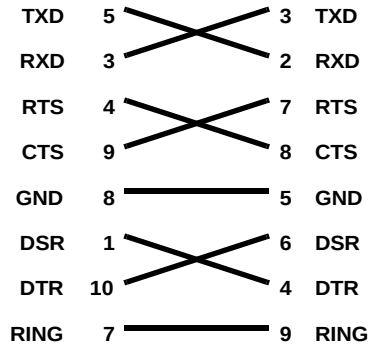


3115 Communications/Charger Adapter - RTS/CTS Null Modem. Female DB25 connector.



RJ45 Passive Cable (P/N 25-10413-01)

PDT 3100
PDT 3500



DE9

Appendix B
Keyboard Layouts

The following pages show the characters and character sequences produced by the keyboards using the default translation tables.

As explained in Chapter 4, these key definitions can be changed by the application program. The captions indicate what sequence of modifier keys produce the keyboard.

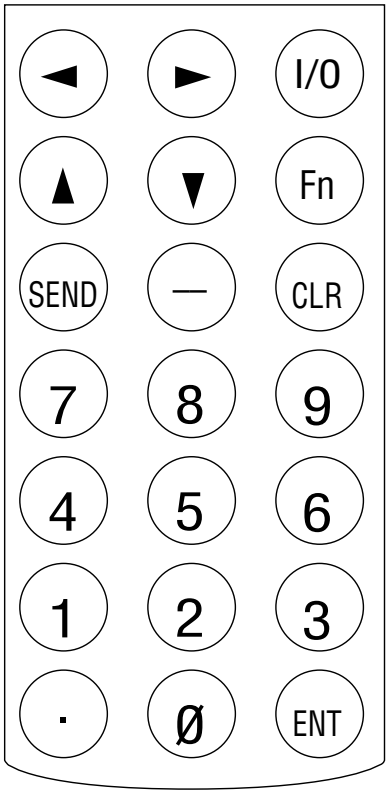


Figure B-1. 21-Key Unmodified PDT 3100 Keyboard

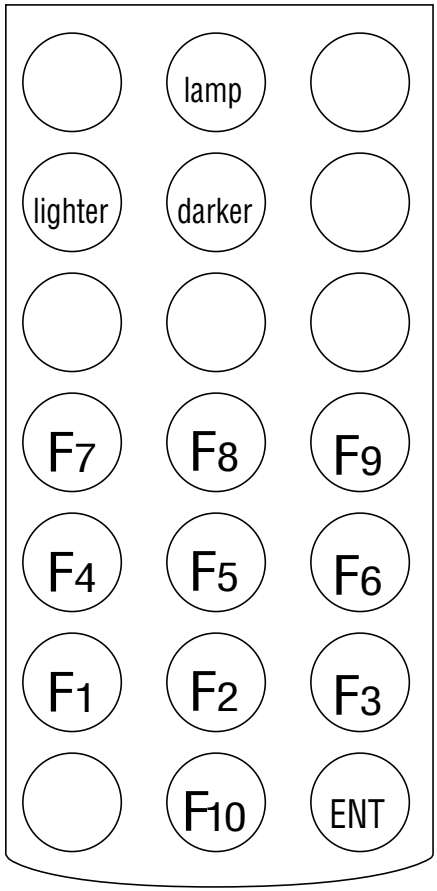


