ProTerm

Technical Reference Manual

Two Technologies, Inc.

Hand Held Terminals • Your Way • Since 1987

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ProTerm Technical Reference Manual

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Changes and Addendum

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Warranty Information

Seller warrants that the product specified in this agreement are free of defects in materials and workmanship, and shall conform to the latest specifications published prior to Buyer's acceptance of the agreement for a period of three years.

Product specifications as defined supersede previous specifications and are complete. Any parameter that is not specifically defined in the specifications is expressly excluded from the warranty. This warranty does not apply to any product which have been subject to misuse, accident, alteration, or if the unit has been serviced by anyone other than an authorized representative of Seller.

Seller's sole obligation to Buyer for products failing to meet specifications shall be, at Seller's discretion, to repair or replace the non-conforming device.

After receiving a Return Authorization (RA) number and a mailing address from Seller, a defective unit covered under this warranty may be returned freight prepaid. Any replacement or repaired product shall carry only the unexpired term of the warranty plus any the period required for repair.

If Buyer has been expressly designated as an Original Equipment Manufacturer (OEM) by Seller, the warranty period shall commence upon the earlier date of (i) delivery to Buyer's first customer, or (ii) 180 days from the original date of shipment by Seller. In the events that products for which: (a) Buyer has title and, (b) have never been used, and (c) have been in the Buyer's possession for more than 180 days and, (d) have an unaltered date code attached, may for an established fixed fee which will not exceed ten percent (10%) of the original purchase price, have the date code updated by the Seller and thereby reestablish those products with a new warranty.

THE FOREGOING WARRANTY AND REMEDIES ARE EXCLUSIVE AND ARE MADE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, INCLUDING WARRANTIES OR MERCHANTABILITY AND FITNESS FOR USE. TWO TECHNOLOGIES NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER LIABILITY IN CONNECTION WITH THE SALE, INSTALLATION OR USE OF ITS PRODUCTS AND TWO TECHNOLOGIES MAKES NO WARRANTY WHATSOEVER FOR PRODUCTS NOT MANUFACTURED BY TWO TECHNOLOGIES.

TWO TECHNOLOGIES SHALL NOT BE LIABLE FOR DAMAGES DUE TO DELAYS IN DELIVERIES OR USE AND SHALL IN NO EVENT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND, WHETHER ARISING FROM CONTRACT, TORT OR NEGLIGENCE, INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, LOSS OF GOODWILL, OVERHEAD OR OTHER LIKE DAMAGES.

To maintain your warranty and to avoid creating hazards, only qualified personnel should perform authorized modifications to Two Technologies' products. Two Technologies cannot assume responsibility for any condition affecting the proper operation of this equipment that may result from unauthorized modifications.

Product Returns

If, after inspection, you note any product damage or discrepancies, please contact us promptly within five days of receipt. If the exterior of the package shows obvious signs of damage, please contact your carrier directly.

All items returned to Two Technologies require a Return Material Authorization number (RMA). Please contact Two Technologies' Service department to request an RMA number.

Regulatory Notices

FCC Compliance

This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his or her own expense.

Canadian Compliance

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications

Le présent appareil numérique n'émet pas de bruits radioélectrique dépassant les limites applicables aux appareils numériques de la class A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Certifications

CENELEC

CE*

EMI Standards

- EN55022: 1998 (CISPR22, Class B) Information Technology
- EN55011 (CISPR11, Class A) Industrial, Scientific and Medical

EMC Standards

- EN50082-1: 1997, General Immunity Part 1
- EN55024: 98 (CISPR24: 1997) Information Technology Equipment

Safety Standards

- EN60950: 2000 Safety of Information Technology Equipment

* Standard Configuration

Warnings

Changes or modifications to this unit, which are not expressly approved by the party responsible for regulatory compliance, could void the user's authority to operate the equipment.

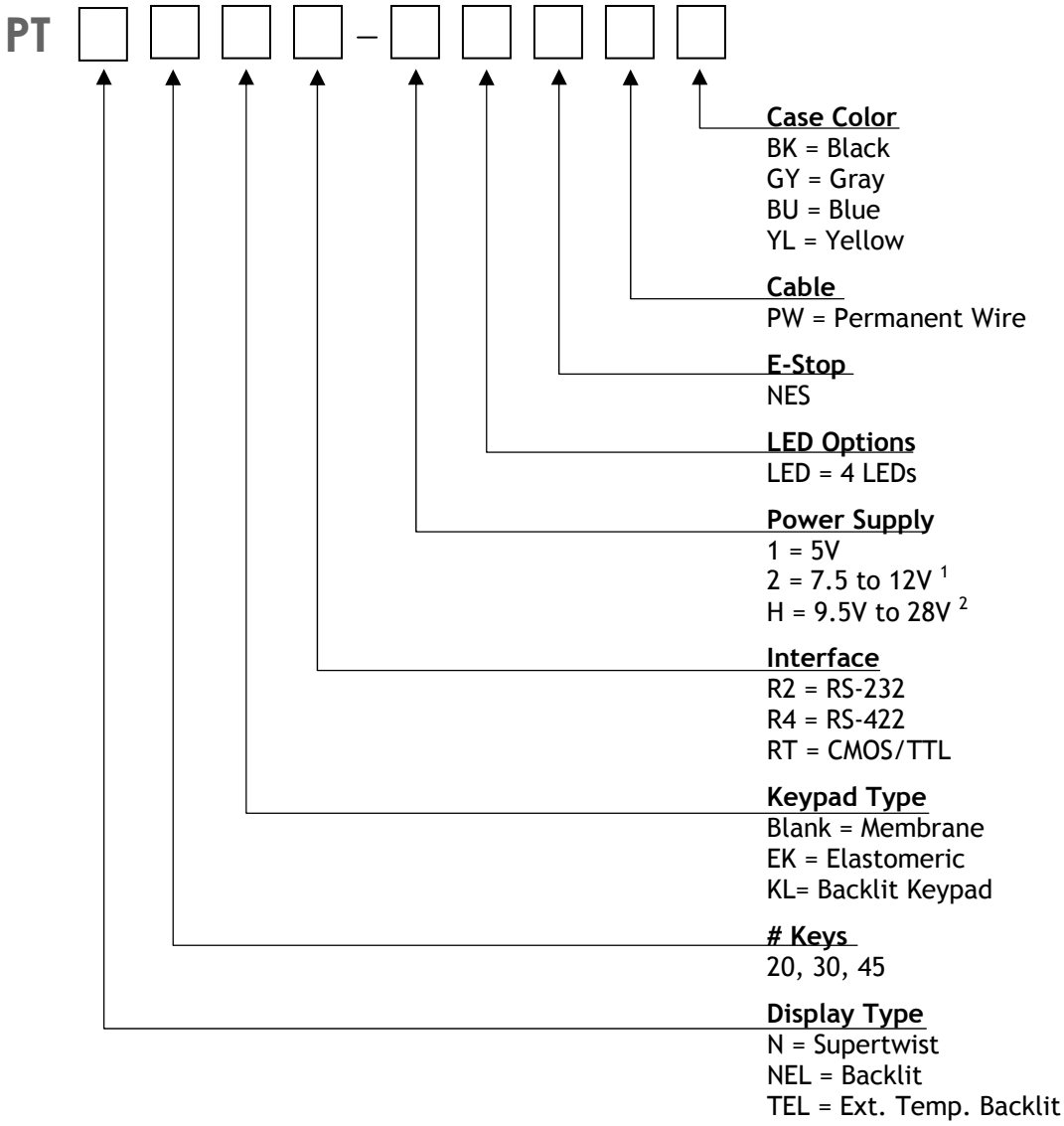
Electrostatic Discharge (ESD)

Electrostatic discharge (static electricity) can have unpredictable adverse effects on any electronic device. Although the design of this product incorporates extensive ESD-related precautions, ESD can still cause problems. It is good practice to discharge static by touching a grounded metal object before inserting cards or connecting devices.

Product Selection Guide

The ProTerm is an ASCII terminal for use with computers, properly equipped instruments and industrial machinery. It features a 20, 30 or 45-key keypad with tactile feedback and a 192 x 128-pixel liquid crystal alphanumeric display that can show either 8 lines of 24 or 16 lines of 32 characters. Four programmable LEDs are optional.

The ProTerm is available in a number of configurations. A suffix applied to the model number identifies the configuration as shown below:



1. A linear regulator (7805A) with a minimum input of 7.5 V and a maximum voltage of 28.0 V that dissipates one watt of power thereby limiting maximum permissible input voltage according to current draw of terminal.
2. A switching type voltage regulator with a minimum input of 9.5 V and a maximum voltage of 28.0 V. Since input voltage is not dependent on the terminal's current draw, it is suitable for all options.

Power Requirements

Power Supply Options

Depending on the current draw requirements, the ProTerm may require the use of different power supplies. Use the configuration number listed below (see previous page) to determine the correct power supply:

- "**-1**"—requires connection to a 5-volt ± 5% regulated power source.
- "**-2**"—requires connection to a power source between 7.5 and 12 VDC that can source adequate current. However, depending on a unit's total current draw, an input of up to 28 VDC may be applied. See chart on next page.
- "**-H**"—requires connection to a power source between 9.5 and 28 VDC that can source adequate current. However, input voltage is not dependent on a terminal's current draw and may be used with all terminal options.

Calculating Total Current Draw

The table below summarizes the current draw requirements for the ProTerm in various configurations (measured at its interface connector). Values listed are approximate due to variations in individual components—actual values may vary.