Figure B-2. 21-Key Function-Modified PDT 3100 Keyboard

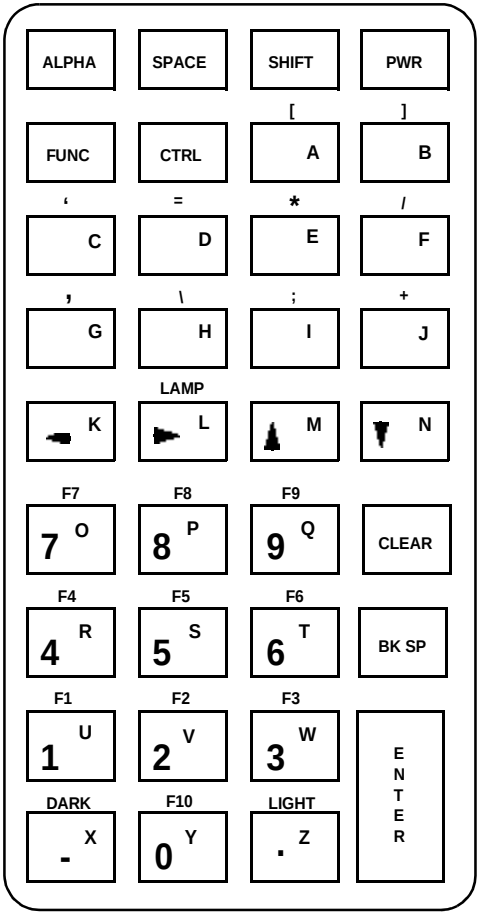


Figure B-3. 35-Key PDT 3100 Keyboard

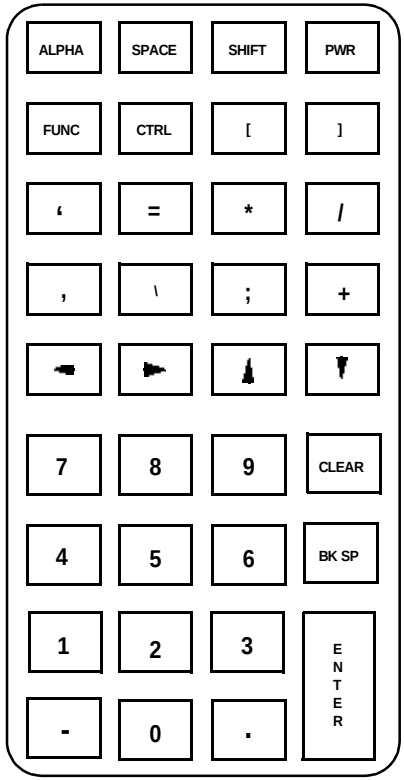


Figure B-4. 35-Key Unmodified PDT 3100 Keyboard

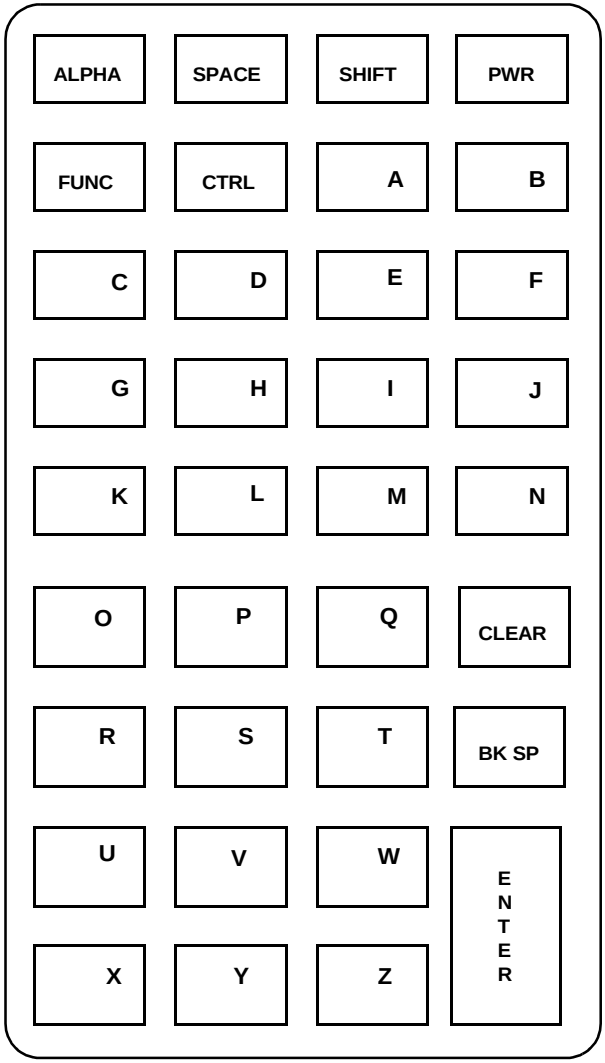


Figure B-5. 35-Key Alpha Key Modified PDT 3100 Keyboard

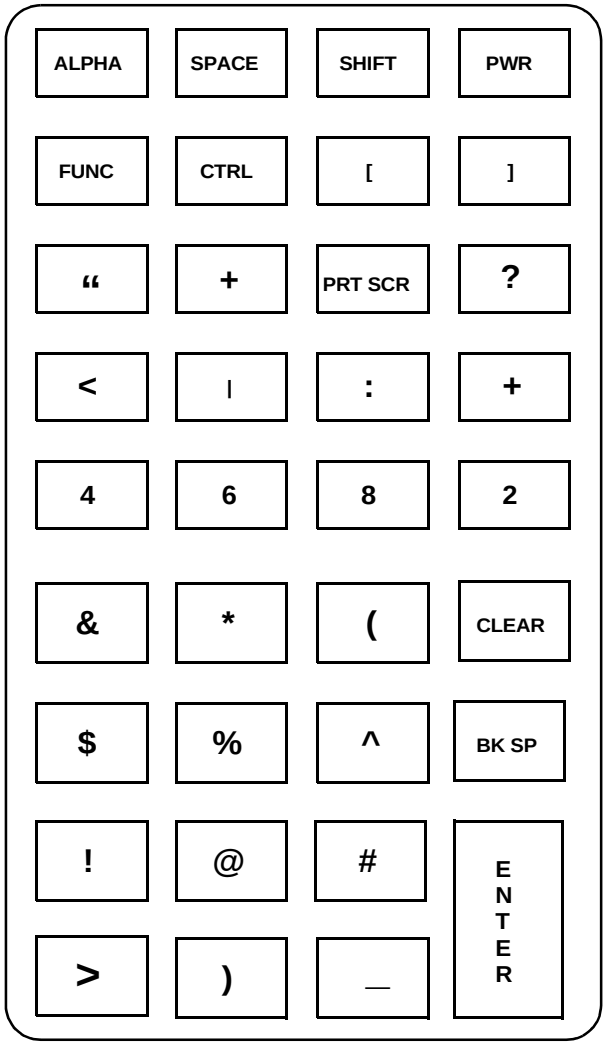


Figure B-6. 35-Key Shift Key Modified PDT 3100 Keyboard

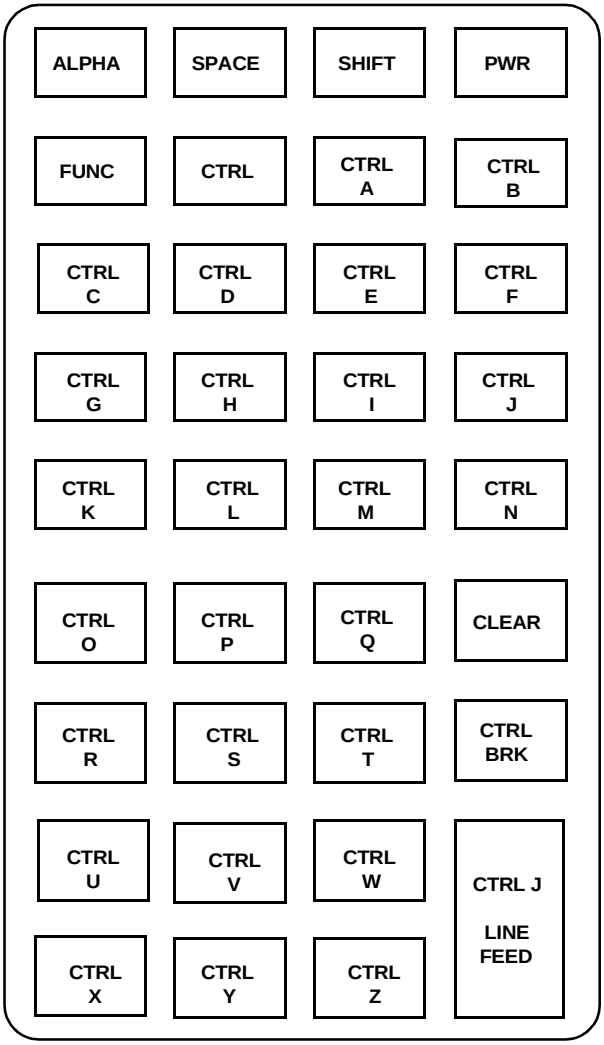


Figure B-7. 35-Key Control Key PDT Modified PDT 3100 Keyboard

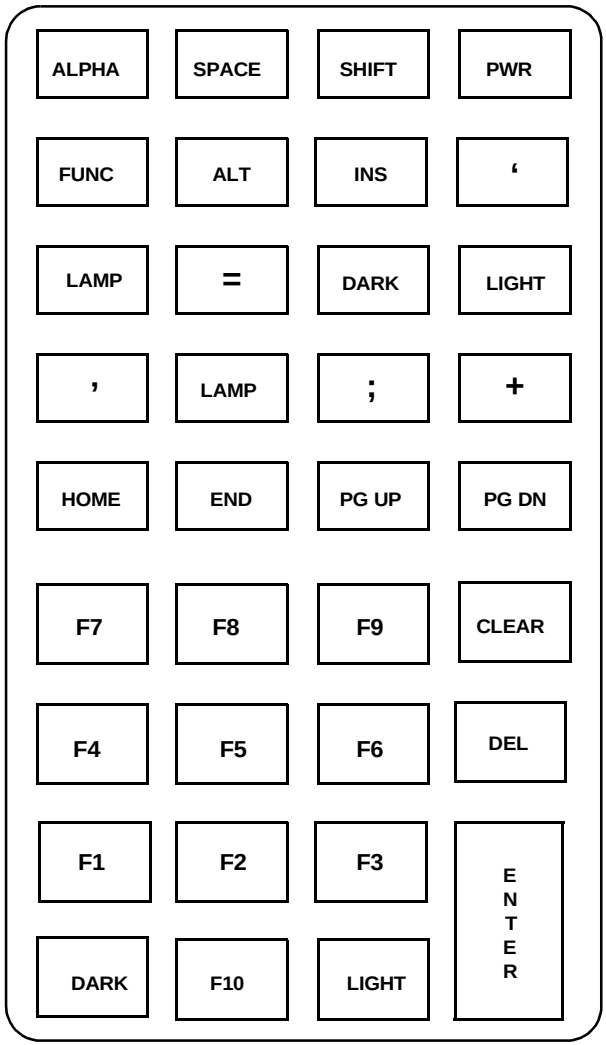


Figure B-8. 35-Key Function Key Modified PDT 3100 Keyboard

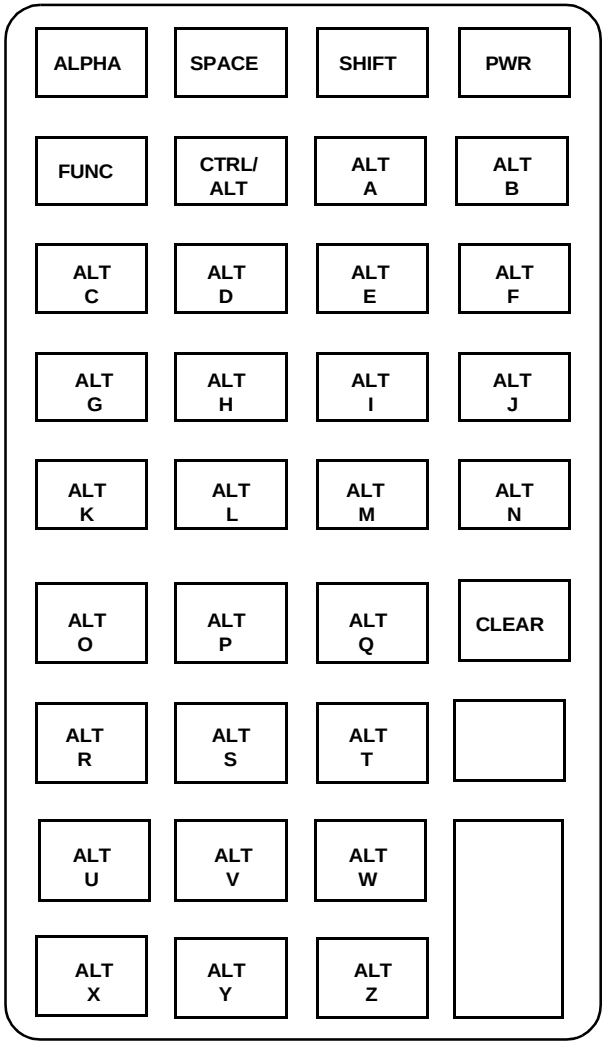


Figure B-9. 35-Key Alt Key Modified PDT 3100 Keyboard

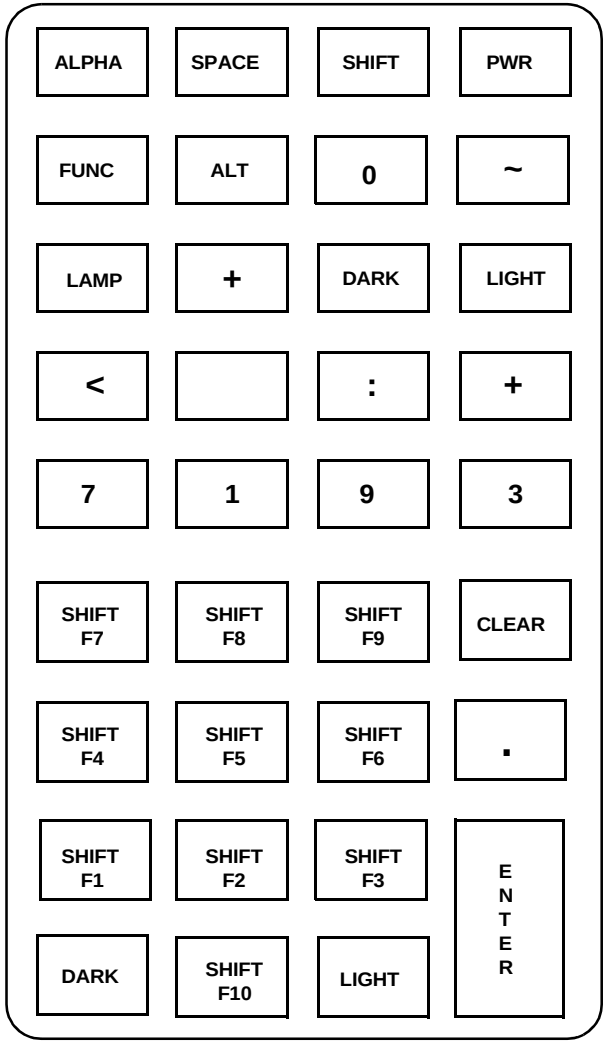


Figure B-10. 35-Key Shift + Func Modified PDT 3100 Keyboard

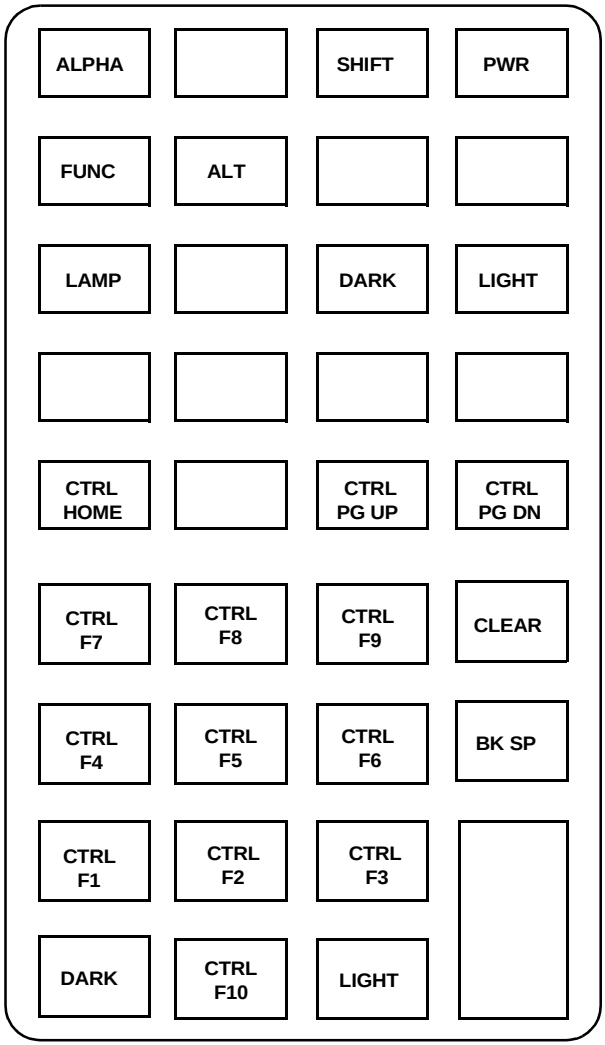


Figure B-11. 35-Key Ctrl + Func Modified PDT 3100 Keyboard

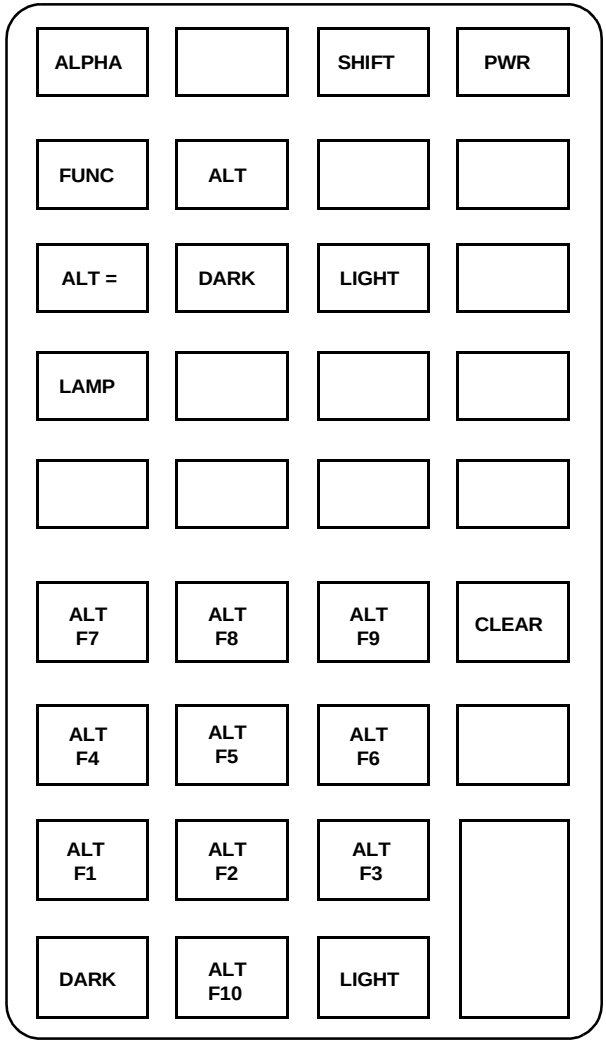


Figure B-12. 35-Key Alt + Func PDT 3100 Keyboard

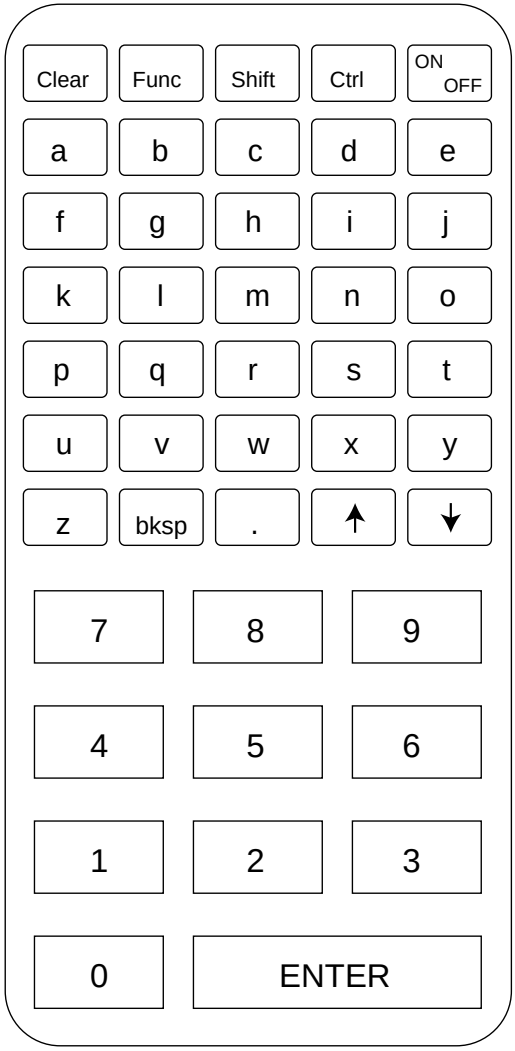


Figure B-13. Series 3100 46-Key Unmodified PDT 3100 Keyboard

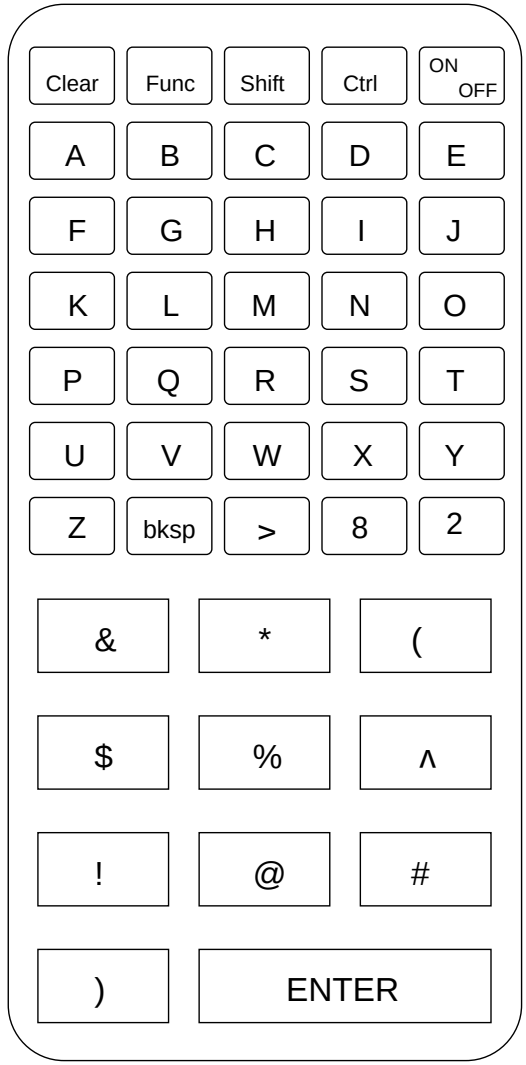


Figure B-14. 46-Key Shift Modified PDT 3100 Keyboard

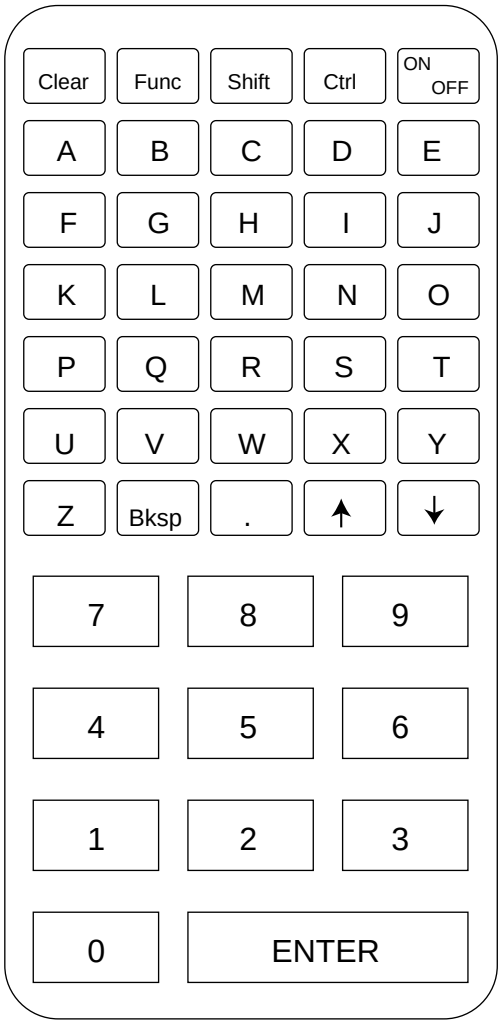