Current Draw for Basic Configuration		
Configuration	*Description*	*Draw*
PTN45R2	Base Unit with RS-232	55 mA
PTN45R4	Base Unit with RS-422	65 mA
Current Draw for Options		
NEL/TEL	Supertwist Backlit Display	Add 60 mA
KL	Backlit Keypad	Add 80 mA
LED	LED Indicators	Add 4 mA per LED

To calculate the total current draw for your terminal configuration:

1. Read the model number on the back of your terminal.
2. Using the model number and the table above, add the current draw for each option to that of the base unit.

   Example 1—PTNEL45R2:

   RS-232 Option 55 mA
   Supertwist Backlit Display 60 mA
   Calculated Total Current 115 mA

   Example 2—PTNEL45KLR2:

   RS-232 Option 55 mA
   Supertwist Backlit Display 60 mA
   Backlit Keypad 80 mA
   Calculated Total Current 195 mA

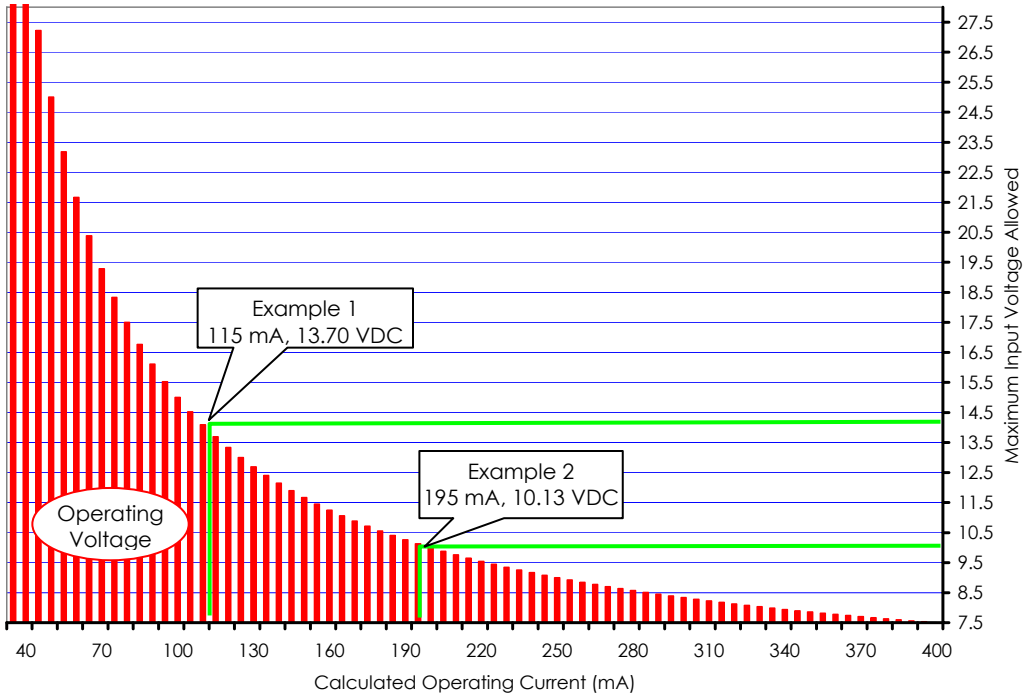
Determining the Maximum Input Voltage Allowed

The maximum input voltage allowed is based on a unit's current draw.

To determine the maximum input voltage allowed based on current:

1. Calculate the maximum current draw using the table on the previous page.
2. On the following chart, locate the Calculated Total Current on the **Calculated Operating Current** axis of the chart, and then move to the top of **Operating Voltage** range.
3. Look at the corresponding **Maximum Input Voltage Allowed** where the intersection occurs to find the maximum useable voltage for your terminal configuration.

Restricted Input Voltage vs. Current Draw



Using Example 1 and the chart above, the 115 mA drawn by the PTNEL45R2 intersects with 13.70 volts. If the maximum supply voltage to the terminal is greater than 13.70 VDC, it requires a -H power supply configuration.

Using Example 2 and the chart above, the 195 mA drawn by the PTNEL45KLR2 intersects with 10.13 volts. If the maximum supply voltage to the terminal is greater than 10.13 VDC, it requires a -H power supply configuration.

To clarify, if your system is supplying 12.00 VDC, the power is acceptable for the PTNEL45R2 (Example 1), but not for the PTNEL45KLR2 (Example 2). Applying 12.00 VDC to the PTNEL45KLR2 (Example 2) will **damage** it.

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CHAPTER 1

OVERVIEW

About this Manual

Intended for developers familiar with operator interface applications, this manual describes the advanced features, operations and interface capabilities of Two Technologies' ProTerm terminals. It is not for use by end-users.

Unless otherwise stated, the operational characteristics described herein correspond to factory default configurations and settings as shipped from Two Technologies with a standard 45-key keypad.

Because the ProTerm is a highly customizable product with many optional configurations and special keypad layouts, this manual only describes the standard features and operation of the ProTerm. For custom configurations and special options, consult the appropriate supplemental manual or addendum.

It is beyond the scope of this manual to provide operating system tutorials or information about commercial or customized ProTerm application programs and connected equipment. This information should be available in the manuals that accompany those products.

Wherever used herein, the term "ProTerm" applies to all models (except as noted).

> ***NOTICE***
>
> The information contained in this manual applies only to ProTerms manufactured after April 1, 2001 (serial number HH182503 and above).
>
> Because newer models contain additional functions not found on previous models, use of these functions on older terminal may cause unexpected results.

Symbols and Conventions

Unless otherwise noted, this manual uses the following format conventions to distinguish elements of text:

- New terms used in this manual initially appear in Italics, for example: *host*.
- Names of keys as shown on a keypad appear in bold type, for example: **CTRL**.
- Names of parameter values appear in uppercase letters, for example: ENABLE.
- Esc represents the ASCII escape character used in Escape commands, for example: Esc [4n.
- A lowercase "h" appearing after a number denotes a hexadecimal value, for example: **1Bh**.

About Two Technologies

Two Technologies has been producing rugged hand held and panel mount terminals and computers for over fifteen years. By implementing state of the art design and manufacturing techniques, we revolutionized hand held terminals and computers inside and out. Today, Two Technologies offers over a dozen cost-effective solutions serving virtually every market.

About the ProTerm

The ProTerm is a hand held terminal that features text and graphics capabilities. It also provides users with selectable communications parameters, programmable function keys, and other features that make it ideal for motion control applications requiring flexibility and solid, reliable operation.

ProTerm Features

The ProTerm offers the following features. You can find additional information regarding specifications in Appendix A.

Display

The ProTerm features a standard 192 x 128 monochrome supertwist liquid crystal display with dark characters on a light background. Its large viewing area (menu or host selectable, 8 rows x 24 characters or 16 rows x 32 characters) supports the U.S. ASCII character set.

The display also has menu-controlled contrast settings with blinking and inverse video attributes, as well as graphics capabilities. Backlit and extended temperature displays are also available.

Keypad

Securely framed and clamped into place, the keypad surface provides excellent splash resistance and prevents curling or peeling of the keypad overlay. Keypad layouts include 45, 30, and 20 keys available with standard or custom graphics and 32 and 15 keys available with custom graphics. Keypads can be made from your choice of elastomeric or membrane material.

Indicators

Four host-controlled LED indicators are available as an option on the ProTerm.

Advanced Control Mode (ACM)

The ProTerm's host activated Advanced Control Mode (ACM) provides an increased level of safety when controlling motion oriented tasks on a robotic device. ACM enables the host and the ProTerm to monitor one another and react to event changes. Host actions are dependent on host software).

Interface Options

The ProTerm interface options include RS-232, RS-422 or CMOS/TTL protocols. Communication (up to 57,600 bps) with a host device is through a modular 6-pin connector.

Durability

Like all Two Technologies' products, the ProTerm is remarkably rugged. The case consists of Cycolac ABS, one of the most durable, chemical-resistant materials available on the market today.

CHAPTER 2

OPERATION

Controls and Indicators

Table 2-1describes the possible components and indicators found on the front of a ProTerm as shown in Figure 2-1.

Figure 2-1: ProTerm Controls and Indicators

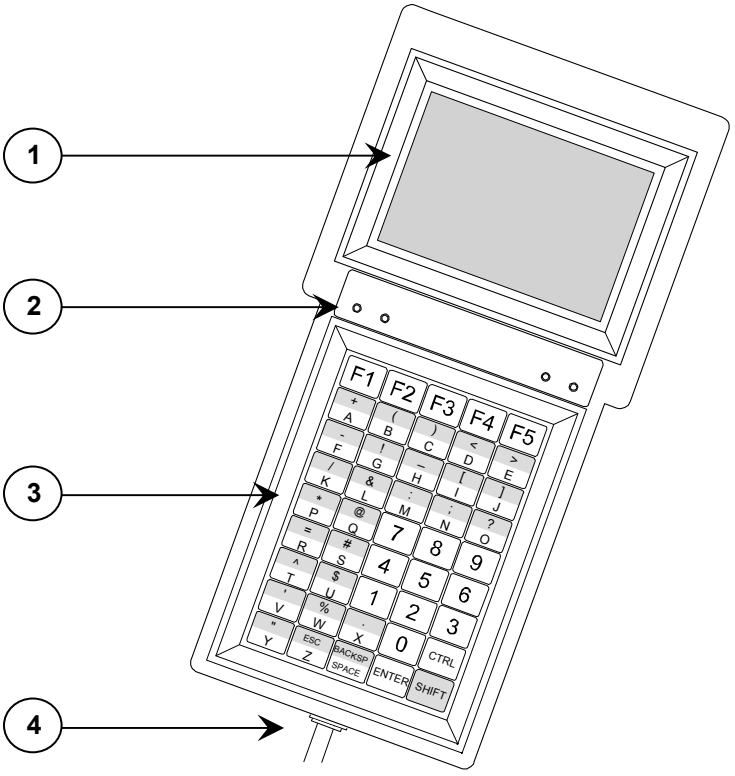


Table 2-1: ProTerm Controls and Indicators

Item	*Control/Feature*	*Description*
1	Display	192 x 128 pixel supertwist nematic LCD (standard)
2	Indicators	Four programmable LEDs (optional)
3	Keypad	45-key keypad (standard)
4	Interface	Modular Interface Connector (for communication and power)

Cable and Power Connections

Internal Communication Devices

The following table lists the internal interface devices used in the ProTerm.

Table 2-2: Interface Devices

Interface	*Manufacturer*	*Device*
RS-232	Linear Technology	LT1281
RS-422	Linear Technology	LTC490

Signal and Pin Assignments

Modular Interface Connector

Figure 2-2 depicts the standard six-pin modular interface connector found on the ProTerm. Table 2-3 describes its signal and pin assignments.

***Warning**: Use the six-pin modular receptacle for compatible serial devices only. Despite its physical similarity to modular telephone connectors, it is not compatible with telephone lines or signals. Connecting the ProTerm to a telephone line will damage it and void the warranty.*

Figure 2-2: Modular Interface Connector

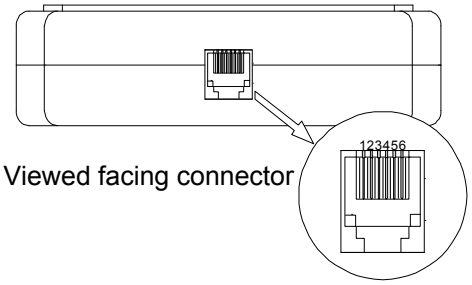


Table 2-3: Modular Interface Connector Signal and Pin Assignments

Pin	*RS-232/CMOS/TTL*	*RS-422*
1	+ Supply to terminal	+ Supply to terminal
2	Handshake-In to terminal	+ Data-In to terminal
3	Handshake-Out from terminal	+ Data-Out from terminal
4	Data-In to terminal	- Data-In to terminal
5	Data-Out from terminal	- Data-Out from terminal
6	Common	Common

ProTerms with Optional E-Stops

ProTerms equipped with an optional E-Stop connect to host equipment via a non-detachable permanent wire cable that ends with a DB-25 male connector (Figure 2-3). Table 2-4 describes the signal and pin assignments for the DB-25 interface connector.

Figure 2-3: DB-25 Interface Connector

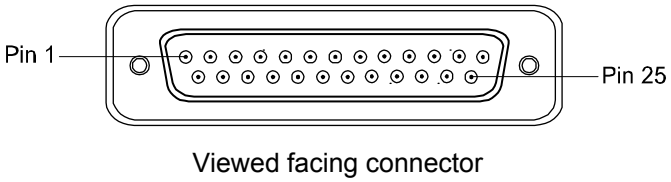


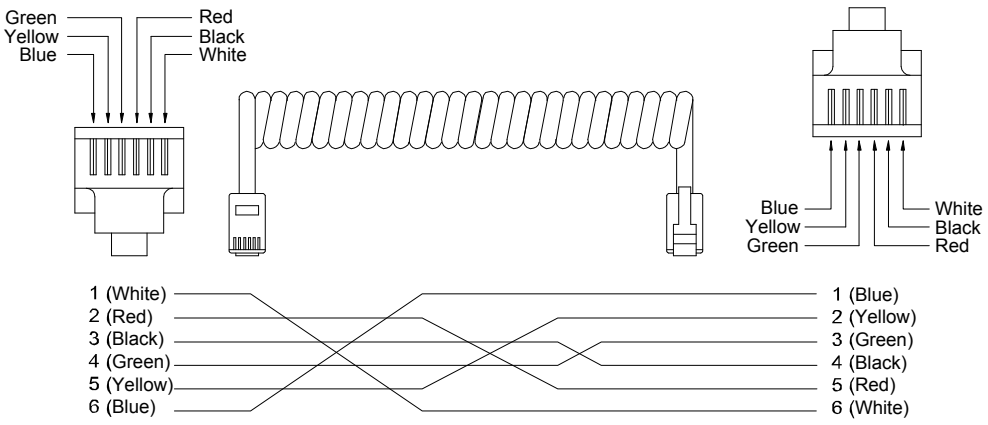
Table 2-4: DB-25 Interface Connector Signal and Pin Assignments

Pin	*Color*	*Signal*	*Pin*	*Color*	*Signal*
2	Yellow	Data-Out to terminal	13	Violet	E-Stop 1 (common)
3	Green	Data-In to terminal	14	Orange	E-Stop 1 (normally closed)
4	Red	Handshake-Out from terminal (RTS)	15	White	E-Stop 2 (common)
5	Black	Handshake-In to terminal (CTS)	16	Brown	E-Stop 2 (normally closed)
6	Red	Pin 20 (Jumpered)	20	Red	Pin 6 (Jumpered)
7	Blue	Common	25	Gray	+ Supply to terminal

Standard Accessory Cables

Standard modular cables (1210-7 and 1210-15) that mate with the ProTerm's modular interface connector and Two Technologies' PCAT wired adapter are available as optional accessories. These cables will reverse the signal output from the ProTerm (see illustration below). Non-reversing modular cables (1210-7-NR and 1210-15-NR) are also available.

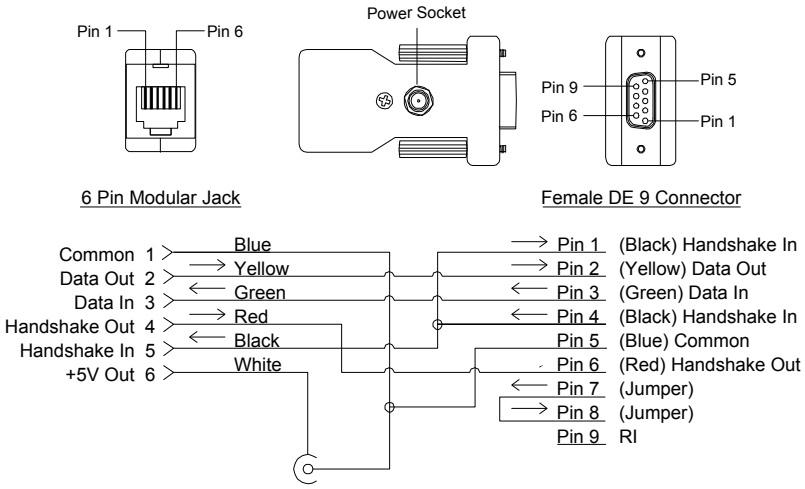
Figure 2-4: 1210 Series Modular Cable



PCAT Wired Adapter

The PCAT modular connector enables connection to a host device as well as supplying a connection for a power supply.

Figure 2-5: PCAT Modular Connector



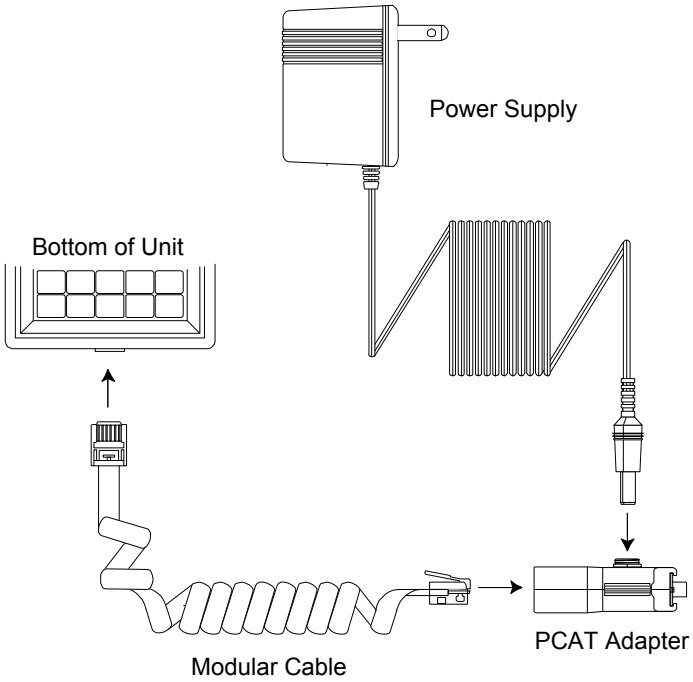
***Note**: Pin descriptions assume connection through a Two Technologies' 1210 series modular cable to the terminal's modular connector.*

Connecting the Terminal

To connect a ProTerm to a host device using separate power and Two Technologies parts:

1. Plug one end of a 1210 modular cable into the modular connector on the bottom of the ProTerm. Plug the other end into the PCAT adaptor.
2. Plug the PCAT adapter into the host device.

Figure 2-6: Cable and Power Supply Connections

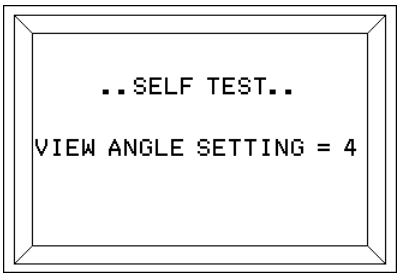


3. Using a Two Technologies' power supply (such as a Two Technologies 1226-1 linear power supply for units with a -2 power supply configuration), plug the power supply connector into the PCAT adapter and then plug the power supply into a 120 VAC 60 Hz power outlet.
4. The terminal should turn on and go through the Boot Sequence. If the ProTerm does not power up, refer to the Troubleshooting section of this manual.

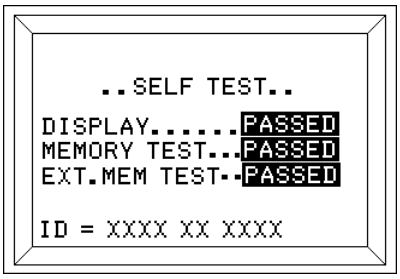
The Boot Sequence

Once you have connected the ProTerm to a host device and supplied power, the ProTerm will boot-up and perform a self-test as shown below.