Figure B-15. 46-Key Keyboard Caplock Modified PDT 3100 Keyboard

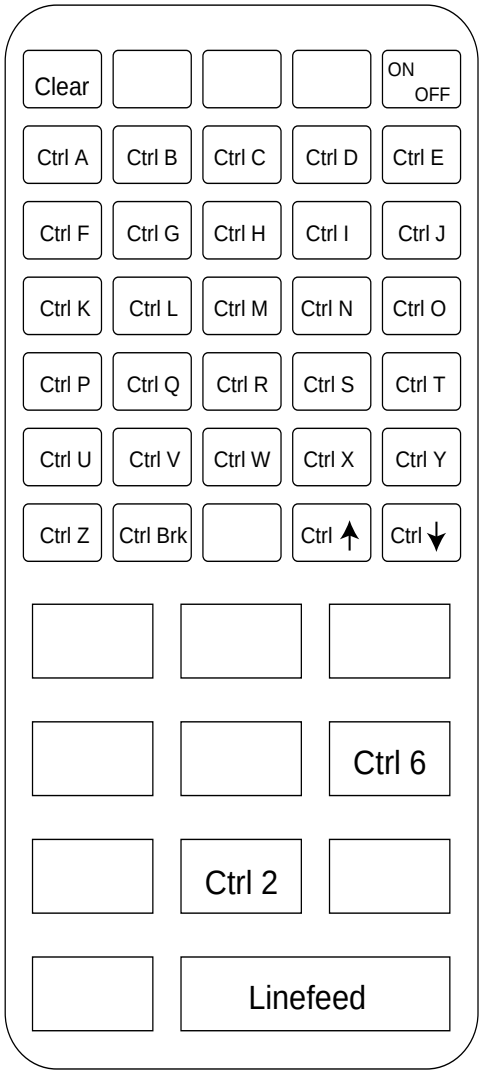


Figure B-16. 46-Key Keyboard Control Modified PDT 3100 Keyboard

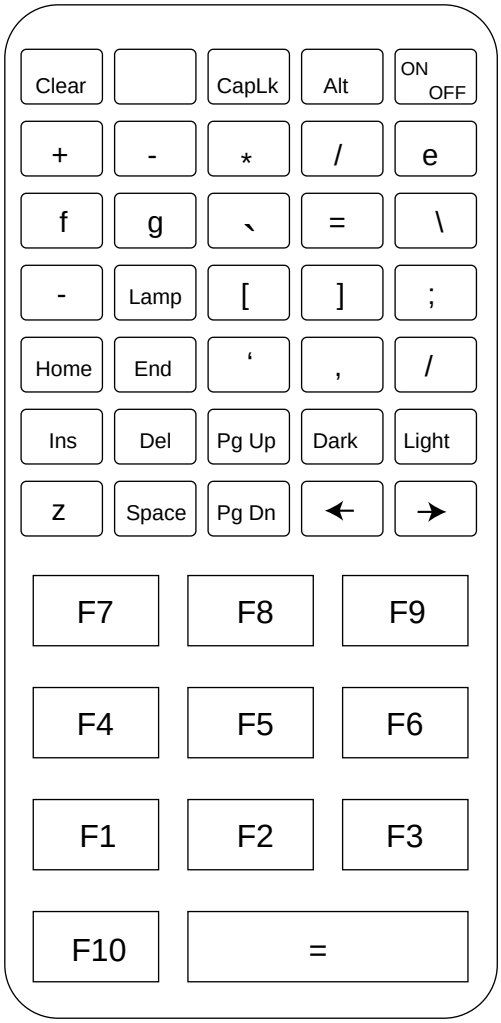


Figure B-17. 46-Key Keyboard Func Modified PDT 3100 Keyboard

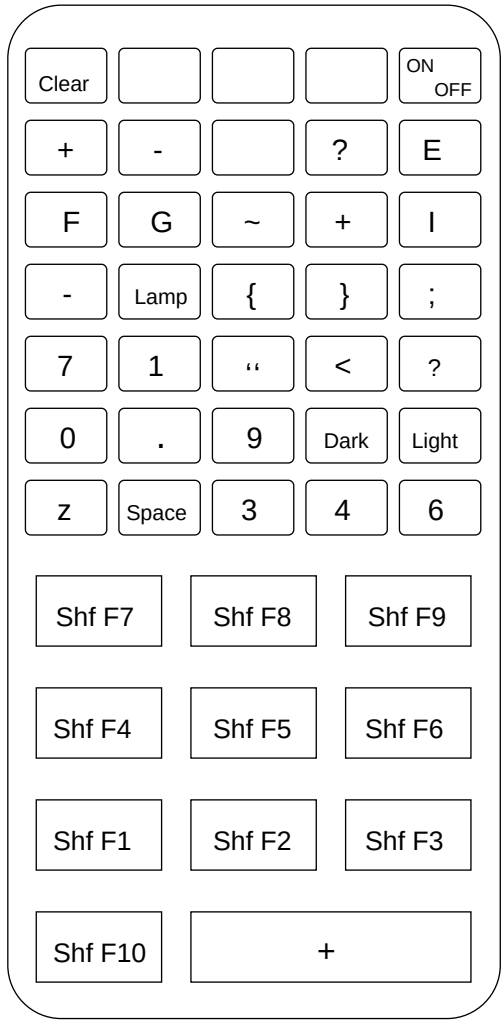


Figure B-18. 46-Key Keyboard Shift + Func Modified PDT 3100 Keyboard

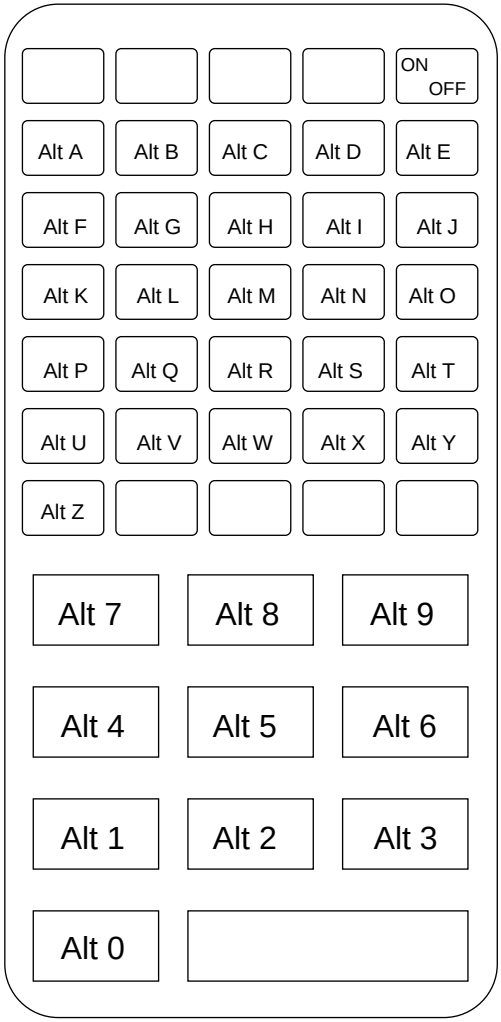


Figure B-19. 46-Key Keyboard ALT (Func + Control)
Modified PDT 3100 Keyboard

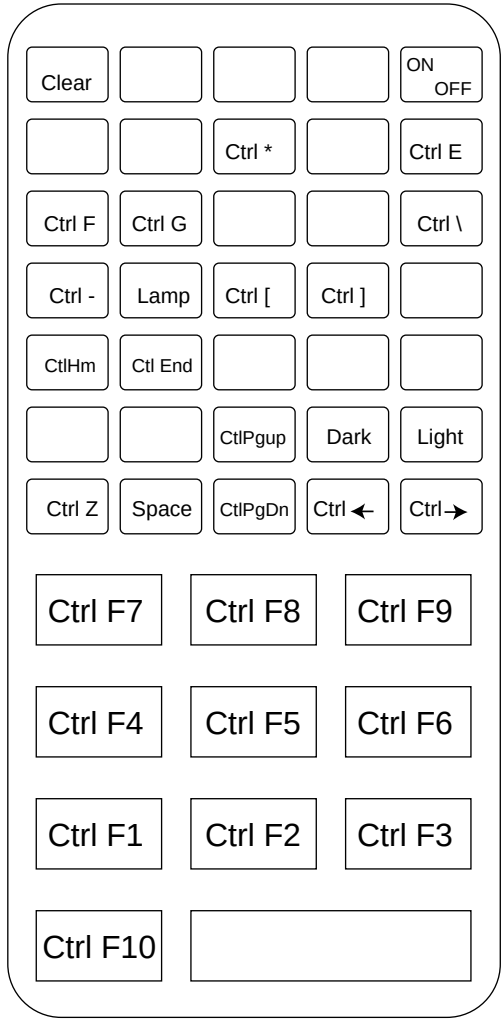


Figure B-20. 46-Key Keyboard Control + Func Modified PDT 3100 Keyboard

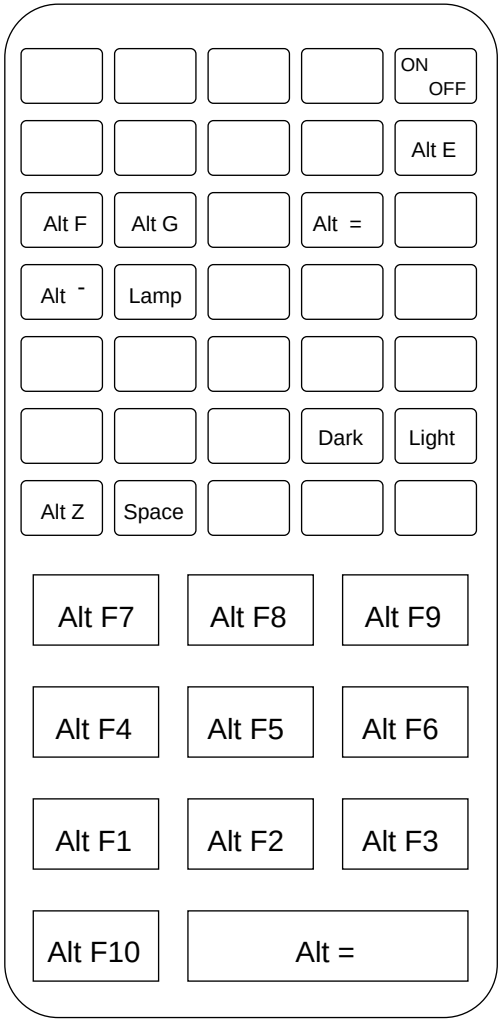


Figure B-21. 46-Key Keyboard ALT + Func Modified PDT 3100 Keyboard

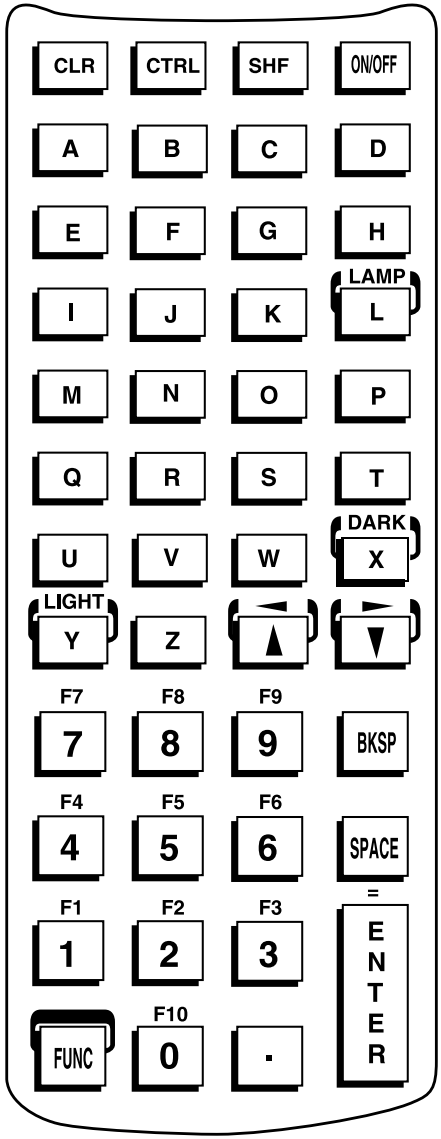


Figure B-22. 47-Key PDT 3500 Keyboard

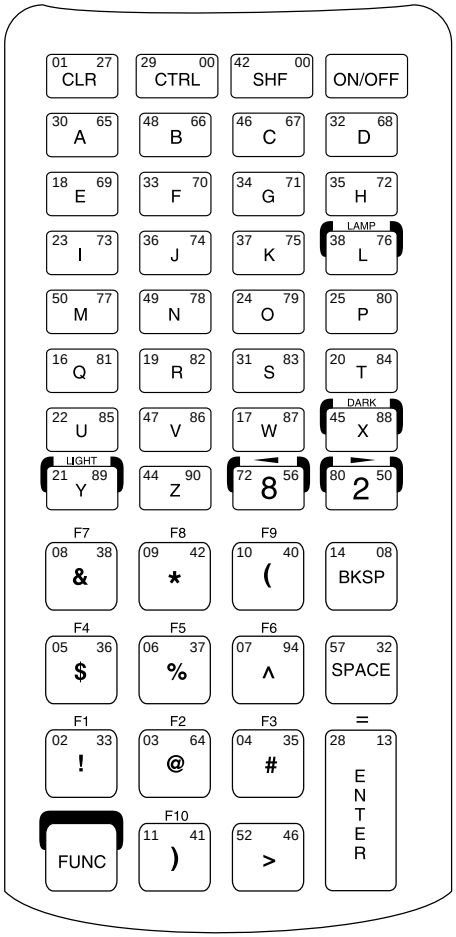


Figure B-23. Series 3500 47-key Shift-Modified Keyboard

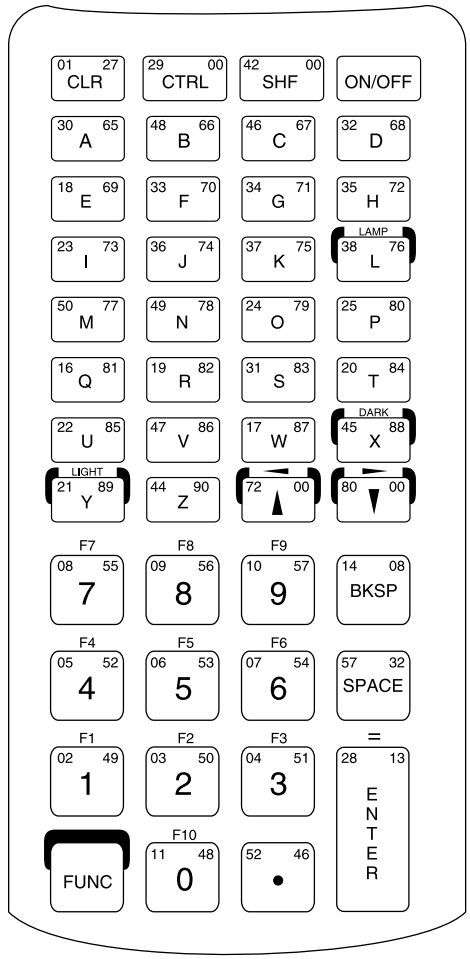


Figure B-24. Series 3500 47-key Caplock-Modified Keyboard

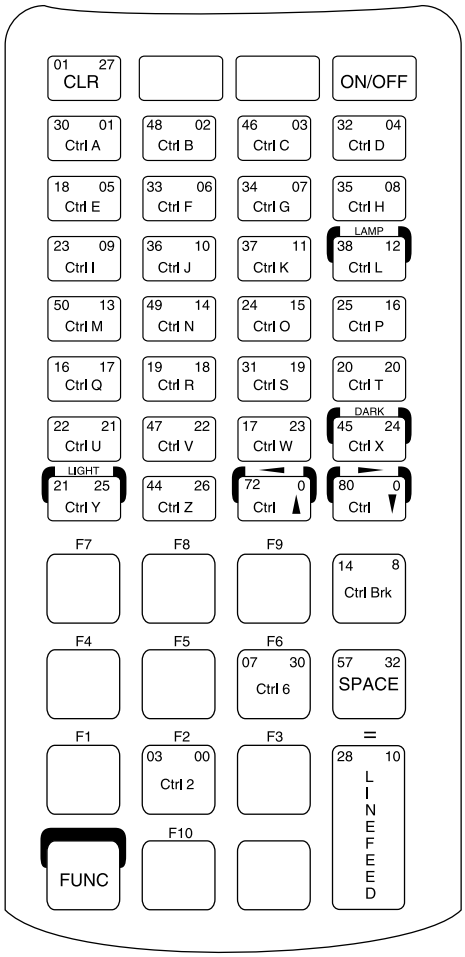


Figure B-25. Series 3500 47-key Ctrl-Modified Keyboard

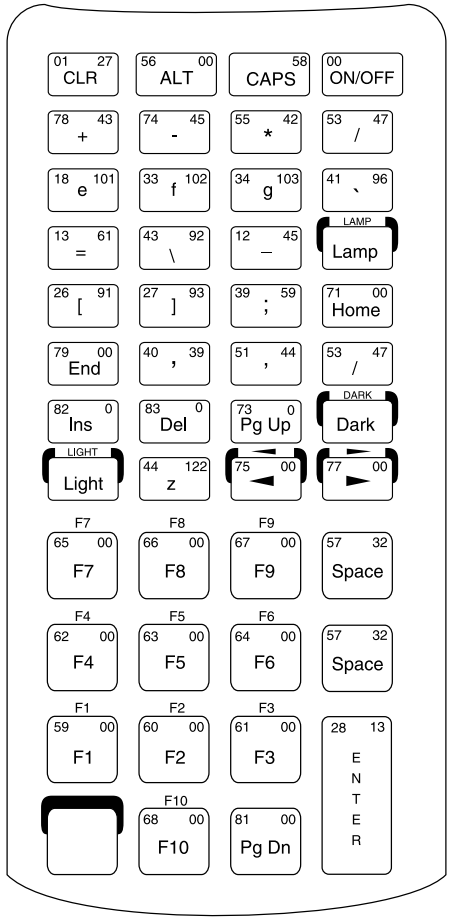


Figure B-26. Series 3500 47-Key Func-Modified Keyboard

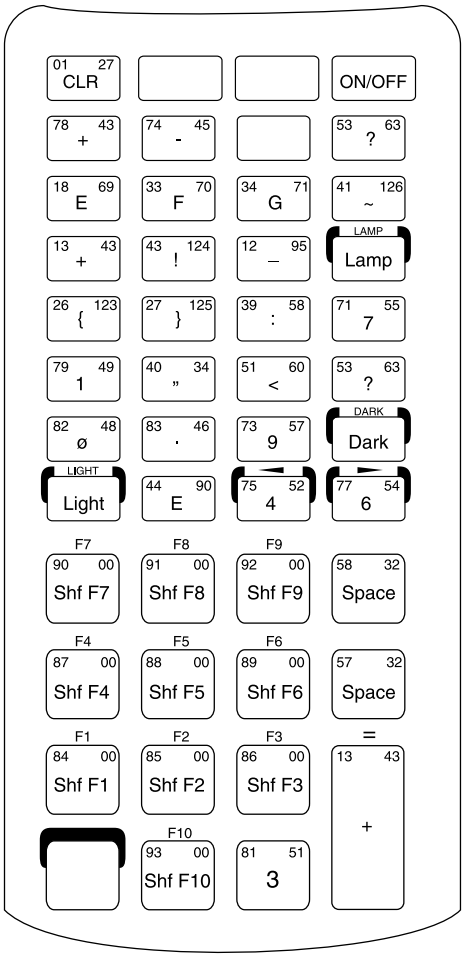


Figure B-27. Series 3500 47-key Shift+Func-Modified Keyboard