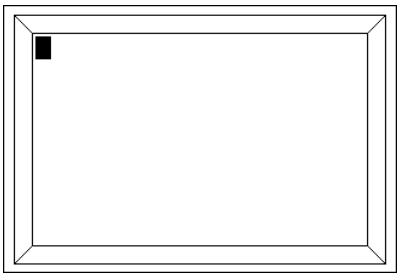
1. The first screen in the boot sequence briefly displays the standard U.S. ASCII character set, followed by a contrast test (Viewing Angle).



2. The ProTerm will then perform a display test, a memory test, an extended memory test and display the software ID.



3. Upon completion of the self-test, the ProTerm will emit an alert (three consecutive beeps) and display a blank screen with a fixed or blinking cursor in Row 1, Column 1.



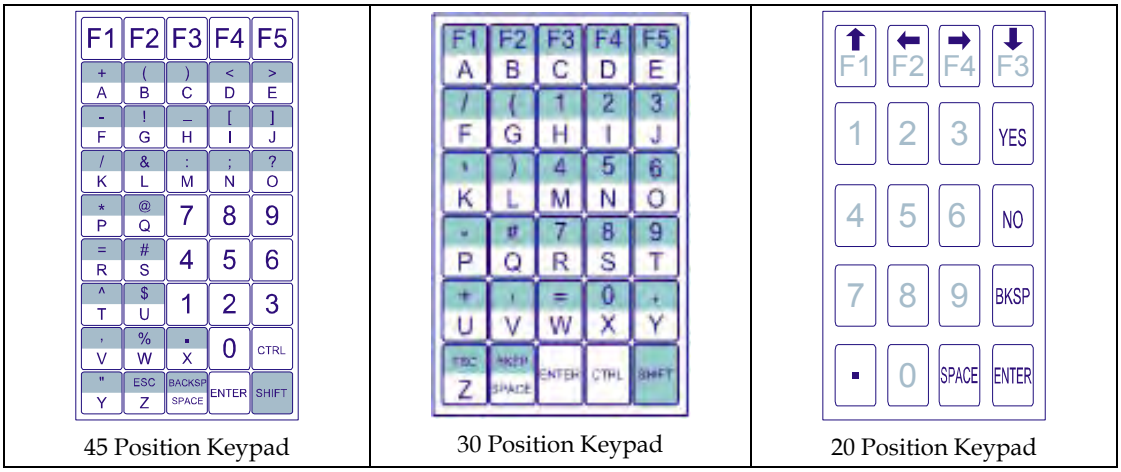
Keypad Operation

The standard 30 position and 45 position keypads consist of uppercase letters, digits 0 through 9, punctuation marks, symbols, function keys and keys for Escape (**ESC**), Space (**SPACE**), Backspace (**BACKSP**/**BKSP**), Control (**CTRL**), Shift (**SHIFT**) and Enter (**ENTER**). You can program the **SHIFT** key to operate in normal or locked mode. In the locked mode, pressing a modifier key will toggle its respective state.

The standard 20 position keypads consist of the digits 0 through 9, functions keys and keys for Yes (**YES**), No (**NO**), Backspace (**BKSP**), Space (**SPACE**) and Enter (**ENTER**).

Transmission of control characters will cancel the control state. If both the Shift and Control states are active, lowercase alphabetic characters will replace corresponding uppercase alphabetic characters. All keys, with the exception of **CTRL** and **SHIFT**, may be re-assigned with user-programmed characters or character strings from the key output definition menu. For information about control states, refer to the SHIFT LOCK parameter.

Figure 2-7: Standard Keypads



45 Position Keypad | 30 Position Keypad | 20 Position Keypad

Display Operation

The ProTerm screen displays the standard U.S. ASCII 96 character set. Characters appear on the display at the current cursor location.

Cursor Position

Typically, the cursor moves from left to right as the ProTerm receives characters (unless altered by Escape commands, see ANSI Mode Host Commands and Private Host Commands for details). The display will scroll when a character appears in the last position in any of the first seven rows for an 8 x 24 display or the first fifteen rows for a 16 x 32 display. In which case, the cursor then moves to the left most position on the next row.

The display will also scroll when a character in the "LAST" (Row 8, Column 24 or Row 16, Column 32) or the "LAST + 1" character position, depending upon the parameter selection (refer to the Scroll parameter for details).

The cursor is selectable as blinking, non-blinking, visible or invisible. When visible, the cursor style will indicate the states of the **SHIFT** and **CTRL** modifier keys (refer to the Cursor and Cursor Blink parameters for details).

Contrast Adjustment

You can adjust the contrast on the ProTerm by pressing **CTRL** and **F5**. There are sixteen adjustments levels. Each key press combination will make the display darker until it reaches the darkest setting, in which case the next key press combination will result in the lightest setting. You can also adjust the contrast using the View Angle (Contrast) parameter or by Setting the Contrast Midpoint.

E-Stop Operation

The optional E-Stop switch consists of two normally closed switches. Contacts for the E-Stop switch are located on the DB25 male connector (see Table 2-4). Pressing the switch opens both sets of contacts. Lamp connections are available only on optional illuminated switches.

Figure 2-8: E-Stop Operation

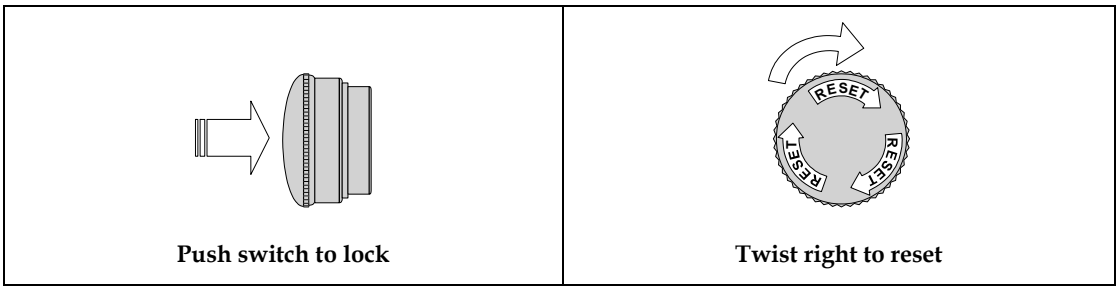
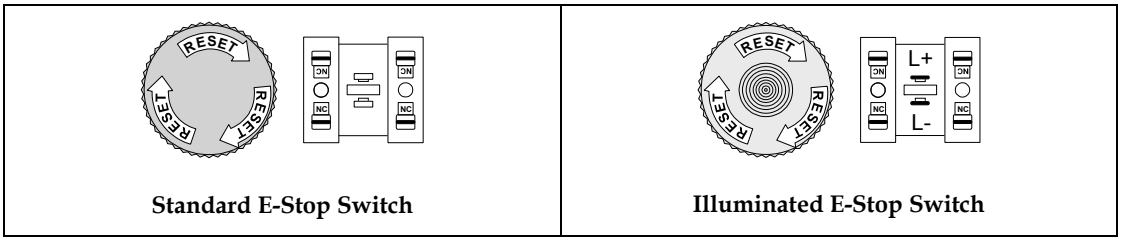


Figure 2-9: E-Stop Switch Wiring



Operating Modes

The ProTerm has several operating modes. The default mode is Terminal mode. It allows the ProTerm to display characters, respond to commands sent by a connecting device, and send characters to the connecting device as keys are pressed. Other modes, described later in this manual, enable you to set operating parameters and program function key definitions.

Host Control

The ProTerm's design allows a connecting device (or "*host*") to control its functions through the transmission of a string of special characters.

Referred to as "*Escape commands*" (because each character string begins with the ASCII escape character), these character strings enable the host to move the cursor to any position on the display, clear selected regions of the display, sound a beep, alert or key click, program the function keys and set any of the operating parameters.

The ProTerm has two sets of built-in Escape command modes, ANSI and Private. The set in use is determined by the setting of the Escape Mode parameter.

When set to **ANSI mode**, the ProTerm recognizes a command set compatible with the American National Standards Institute Standard X3.64.

When set to **Private mode**, the ProTerm recognizes a smaller, non-standard set of commands.

The host can change the current Escape mode type at any time by issuing the corresponding Escape command.

Information about using ANSI and Private Mode Escape commands appears later in this manual.

CHAPTER 3

MANUAL CONFIGURATION

Introduction

A comprehensive set of user-settable operating parameters and programmable function keys makes the ProTerm suitable for diverse applications. Each settable parameter and programmable function key has a default value. These values are stored in the ProTerm's permanent memory.

This chapter describes each operating parameter in detail, as well as how to set the parameters and load the default values. Chapter 4 covers programming function keys.

***Note**: You can also program the ProTerm remotely using ANSI host commands. For more information, see Chapter 5.*

Parameter Menu Settings

The following section describes the parameters that you can program in the ProTerm. A summary (Table 3-2) appears at the end of the section.

Baud Rate

This parameter sets the number of bits per second transmitted that the ProTerm transmits for serial communication. The data rate can be set to: 300, 600, 1200, 2400, 4800, 9600, 19200 or 57600 baud. The default value is 9600.

***Note**: Baud rates above 9600 require handshaking.*

Data Bits

This parameter sets the number of data bits transmitted per character, either 7 or 8. The default value is eight (8).

***Note**: Depending on the Data Bits and Parity settings, the Stop Bits and Display PE parameters may not be accessible. See Table 3-1 for details.*

Parity

This parameter enables/disables the host's ability to perform error checking on incoming characters and ensure accuracy. Allowable settings are EVEN, ODD, MARK, SPACE, NONE and IGNORE. The default value is NONE.