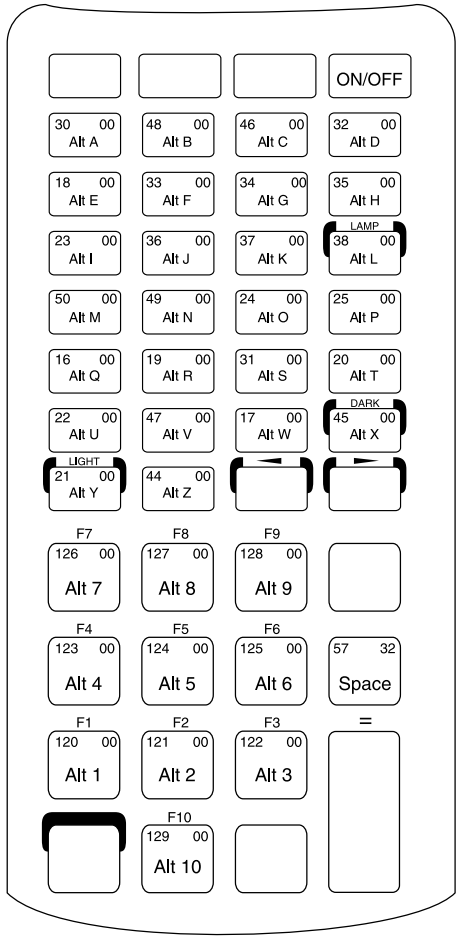


Figure B-28. Series 3500 47-key Alt (Func+Ctrl)-Modified Keyboard

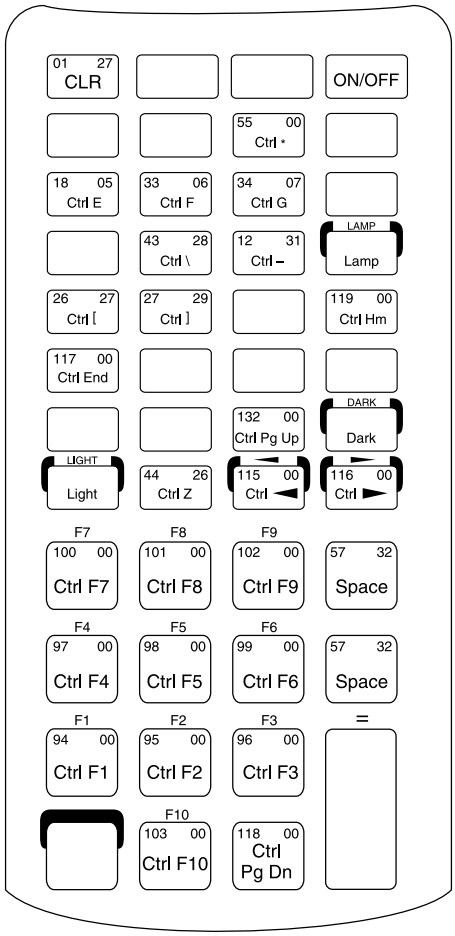


Figure B-29. Series 3500 47-key Ctrl+Func-Modified Keyboard

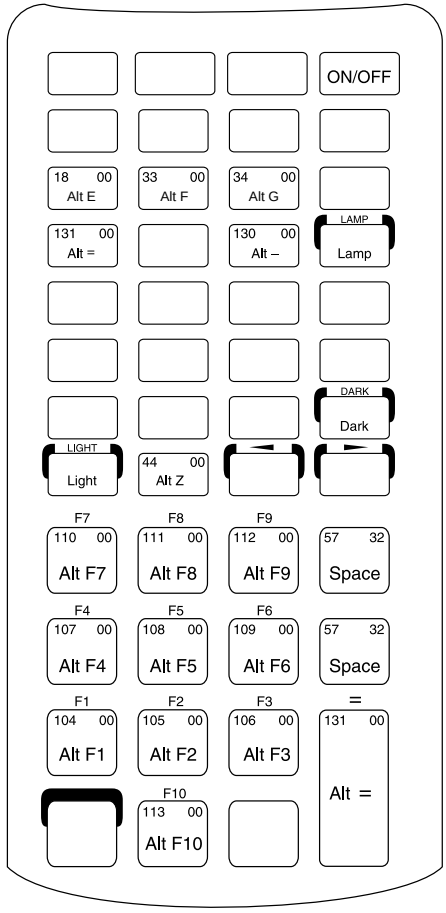


Figure B-30. Series 3500 47-key Alt+Func-Modified Keyboard

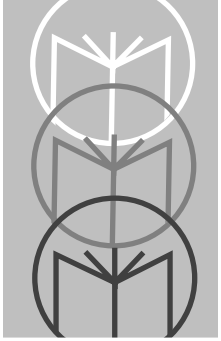
Appendix C
Communications Status Codes

The program loader status code consists of four hexadecimal digits which indicate whether or not the transfer was successful, and if not, the source of the communications error. A status code of 0000 indicates success; any other code indicates failure.