Selecting IGNORE will still add a parity bit to each character, but the value is indeterminate. Selecting NONE will prevent the sending of the parity bit. In either case, the host will not perform an error check on incoming characters.

***Note**: Depending on the Data Bits and Parity settings, the Stop Bits and Display PE parameters may not be accessible. See Table 3-1 for details.*

Stop Bits

This parameter sets the number of stop bits between each character transmission, either 1or 2 (the default value is 1) with the following exceptions:

A. When using 7-data bits and no parity, the ProTerm will automatically select 2-stop bits.

B. When using 8-data bits and any parity the ProTerm will automatically select 1-stop bit.

In either case, the Stop Bits parameter will not be accessible. See Table 3-1 for accessibility.

Display PE

When using parity checking, you can enable/disable this parameter to display a special character (Figure 3-1) when a parity error occurs. The default value is DISABLE. If the Parity parameter is set to IGNORE or NONE, the Display PE parameter will not be accessible. See Table 3-1 for accessibility.

Figure 3-1: Parity Error Symbol

Table 3-1: Communication Parameters Accessibility

Parameter Setting		*Parameter Access*	
Data Bits	**Parity**	**Stop Bits**	**Display PE**
7	NONE	No	No
7	IGNORE	Yes	No
7	EVEN	Yes	Yes
7	ODD	Yes	Yes
7	MARK	Yes	Yes
7	SPACE	Yes	Yes
8	NONE	Yes	No
8	IGNORE	No	No
8	EVEN	No	Yes
8	ODD	No	Yes
8	MARK	No	Yes
8	SPACE	No	Yes

Repeat

This parameter determines the repeat keypad character rate while the key remains pressed. The allowable values are SLOW (6 characters per second), MEDIUM (10 characters per second), FAST (36 characters per second) and DISABLED. The default value is MEDIUM. In all cases, there is a short delay between the initial character and the start of the repeat.

***Note**: Should you enable the KNP function (disabled by default), the Repeat parameter will not be accessible.*

Key Click

This parameter enables/disables the ProTerm's ability to emit an audible click each time a key is pressed, and for each repeated character. The default value is DISABLE.

KNP Function

The Key Not Press (KNP) parameter enables/disables the ProTerm's ability to detect the release of a key press. When set to ENABLE, the ProTerm will transmit the keypad character or function key data after a key press and a null (00h) character after a key release. The default value is DISABLE.

***Note**: Should you enable the KNP function (disabled by default), the Repeat parameter will not be accessible.*

Cursor

This parameter enables/disables the ProTerm's ability to display a rectangular cursor at the next character position. The default value is ENABLE.

Cursor Blink

This parameter enables/disables the cursor's ability to blink at a steady rate. The default value is ENABLE.

XON/XOFF

This parameter enables/disables the ProTerm's ability to control data flow with XON/XOFF protocol (i.e., When the receiving device is ready to receive data, it sends an XON signal to the sending device. When its buffer is full, the receiving device then sends an XOFF message to the sending device, which stops sending data). The default value is DISABLE.

Handshake

This parameter enables/disables use of handshake lines (DTR-DSR or RTS-CTS) for ProTerms with an RS-232 interface. The default value is DISABLE.

When enabled, the ProTerm informs the host when it can and cannot accept data and vice versa. The Handshake-Out line is the signal to the host, and the Handshake-In line is the signal from the host.

If you enable both XON/XOFF and Handshake parameters, Handshaking has priority. For example, the ProTerm cannot send an XON/XOFF command to the host if the Handshake-In line is false (low).

Should you press a key on the ProTerm and the existing handshake condition prevents transmission to the host within approximately one second, the ProTerm will display a wait symbol (Figure 3-2).

Any subsequent key presses on the ProTerm will generate an audible tone. To cancel the waiting condition and send the waiting keystroke until the next keystroke, press **CTRL** and **F5** simultaneously.

Figure 3-2: Wait Symbol

Echo

This parameter enables/disables the ProTerm's ability to display (echo) keypad entries on the screen. The default value is DISABLE.

Escape Mode

This parameter sets the Escape Command type used by the ProTerm to either ANSI or PRIVATE. The default mode is ANSI.

CR/LF Mode

This parameter determines which character is sent by the ProTerm to the host when the **ENTER** key is pressed, and how the ProTerm interprets a linefeed character sent by the host. Available options are NORMAL and NEWLINE. The default value is NORMAL.

In NORMAL mode, pressing **ENTER** on the ProTerm sends a carriage return to the host. A linefeed received by the ProTerm moves the cursor to the same column on the next line.

In NEWLINE mode, pressing **ENTER** on the ProTerm sends both a carriage return and a linefeed to the host. A linefeed received by the ProTerm moves the cursor to the first column on the next line.

Self-Test

This setting determines if the ProTerm will perform a confidence test at boot-up. The test initially displays the U.S. ASCII Character Set, performs a number of internal tests, and shows the model identifier string with checksum. The ProTerm will beep when the test is completed. If an error occurs, the ProTerm will display an error message.

Shift Lock

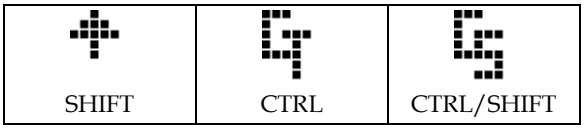
This parameter determines how the **SHIFT** and **CTRL** modifier keys are used. Typically, pressing the **SHIFT** key displays the symbols and characters that appear on the upper half of each key, while pressing the **SHIFT** key sends control characters to the host. Available options are ENABLE, DISABLE and CANCEL. The default value is DISABLE.

With Shift Lock enabled, pressing **SHIFT** will lock the keypad into Shift mode until you press **SHIFT** again.

With Shift Lock disabled**,** you must hold **SHIFT** and/or **CTRL** while pressing other keys.

With Shift Lock cancelled, pressing **SHIFT** and/or **CTRL** will modify only the next key press.

Figure 3-3: Shift/Control Key Indicators



Scroll

This parameter determines how the scrolling function will work when the ProTerm displays a character in the last display position (lower right corner). Available options are LAST CHR and LAST CHR+1.

When set to LAST CHR, the screen will scroll up one line and position the cursor in the first column of the last line (lower left corner) after displaying a character in the last display position.

When set to LAST CHR+1, the screen will scroll up one line and position the cursor in the second column of the last line after displaying a character in the last display position and receiving the next displayable character from the host.

If the ProTerm receives a control code or an escape command that alters the cursor position, the cursor will remain at the last position and the pending scroll condition canceled.

View Angle (Contrast)

This parameter adjusts the viewing angle for various environmental conditions based on contrast mid-point (which is set when you restore factory defaults). There are 16 available settings: MIN, 2, 3, 4, 5, 6, 7, MID, 9, 10, 11, 12, 13, 14, 15 and MAX. The default value is MID.

***Notes**: Should you use host control, there are only eight available settings. You can also adjust the contrast by pressing **CTRL** and **F5**.*

Break Commands

This parameter enables/disables the Break commands that define programmable keys. The default value is DISABLE.

Screen Size

This parameter defines the screen size, either 24 (characters) x 8 (lines) or 16 x 32. The default value is 24 x 8.

Menu Modes

This parameter preserves or clears the contents of the screen that were visible prior to exiting the Parameter Setup menu.

DESTRUCTIVE mode clears the contents of the display that were visible prior to entering the Parameter Setup menu. NON DESTRUCT mode preserves the contents of the display that were visible prior to entering the Parameter menu.

Allowable settings are DESTRUCTIVE or NON DESTRUCT. The default value is DESTRUCTIVE.

***Note**: While in NON DESTRUCT mode, if you change the screen size, you must reboot the unit before the new screen size takes effect.*

Backlight

For units equipped with the backlight option, this parameter turns the backlight on, completely off or off after 10 minutes of inactivity (in which case, any key press will reset the backlight timer and turn the backlight on). Allowable settings are ON, OFF or TIMED. The default value is ON.

Parameter Menu Summary

Table 3-2 lists the allowable settings and default values available through the Parameter menu.

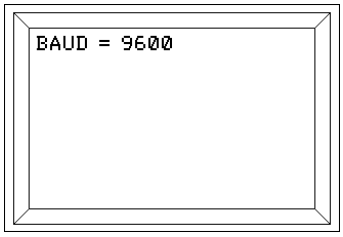
Table 3-2: Parameter Menu Summary

Parameter	*Options (Default In Bold)*
Baud	300, 600, 1200, 2400, 4800, **9600**, 19200, 57600
Data Bits	7, **8**
Parity	EVEN, ODD, MARK, SPACE, **NONE**, IGNORE
Stop Bits [1]	**1**, 2
Display PE [1]	ENABLE, **DISABLE**
Repeat [2]	SLOW, **MEDIUM**, FAST, DISABLED
Key Click	**ENABLE**, DISABLE
KNP Function	ENABLE, **DISABLE**
Cursor	**ENABLE**, DISABLE
Cursor Blink	**ENABLE**, DISABLE
XON/XOFF	ENABLE, **DISABLE**
Handshake	ENABLE, **DISABLE**
Echo	ENABLE, **DISABLE**
Escape Mode	**ANSI**, PRIVATE
CR/LF Mode	**NORMAL**, NEWLINE
Test	ENABLE, **DISABLE**
Shift Lock	ENABLE, **DISABLE**, CANCEL
Scroll on Last Character	**LAST CHR** , LAST CHR +1
Viewing Angle	MIN, 2, 3, 4, 5, 6, 7, **MID**, 9, 10, 11, 12, 13, 14, 15, MAX
Break Commands	ENABLE, **DISABLE**
Screen Size	**24 x 8**, 32 x 16
Menu Mode	NON-DESTRUCT , **DESTRUCTIVE**
Backlight [3]	**ON**, TIMED, OFF

1. Access to parameter is dependent on Data Bits and Parity settings
2. Access to parameter is dependent on KNP Function setting
3. Only if the terminal has an optional backlit display

Viewing Parameter Settings

To scroll through the current parameter settings, simultaneously hold **CTRL** and **SHIFT**, and then press **F5** (**YES** on 20-key keypads). The ProTerm will display each setting for approximately two seconds.