Table C-1 lists the failures associated with the status codes. The values are additive.

Table C-1. Communications Status Codes

Status Code	Meaning
0002	Receive overrun error
0004	Receive parity error
0008	Receive framing error
0010	Programming voltage not present
0020	Data Set Ready or Carrier Detect not detected on open
0080	ABORT key hit during comm
0100	Insufficient NVM for image
0200	Illegal Intel hexadecimal record
0400	Unsupported Intel record
0600	NVM EEPROM failed to erase
0800	Receive time-out error
1000	Control start character time-out
2000	Clear To Send inactive time-out error
4000	Receive buffer full



Appendix D
Specifications

Environment

The terminal's operating conditions are listed in Table D-1, Environmental Specifications.

Table D-1. Environmental Specifications

Condition	Range
Operating Temperature	0^{o} C to 40^{o} C
Storage Temperature	-20^{o} C to 60^{o} C
Humidity (Operating)	0 to 95% (noncondensing)
Altitude	Up to 10,000 feet

Note: Batteries lose power faster at extremely high and low temperatures, and at temperatures below 0^{o}C, the LCD operates slowly.

Storage

If the terminal is not used for more than a week, store it in a cool, dry place, away from dust. Remove the battery and repack the terminal in its original shipping container.

For a storage period of a few days, the batteries can remain in the terminal. If the batteries are left in the terminal for an extended period of time, data stored in the terminal may be lost. To avoid data loss, keep the NiCd batteries charged.

Scanning

Standard 1-D Scan Element

Table D-2. Standard 1-D Scan Element Specifications

Item	Description
Power Requirements	3.0 to 5.5 VDC; 60 mA typ @V_{cc}; 70 mA max
Surge Current	60 mA typical @ 5.5 VDC; duration — 16 mSec
Cold Standby Current	50 mA
Max V_{cc} Noise Level	100 mV p to p
Scan Repetition Rate	36 (± 3) scans / sec (bidirectional)
Laser Power	.9 mW max
Skew Tolerance	± 65° from normal
Pitch Angle	± 55° from normal
Specular Dead Zone	±2°
Decode Depth of Field	Minimum element resolution is 5 mils (.127 mm) Max Typical working distance is 34 in. (86 cm)
Print Contrast Minimum	20% absolute dark / light reflectance differential, measured at 675 nm.
Ambient Light Immunity	Immune to direct exposure from normal office and factory level light
Sunlight	8000 ft. candles; 86,112 lux with correct enclosure
Artificial Light	150 ft. candles; 1615 lux
Shock	1500 G applied via any mounting surface @23° C
Vibration	Withstands a sinusoidal vibration of 1 G along each of the 3 mutually perpendicular axes for a period of 1 hr. per axis, over a frequency range of 5 Hz to 2000 Hz.
Operating Temperature	-4° to 122° F; -20° to 50° C
Storage Temperature	-40° to 140° F; -40° to 60° C
Humidity	5% to 95% non-condensing
Height	0.76 in. max.; 1.93 cm
Width	1.60 in. max.; 4.1 cm
Length	1.49 in. max.; 3.8 cm
Weight	1.70 oz. max.; 48 gm

Long Range 1-D Scan Element

Table D-3. Long Range 1-D Scan Element Specifications

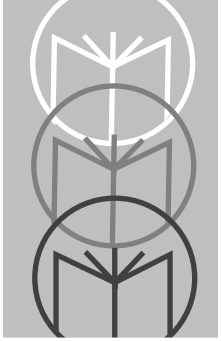
Item	Description
Power Requirements	3.0 to 5.5 VDC; 70 mA typ @V_{cc}; 95 mA max
Surge Current	120 mA typical @ 5.5 VDC; duration — 15 mSec
Max V_{cc} Noise Level	100 mV p to p
Scan Repetition Rate	36 (± 3) scans / sec (bidirectional)
Laser Power	1.45 mW max
Skew Tolerance	± 65° from normal
Pitch Angle	± 55° from normal
Specular Dead Zone	±2°
Decode Depth of Field	Minimum element resolution is 10 mils (.254 mm) Max Typical working distance is 65 in. (165 cm)
Print Contrast Minimum	50% absolute dark / light reflectance differential, measured at 675 nm.
Ambient Light Immunity	Immune to direct exposure from normal office and factory level light
Sunlight	8000 ft. candles; 86,112 lux with correct enclosure
Artificial Light	150 ft. candles; 1615 lux
Shock	1500 G applied via any mounting surface @23° C
Vibration	Withstands a sinusoidal vibration of 1 G along each of the 3 mutually perpendicular axes for a period of 1 hr. per axis, over a frequency range of 5 Hz to 2000 Hz.
Operating Temperature	-4° to 122° F; -20° to 50° C
Storage Temperature	-40° to 140° F; -40° to 60° C
Humidity	5% to 95% non-condensing
Height	0.76 in. max.; 1.93 cm
Width	1.60 in. max.; 4.1 cm
Length	1.49 in. max.; 3.8 cm
Weight	1.70 oz. max.; 48 gm

1-D / PDF417Scan Element

Table D-4. 1-D / PDF417 Scan Element Specifications

Item	Description
Power Requirements	+5 V, @ <130mA Typical
Laser Diode Power	1.2 mW, max
Scan Pattern	
Start Time:	0.065 sec. to 75% of steady state horizontal amplitude; 0.50 sec. to 90% of steady state vertical amplitude
Scan Angle	X = ± 18.1 degrees optical; Y = ± 6.8 degrees optical
Beam Deviation (offset from the nominal)	X = 3.3 degrees; Y = 3.0 degrees. Max droop ± 1 degree. Horizontal tilt: ± 2 degrees.
Pattern Geometry	At 10 in. from the chassis front, the pattern is 7.2 in. horizontally and 2.6 in. vertically. Parallelogram (deviation from the rectangular): 10^{o} max.
Scan Rate	560 scans / sec. 280 Hz ±10 Hz (horizontal)
Frame Rate	25 frames / sec. 12.5 Hz ±1 Hz (vertical)
Optical Resolution	Can decode a 6.6 mil (minimum X-dimension) symbol (PDF417); *Y-dimension must be 3X*.
Max. Size of PDF417	5.0 in. wide x 2.3 in. high (928 codewords, at security level 0 - 8)
Decode Capability	1-D Symbologies: UPC-A, UPC-E, EAN-8, EAN-13, Code 39, Code 39 Full ASCII, Code 128, Interleaved 2 of 5, Codabar, UCC / EAN 128. Cannot autodiscriminate between Code 39 and Code 39 Full ASCII. 2-D Symbology: PDF417 (up to 928 codewords at security level 0 - 8).
Angular Orientation Tolerances	
Pitch Tolerance	± 30^{o} (“front to back”)
Skew	± 15^{o} from plane parallel to symbol (“side-to-side”)
Rotational Tolerance	± 4^{o} (for scanning benchmark label, assuming 3:1 codeword aspect ratio). Note that this is dependent on the decoder.
Specular Dead Zone	± 2° (1-D symbologies) or ± 9° (PDF417) from beam direction

Item	Description
Print Contrast Minimum	35% absolute dark / light reflectance differential (PDF); 25% absolute dark / light reflectance differential (1-D)
Vibration	$\leq$ .15 g when attached with vibration isolation; $\leq$ .3 g when hard-mounted
Humidity	5% to 95% non-condensing
Shock	3 ft (91.44 cm) drop when attached to a solid surface
Ambient Light Immunity	Immune to direct exposure from normal office and factory level lighting
Sunlight	8000 ft. candles; 86,112 lux with correct enclosure
Incandescent	450 ft. candles 4845 lux
Flourescent	450 ft. candles 4845 lux
Sodium Vapor	450 ft. candles 4845 lux
Mercury	450 ft. candles 4845 lux
Operating Temperature	-4° to 122° F; -20° to 50° C (@ 100% duty cycle)
Storage Temperature	-40° to 140° F; -40° to 60° C
Humidity	5% to 95% non-condensing
Height	0.875 in. max.; 2.08 cm
Width	1.56 in. max.; 3.96 cm
Length	1.32 in. max.; 3.4 cm
Weight	1.6 oz. max.; 45 gm



Glossary

Access Point	A device that provides transparent access between Ethernet wired networks and IEEE 802.11 interoperable radio-equipped mobile units (MUs) like Symbol's hand-held computers or other devices equipped with a PCMCIA slot. The mobile unit may roam among the APs in the same subnet while maintaining a continuous, seamless connection to the wired network. Refer to **Subnet**.
ADK	Refer to **Application Development Kit**.
Application Development Kit (ADK)	A kit for use with Series 3000 terminals that provides various libraries, examples, utilities, and drivers. Use to enable program segments and build program images for execution on a Series 3100/3500 terminal.
AP	See **Access Point**.
Application Programming Interface (API)	An interface by means of which one software component communicates with or controls another. Usually used to refer to services provided by one software component to another, usually via software interrupts or function calls
ASCII	American Standard Code for Information Interchange. A 7 bit code representing 128 letters, numerals, punctuation marks, and control characters. It is a standard data transmission code in the U.S.
Bar Code	A pattern of variable-width bars and spaces which represents numeric or alphanumeric data in machine-readable form. The general format of a bar code symbol consists of a leading margin, start character, data or message character, check character (if any), stop character, and trailing margin. Within this framework, each recognizable symbology uses its own unique format. See **Symbology**.
BIOS	Basic Input Output System. A collection of ROM-based code with a standard API used to interface with standard PC hardware.

Bit	Binary digit. One bit is the basic unit of binary information. Generally, eight consecutive bits compose one byte of data. The pattern of 0 and 1 values within the byte determines its meaning.
Bits per Second (bps)	Bits transmitted or received.
BOOTP	Bootstrap protocol.
Byte	On an addressable boundary, eight adjacent binary digits (0 and 1) combined in a pattern to represent a specific character or numeric value. Bits are numbered from the right, 0 through 7, with bit 0 the low-order bit. One byte in memory can be used to store one ASCII character.
Codabar	A discrete self-checking code with a character set consisting of digits 0 to 9 and six additional characters: (- $: / , +).
Code 128	A high density symbology which allows the controller to encode all 128 ASCII characters without adding extra symbol elements.
Code 3 of 9 (Code 39)	A versatile and widely used alphanumeric bar code symbology with a set of 43 character types, including all uppercase letters, numerals from 0 to 9, and 7 special characters (- . / + % $ and space). The code name is derived from the fact that 3 of 9 elements representing a character are wide, while the remaining 6 are narrow.
Code 93	An industrial symbology compatible with Code 39 but offering a full character ASCII set and a higher coding density than Code 39.
Cradle	A cradle is used for charging the terminal battery and for communicating with a host computer, and provides a storage place for the terminal when not in use.
Data Communications Equipment (DCE)	A device (such as a modem) which is designed to attach directly to a DTE (Data Terminal Equipment) device.
Data Terminal Equipment (DTE)	A device (such as a terminal or printer) which is designed to attach directly to a DCE (Data Communications Equipment) device.
DCE	Refer to **Data Communications Equipment**.
Decode	To recognize a bar code symbology (e.g., Codabar, Code 128, Code 3 of 9, UPC/EAN, etc.) and analyze the content of the bar code scanned.

Development Kits	A set of software tools provided to customers to help them create applications for their terminals. See **ADK**.
Discrete 2 of 5	A binary bar code symbology representing each character by a group of five bars, two of which are wide. The location of wide bars in the group determines which character is encoded; spaces are insignificant. Only numeric characters (0 to 9) and START / STOP characters may be encoded.
DTE	Refer to **Data Terminal Equipment**.
EAN	European Article Number. This European / International version of the UPC provides its own coding format and symbology standards. Element dimensions are specified metrically. EAN is used primarily in retail.
Flash Disk	An additional megabyte of non-volatile memory for storing application and configuration files.
File Transfer Protocol (FTP)	A TCP / IP application protocol governing file transfer via network or telephone lines. Refer to **TCP/IP.**
Frequency Hopping	The use of a random sequence of frequency channels to achieve spread spectrum compliance. Stations that use frequency hopping change their communications frequency at regular intervals. A **hopping sequence** determines the pattern at which frequencies are changed. Messages take place within a hop. Refer to **Hopping Sequence** and **Spread Spectrum.**
FTP	See **File Transfer Protocol.**
Hopping Sequence	A set of random frequencies designed to minimize interference with other sets of random frequencies. A hopping sequence determines the pattern with which a station that uses frequency hopping changes its communications frequency. Refer to **Frequency Hopping.**
Host	A computer that serves other terminals in a network, providing services such as network control, data base access, special programs, supervisory programs, or programming languages.
Interleaved 2 of 5	A binary bar code symbology representing character pairs in groups of five bars and five interleaved spaces. Interleaving provides for greater information density. The location of wide elements (bar / spaces) within each group determines which characters are encoded. This continuous code type uses no intercharacter spaces. Only numeric (0 to 9) and START / STOP characters may be encoded.

IOCTL	Input / Output Control.
IP	Internet Protocol.
Klasse Eins	European laser safety standard. Relates to energy expended over time.
LAN	Local Area Network.
LCD	Refer to **Liquid Crystal Display.**
LED	Refer to **Light Emitting Diode.**
Light Emitting Diode (LED)	A low power electronic light source commonly used as an indicator light. Uses less power than incandescent light bulb but more than a Liquid Crystal Display (LCD).
Liquid Crystal Display (LCD)	A display that uses liquid crystal sealed between two glass plates. The crystals are excited by precise electrical charges, causing them to reflect light outside according to their bias. They use little electricity and react relatively quickly. They require external light to reflect their information to the user.
MU	Mobile Unit.
NCU	Network Control Unit.
Null Modem	A special cable that allows direct connection of two DTE (Data Terminal Equipment) devices by making each perceive the other as a DCE (Data Communications Equipment) device.
NVM	Non-Volatile Memory.
ODI	Refer to **Open Data-Link Interface**.
Open Data-Link Interface (ODI)	Novell's driver specification for an interface between network hardware and higher-level protocols. It supports multiple protocols on a single NIC (Network Interface Controller). It is capable of understanding and translating any network information or request sent by any other ODI-compatible protocol into something a NetWare client can understand and process.
PDT	Portable Data Terminal.
RAM	Random Access Memory.
Real Time Clock (RTC)	
RF	Radio Frequency.

Router — A device that connects networks and supports the required protocols for packet filtering. Routers are typically used to extend the range of cabling and to organize the topology of a network into subnets. Refer to **Subnet**.

Scanner — An electronic device used to scan bar code symbols and produce a digitized pattern that corresponds to the bars and spaces of the symbol. Its three main components are:

1. Light source (laser or photoelectric cell) - illuminates a bar code.
2. Photodetector - registers the difference in reflected light (more light reflected from spaces).
3. Signal conditioning circuit - transforms optical detector output into a digitized bar pattern.

SDK — Software Development Kit.

SE-1000, SE-1200 — Symbol's laser scan modules that can be integrated into portable computing devices.

SHIP — Symbol Host Interface Program.

Spectrum24 — Symbol's frequency-hopping, spread spectrum cellular network.

Spectrum One — Symbol's implementation of the Spread Spectrum wireless network, utilizing direct sequencing.

Spread Spectrum — A technique for uniformly distributing the information content of a radio signal over a frequency range larger than normally required for robust transmission of data. Spreading the signal without adding additional information adds significant redundancy, which allows the data to be recovered in the presence of strong interfering signals such as noise and jamming signals.

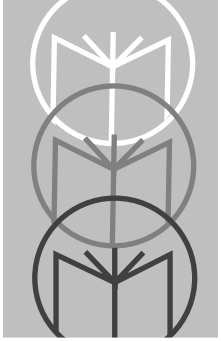
The primary advantage of spread spectrum technology is its ability to provide robust communications in the presence of interfering signals.

STEP — Symbol Terminal Enabler Program.

Subnet — A subset of nodes on a network that are serviced by the same router. Refer to **Router**.

SVTP — Symbol Virtual Terminal Program.

Symbology	The set of structural rules and conventions used to represent data within a particular bar code (e.g., UPC/EAN, Code 39, PDF417, etc.).
TCP/IP	Refer to **Transmission Control Protocol/Internet Protocol.**
Terminal	A Symbol portable computer product.
Terminate and Stay Resident (TSR)	A program under DOS that ends its foreground execution to remain resident in memory to service hardware/software interrupts, providing background operation. It remains in memory and may provide services on behalf of other DOS programs.
Transmission Control Protocol/Internet Protocol (TCP/IP)	A suite of the standard network protocols that were originally used in UNIX environments but are now used in many others. The TCP governs sequenced data; the IP governs packet forwarding. TCP/IP is the primary protocol that defines the Internet.
TFTP	Trivial File Transfer Protocol
TSR	Refer to **Terminate and Stay Resident**.
UPC	Universal Product Code. A relatively complex numeric symbology. Each character consists of two bars and two spaces, each of which can be any of four widths. The standard symbology for retail food packages in the United States.
WLAN	Wireless Local Area Network.



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