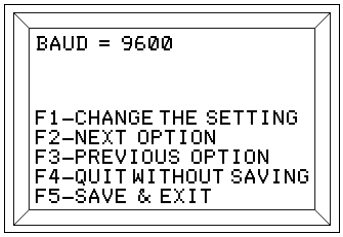
Changing Parameter Settings

To enter the Parameters menu and change settings:

1. For 45 or 30-key ProTerms, simultaneously hold **CTRL** and **SHIFT,** then press **F1**.

   For 20-key ProTerms, simultaneously hold **BKSP** and **ENTER,** then press **F1**.

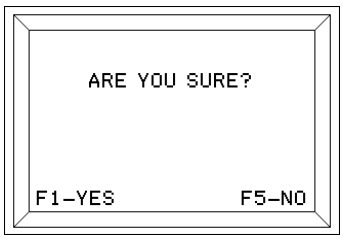
   The Parameter menu appears with the first parameter on the top line.



2. To change the value of the current parameter, press **F1**.
3. To view the next parameter, press **F2**.
4. To view the previous parameter, press **F3**.
5. To exit the menu without saving any changes on 45 or 30-key ProTerms, press **F4**.
6. To save any changes and exit the menu on 45 or 30-key ProTerms, press **F5**.

   To save any changes and exit the menu on 20-key ProTerms, press **F4**.

   The ProTerm will sound an alert (three consecutive short beeps and prompt you to confirm your changes.



7. To confirm the changes, press **F1**.

   To exit the menu without saving any changes on 45 or 30-key ProTerms, press **F5**.

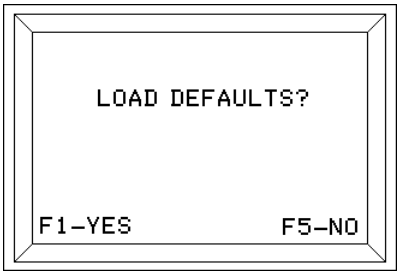
   To exit the menu without saving any changes on 20-key ProTerms, press **F4**.

Loading Factory Default Settings

To load the factory default settings:

1. Remove power from the ProTerm.
2. For 45 or 30-key ProTerms, simultaneously hold **CTRL**, **SHIFT** and **F1,** and reapply power.

   For 20-key ProTerms, simultaneously hold **BKSP**, **ENTER** and **F1,** and reapply power.
3. After the ProTerm sounds an alert and displays the "LOAD DEFAULTS?" message, release the keys.



4. For 45 or 30-key ProTerms, press **F1** to reload the default values. Press **F5** to leave the parameters unchanged.

   For 20-key ProTerms, press **F1** to reload the default values. Press **F4** to leave the parameters unchanged.

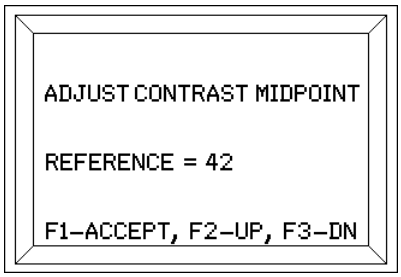
   When you reload the default values, the ProTerm will save the data and then prompt you to adjust the Setting the Contrast Midpoint. Should you leave the parameters unchanged, the ProTerm will continue on to the self-test.

Setting the Contrast Midpoint

The contrast mid-point enables you to optimize the display contrast for various environmental conditions that can affect character brightness based on a range of values where 00 is the lightest setting and 99 is the darkest. The contrast midpoint is also the MID value for the View Angle Parameter setting, where it is the midpoint of eight lighter and eight darker settings.

To set the contrast midpoint:

1. Load the factory default values described previously. The ADJUST CONTRAST MIDPOINT screen appears and displays the current midpoint value.



2. To increment the reference value by three, press **F2**.
3. To decrement the reference value by three, press **F3**.
4. To save any changes, press **F1**.
5. After setting contrast mid-point, the ProTerm will then perform a self-test.

Restricting Access

If needed, you can prevent access to the Parameter menu and disable the following Escape commands: Set All Parameters (Esc [1z), Set and Save All Parameters (Esc [2z), Set All Defaults (Esc [3z) and Program Function Keys (Esc [5z).

To restrict access to the Parameter menu and disable related Escape commands:

1. Remove power from the ProTerm.
2. For 45 or 30-key ProTerms, simultaneously hold **CTRL**, **SHIFT** and **F3,** and reapply power.

   For 20-key ProTerms, simultaneously hold **BKSP**, **ENTER** and **F3,** and reapply power.

   In either case, the ProTerm will save the change and then perform a self-test

To re-enable access to the Parameter menu and related Escape commands after restricting access, simply repeat the above procedure.

CHAPTER 4

KEY PROGRAMMING

Introduction

You can reprogram all the keys on the ProTerm's keypad. However, you are limited to a total of 222 bytes of memory (one character per byte plus an additional two bytes for each key programmed). For example, to program a key to display, "HELLO" would take seven bytes of memory.

In addition to programming characters, you can enter special hex codes to control the transmission and display of characters between the host and terminal.

All programmable key settings are stored in the ProMotion's non-volatile memory.

When pressed separately or in tandem with the **SHIFT** and/or **CTRL** modifiers, the keys on the terminals output preset values as shown in Appendix C.

To display the results of key programming on your terminal, you should first enable ECHO.

When programming keys that use both the **CTRL** and **SHIFT** modifier keys, you should enable SHIFT LOCK to avoid conflicts with existing functions (e.g., pressing **CTRL**, **SHIFT** and **F1** accesses the Parameter menu) as well as prevent "Phantom Key" syndrome.

If you keypad has limited alphanumeric capability, you can program the function key using ANSI mode host commands. See Programming Key Commands for more information.

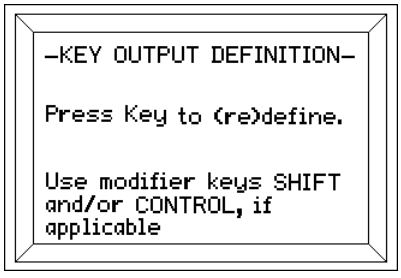
Defining Key Output

To create a key output definition:

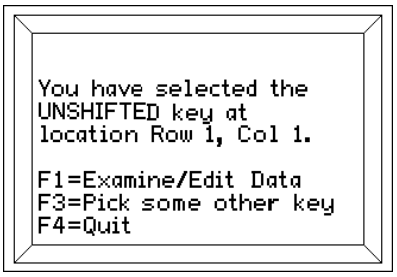
1. For 45 or 30-key ProTerms, simultaneously hold **CTRL**, **SHIFT** and **F2**.

   For 20-key ProTerms, simultaneously hold **BKSP**, **ENTER** and **F2**.

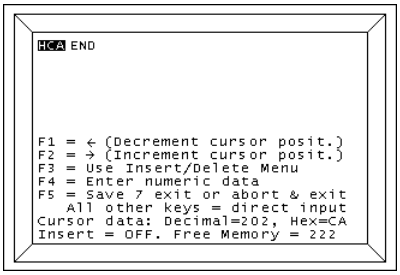
   In either case, the ProTerm then will display the following screen:



2. Press a key (for example, F1) to define its key output definition. The screen will then show the row and column location for that key (Row 1, Column1).

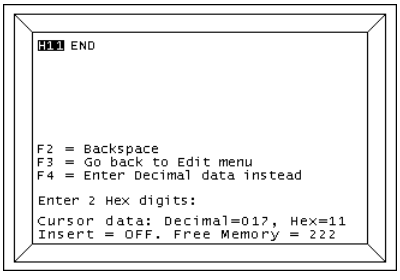


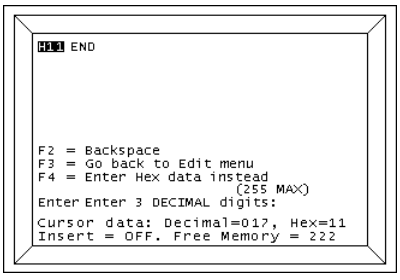
3. Press **F1** to display the Examine/Edit Data menu. Displayable characters appear within single quotes (for example, 'A'). Non-printable characters appear in hexadecimal notation, prefixed with an uppercase H (for example, F1 = HCA). Note the available free memory appears in the lower right corner.



4. To change the current value (indicated a blinking cursor), either press any alphanumeric key for direct character input (i.e., press **A** to enter A) or press **F4** to enter the hex (A = 41) or decimal equivalent (A = 065).

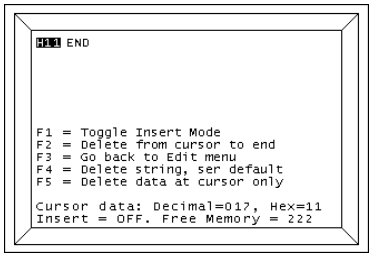
Note: *Since there are no alphabetical characters or symbols a 20-key keypad, you must enter the hex or decimal equivalent (see Appendix B).*



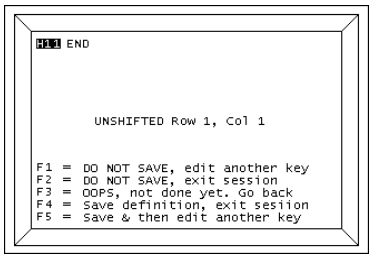


5. To add an additional value, press **F2** to move the cursor right and over the "END" field and then repeat Step 4. To move the cursor left, back to its original position, press **F1**.

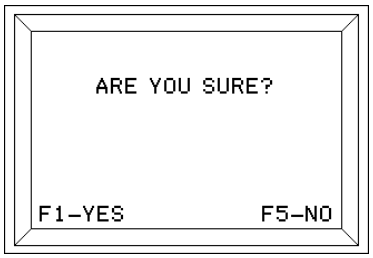
6. To make insertions or deletions between fields or reset a key's default value, press **F3** to access the Insert/Delete menu.



7. After making a selection from the Insert/Delete menu, you will return to the Examine/Edit Data menu. After completing your entries, press **F5** to go to the Save menu.



8. To save the definition and exit the session, press **F4**. To save the definition and edit another key, press **F4**. In either case, a confirmation screen will appear.



9. Press **F1** to save the session, or **F5** to abort (for 20-key keypads, press **F4**). If you select **YES**, the following screen appears:

10. Do **not** remove power from the ProTerm while the above message appears on the screen or you will corrupt **all** stored data. Should you remove power during this time, you will have load default values.

Extended Key Functionality

Extended Key commands are special hex codes that you use while defining key output to control the transmission and display of characters on both the terminal side and host side. For example, sending the string "START" to the host, while displaying "RUNNING" on the terminal. Extended Key commands fall into the following categories:

- Break Commands
- Output Control Commands
- Pause Commands
- Branching Commands
- Handshake-Out Line Manipulation Commands

***Note**: Before attempting to program keys with extended functionality, you must enable the Break Command parameter by using either the Parameter Setup menu or ANSI Host Commands.*

Break Commands

When a communication line is idle, the normal state of the terminal, the line is *marking* or transmitting continuous series of ones. The marking signal is a voltage between -3 and -30 VDC. Break commands place the transmit line into a condition known as *spacing*, where the terminal is sending zeroes for a specified time (either 250 ms or 3.5 seconds). The spacing signal is a voltage between +3 and +30 VDC.

Short Break

When defining key output, enter BB as the two HEX digits to specify a break of 250 ms.

Long Break

When defining key output, enter BC as the two HEX digits to specify a break of 3.5 seconds

Output Control Commands

Normally, the ProTerm transmits data from a programmable key string serially. If you enable the Echo parameter, data also outputs to the display.

Toggle Display Echo

When defining key output, enter BE as the two HEX digits to allow any or all parts of a programmable key string to both transmit and display simultaneously. With terminal echo disabled, the terminal will transmit all characters after the Toggle Display Echo command to both the display and the serial port.

Escape commands echoed to the display that do not require serial output will process normally. Commands that require serial output are stored in the receiver buffer until the end of the current key string execution. Remember that this command is a toggle function and will operate according to the state of the terminal's Echo parameter setting.

Toggle Serial Output

When defining key output, enter BF as the two HEX digits to prevent the terminal from transmitting characters within a programmable key string.

When used in conjunction with the Toggle Echo command, you can control which parts of a programmable key strings display on the terminal parts of strings and which parts transmit to the host. For example, to send the string "START" to the host while displaying "RUNNING" on the terminal, your key output definition would look like:

'S' 'T' 'A' 'R' 'T' BFh BEh 'R' 'U' 'N' 'N' 'I' 'N' 'G'

Pause Commands

With the use of extended key functionality, you can program a key string to pause while either waiting to receive a specific character or a specific handshake line input.

Pause until Handshake Line Input is +V

When defining key output, enter B7 as the two HEX digits to suspend programmable key output until the ProTerm's handshake line (at the interface connector) is between +3 and +30 volts.

If the handshake line is already in the +V range, there should be no delays in output. Should the terminal wait for a response for more than 0.50 seconds, it will display the Wait character. To abort the pause, press **CTRL** and **F5** simultaneously.

***Note**: Use of this command requires that you disable the terminal's Handshake parameter.*

Pause until Handshake Line Input is –V

When defining key output, enter B6 as the two HEX digits to suspend programmable key output until the ProTerm's handshake line (at the interface connector) is between -3 and -30 volts.

If the handshake line is already in the -V range, there should be no delays in output. Should the terminal wait for a response for more than 0.50 seconds, it will display the Wait character. To abort the pause, press **CTRL** and **F5** simultaneously.

***Note**: Use of this command requires that you disable the terminal's Handshake parameter.*

Pause until n Character Received

When defining key output, enter BD as the two HEX digits to suspend communication until the ProTerm receives a specified character (n) from the host before continuing.

For example to have the terminal send the string “START, ” wait for a specific character (in this case, the letter “G” in the string “STARTING”) and then respond to the host by sending the string “RUNNING” to the host, your key output definition would look like:

‘S’ ‘T’ ‘A’ ’R’ ‘T’ BFh BDh ‘G’ BFh ‘R’ ‘U’ ‘N’ ‘N’ ‘I’ ‘N’ ‘G’

Should the terminal wait for a response for more than 0.50 seconds, it will display the Wait character. To abort the pause, press **CTRL** and **F5** simultaneously.

Branching Commands

Branching commands enable you to reprocess or conditionally process all or portions of a programmable key string. Branch commands make use of a label that it will search for within a key output definition, starting at the beginning of the string.

When a Branch command finds the correct label, programmable key processing and output will continue normally with the character following the label. Any search for a non-existent label will result in the termination of programmable key string processing and a normal exit.

The terminal will ignore Label Designator commands and their respective values in all cases except for searches initiated by a branch condition.

Label Designator Command

When defining key output, enter B4 as the two HEX digits to define the next character as a label. The label may be any value, such as “1,” “A,” or “>.”

For example to define “1” as your label, your key output definition would look like:

B4h ‘1’

Branch Always Command

When defining key output, enter BA as the two HEX digits to unconditionally branch to the label value that follows.

For example, to jump unconditionally to label “1” after the terminal receives the character “Y,” your key output definition would look like:

B4h ‘1’ ‘N’ ‘E’ ‘X’ ‘T’ BDh ‘Y’ BAh ‘1’

Branch Conditional Command

When defining key output, enter B5 as the two HEX digits to branch to the label value that follows when the Handshake-In line is between -3 and -30 volts.

If the Handshake-In line is between +3 and +30 volts, programmable key processing and output will continue normally with the character following the conditional branch's label value.

In the following example, the terminal acts as a remote monitoring device that checks the paper status and assumes the following:

1. The host will power up in a "STOPPED" state.
2. When the paper is low, the host asserts a -V on the line connected to handshake input of the terminal.
3. When the unit begins to run, the host will transmit "R."
4. When the unit stops, the host will transmit "S."
5. Parameters settings for the terminal include DISABLE ECHO, ESCAPE MODE = PRIVATE and SCREEN SIZE = 24 x 8.

```
BFh BEh B4h '1' 1Bh 'E' 'S' 'T' 'O' 'P' 'P' 'E' 'D' B5h '2' 0Dh 0Ah 'P' 'A' 'P' 'E' 'R' ' ' 'L' 'O' 'W '
4Bh '2' BDh 'R' 1Bh 'E' 'R' 'U' 'N' 'N' 'I' 'N' 'G' 'B5h '3' 0Dh 0Ah P' 'A' 'P' 'E' 'R' ' ' 'L' 'O' 'W '
B4h '3' BDh 'S' BAh '1'
```

Handshake-Out Manipulation Commands

Handshake-Out Manipulation commands are useful to signal an external device. The Handshake-Out line will maintain voltage levels between +3 and +15 volts or -3 and -15 volts. Effective line load resistance should always be greater than 3K ohms (RS-232 interface only).

Assert Handshake-Out Equals -V Command

When defining key output, enter B8 as the two HEX digits to assert the Handshake-Out line at the interface connector to between -3 and -15 volts (-V).

***Note**: Use of this command requires that you disable the terminal's Handshake parameter.*

Assert Handshake-Out Equals +V Command

When defining key output, enter B9 as the two HEX digits to assert the Handshake-Out line at the interface connector to between +3 and +15 volts (+V).

***Note**: Use of this command requires that you disable the terminal's Handshake parameter.*

Extended Function Key Command Summary

The following table is a summary of extended function key commands.

Table 4-1: Extended Function Key Command Summary

Hex Code/Syntax	*Command/Summary*
BC	Execute Long Break—specifies a break of 3.5 seconds
BB	Execute Short Break—specifies a break of 250 ms
BE	Toggle Display Echo—defaults to ECHO parameter setting
BF	Toggle Serial Output—defaults to serial output
BD *n*	Pause until *n* Character Received—wait to receive a specific character (*n*) from serial input
B7	Pause Until Handshake Line Input +V—suspend programmable key output until handshake line is between +3 and +30 volts
B6	Pause Until Handshake Line Input -V—suspend programmable key output until handshake line is between -3 and -30 volts
B4 *n*	Label Designator—define the next character (*n*) as the label for branch commands
BA *n*	Branch Always—jump to *n*, where *n* is the character specified in the Label Designator command
B5 *n*	Branch Conditional—jump to *n*, where *n* is the character specified in the Label Designator command, provided that the Handshake-In line is between -3 and -30 volts
B8	Assert Handshake-Out Equals -V Command—assert the Handshake-Out line, at the interface connector to between -3 and -15 volts
B9	Assert Handshake-Out Equals +V Command—assert the Handshake-Out line, at the interface connector to between +3 and +15 volts

CHAPTER 5

ANSI MODE HOST COMMANDS

Introduction

As discussed previously, the ProTerm's design allows a host to control its functions by sending commands that begin with the Escape character. When set to ANSI mode, the ProTerm will recognize commands that are compatible with the American National Standards Institute X3.64 standard. For example, sending an Esc [H (1Bh 5Bh 48h) will move the cursor to the home position (upper right corner). A command summary appears at the end of this section.

***Note**: Do not use spaces between characters in Escape commands. Any spacing shown for Escape commands in this chapter is for clarity only unless otherwise noted.*

Cursor Commands

Cursor Up

Syntax Esc [*Pn* A

Notes *Pn* indicates an optional repeat count. If the count is absent, the cursor will move one position. The cursor will not move beyond the start or end of a line, nor will it scroll the display.

Cursor Down

Syntax Esc [*Pn* B

Notes *Pn* indicates an optional repeat count. If the count is absent, the cursor will move one position. The cursor will not move beyond the start or end of a line, nor will it scroll the display.

Cursor Right

Syntax Esc [*Pn* C

Notes *Pn* indicates an optional repeat count. If the count is absent, the cursor will move one position. The cursor will not move beyond the start or end of a line, nor will it scroll the display.

Cursor Left

Syntax Esc [*Pn* D

Notes *Pn* indicates an optional repeat count. If the count is absent, the cursor will move one position. The cursor will not move beyond the start or end of a line, nor will it scroll the display.

Cursor Position

Syntax Esc [*Pr*; *Pc* f or Esc [*Pr*; *Pc* H

Notes *Pr* and *Pc* are the optional row and column numbers of the target cursor location, respectively. For example, Esc [4; 20 f will send the cursor to Row 4, Column 20.

If the row and column are absent, the command simply moves the cursor to the home position.

Cursor Home & Clear Display

Syntax Esc [1 s

Save Cursor Position

Syntax Esc [s

Notes Temporarily stores the current cursor position in RAM memory and is lost when you remove power.

Restore Cursor Position

Syntax Esc [u

Notes Returns the cursor to the stored position

Enable Cursor

Syntax Esc [4t

Disable Cursor

Syntax Esc [5t

Enable Cursor Blink

Syntax Esc [3; 0z or Esc [6t

Disable Cursor Blink

Syntax Esc [3; 1z or Esc [7t

Hide Cursor

Syntax Esc [3; 4z

CR/LF Commands

Normal Mode

Syntax Esc [20l

Notes Sends a carriage return character (0Dh) to the host

New Line Mode

Syntax Esc [20h

Notes Sends a carriage return character (0Dh) and a line feed character (0Ah) to the host

Erasure Commands

Erase Cursor to End of Line

Syntax Esc [K

Notes Includes the character at the cursor location and does not alter the cursor position

Erase Start of Line to Cursor

Syntax Esc [1K

Notes Includes the character at the cursor location and does not alter the cursor position

Erase Entire Line

Syntax Esc [2K

Notes Includes the character at the cursor location and does not alter the cursor position

Erase Cursor to End of Display

Syntax Esc [J

Notes Includes the character at the cursor location and does not alter the cursor position

Erase Start of Display to Cursor

Syntax Esc [1J

Notes Includes the character at the cursor location and does not alter the cursor position

Erase Entire Display

Syntax Esc [2J

Notes Includes the character at the cursor location and does not alter the cursor position

Reset Commands

Reset Terminal

Syntax Esc c

Notes This command is equivalent to removing and reapplying operating power from the terminal.

Escape Mode Commands

Switch to Private Mode

Syntax Esc [?2l

Notes This command causes the terminal to switch from recognizing ANSI host commands to recognizing Private host commands.

Character Attribute Commands

Set Blink Attribute

Syntax Esc [2s or Esc [5; m

Notes Characters written subsequent to the setting or clearing of attributes will assume the new attribute characteristics.

Clear Blink Attribute

Syntax Esc [3s

Notes Characters written subsequent to the setting or clearing of attributes will assume the new attribute characteristics.

Set Reverse Video Attribute

Syntax Esc [7; m

Notes Characters written subsequent to the setting or clearing of attributes will assume the new attribute characteristics.

When Reverse Video is set, functions that clear any portion of the screen (e.g., scrolling and erase line) will use a solid fill character.

Clear All Attributes

Syntax Esc [0; m

Notes Characters written subsequent to the setting or clearing of attributes will assume the new attribute characteristics.

Key Attribute Commands

Enable Key Repeat

Syntax Esc [?8h

Notes This command enables key repeat, using the most recent rate setting.

Disable Key Repeat

Syntax Esc [?8l

Enable Key Click

Syntax Esc [0t

Disable Key Click

Syntax Esc [1t

Enable KNP Function

Syntax Esc [2t

Disable KNP Function

Syntax Esc [3t

Self-Test & Return Commands

Perform Self-Test & Return Results

Syntax Esc [4n

Notes This command performs the built-in confidence test and reports the result.

A response of Esc [0n indicates that the terminal passed the confidence test; a response of Esc [3n indicates that the confidence test has not run or that a malfunction occurred.

Return Last Self-Test Results

Syntax Esc [5n

Notes This command reports the result of the last confidence test run since the terminal power up.

A response of Esc [0n indicates that the terminal passed the confidence test; a response of Esc [3n indicates that the confidence test has not run or that a malfunction occur.

Return Device Attributes

Syntax Esc [c

Notes This command sends the following string to the host indicating that the ProTerm is ANSI 3.64/VT100 compatible: Esc [?8; 4c.

Return Terminal Identifier String

Syntax Esc [p

Notes This commands sends the following identifier string to the host:

Esc [0x PT *NN* XM *CCCC* Esc [1x

Where *NN* is the keypad type (20, 30 or 45) and *CCCC* is the four-byte hexadecimal checksum of the terminal's program memory.

When using this command to identify the terminal type, do not include the checksum as it may change.

Return Cursor Position

Syntax Esc [6n

Notes This command sends the cursor's current location to the host in the form:

Esc [*Rn*; *Cn*R

Where *Rn* is the row number and *Cn* is the column number. For example, a return of Esc [4; 21R indicates a cursor position of Row 4, Column 21.

When the Scroll parameter is set to LAST CHR+1, a return of Esc [8; 25R or Esc [16; 33R (depending on the screen size) represents the cursor position after a character is written to Row 8, Column 24 or Row 16, Column 32.

Display Attribute Commands

Set Screen Size to 32 x 16

Syntax Esc [1 ; 0z

Set Screen Size to 24 x 8

Syntax Esc [1 ; 1z

Adjust LCD Contrast

Syntax Esc [v

Notes This command increases the contrast one level

Enable Backlight

Syntax Esc [8t

Notes Applies only to terminals with optional backlit displays

Disable Backlight

Syntax Esc [9t

Notes Applies only to terminals with optional backlit displays

Sound Commands

You cannot buffer sound commands. To produce properly spaced chain sounds, the host must delay a short time between issuing sound commands.

Short Bell

Syntax Esc [0q

Long Bell

Syntax Esc [1q

Alert

Syntax Esc [2q

Key Click

Syntax Esc [3q

LED Control Commands

On models equipped with optional LED indicators, the following commands control LEDs usage:

Disable LED 1

Syntax Esc [6q

Enable LED 1

Syntax Esc [7q

Disable LED 2

Syntax Esc [8q

Enable LED 2

Syntax Esc [9q

Disable LED 3

Syntax Esc [10q

Enable LED 3

Syntax Esc [11q

Disable LED 4

Syntax Esc [12q

Enable LED 4

Syntax Esc [13q

Disable All LEDS

Syntax Esc [16q

Parameter Modification Commands

You can change the ProTerm's parameter settings from the host using Escape commands. You can issue commands for individual settings, all settings or simply report the current settings.

The Set Defaults command resets all parameters and keys to their default settings. The Set Parameters command enables you to change but not save parameters to memory. The Set and Save Parameters command enables you to change and save parameters to memory.

***Note**: If you have restricted access to the Parameter menu, you cannot use these commands.*

Set Defaults

Syntax Esc [3z Esc [0z

Set Parameters

Syntax Esc [1z P1; P2; P3; P3A; . . . P22 Esc [0z

Set and Save Parameters

Syntax Esc [2z P1; P2; P3; P3A; . . . P22 Esc [0z

Set Parameters & Set and Save Parameters Command Notes

Both commands can specify up to twenty-three single character parameters from a fixed list (see Table 5-1).

You can omit any or all of the parameters by using the semicolon as a placeholder, except in the case of P3A (STOP BITS). P3A is only significant if specified.

P3A has the following characteristics:

You cannot substitute P3A with a placeholder. The terminal will interpret a placeholder in the P3A position as a placeholder for P4.

You can specify P3A even if P3 has a placeholder.

In certain situations, the terminal will automatically set the number of stop-bits to either one (when you select eight data-bits and any parity) or two (when you select seven data-bits and no parity). In either case, the setting of P3A will have no effect.

Parameter values not specified in the Set All Parameters and Set and Save All Parameters commands will remain unchanged.

After the terminal has processed a Set All Parameters or Set and Save All Parameters command, it will send the new parameters setting the host as ASCII text, with each parameter followed by a carriage return and line feed.

To send the current parameter values to the host without changing any values, simply send: Esc [1z Esc [0z.

Table 5-1: Set Parameters Commands

Parameter	*Name*	*Options*
P1	Baud	**3**00, **6**00, **1**200, **2**400, **4**800, **9**600, 1920**0**, **5**7600
P2	Data Bits	**7** or **8**
P3	Parity	**E**VEN, **O**DD, **M**ARK, **S**PACE, **N**ONE, **I**GNORE
P3A	Stop Bits	**1** or **2**
P4	Display PE	**E**NABLE, **D**ISABLE
P5	Repeat	**S**LOW, **M**EDIUM, **F**AST, **D**ISABLE
P6	Key Click	**E**NABLE, **D**ISABLE
P7	KNP Function	**E**NABLE, **D**ISABLE
P8	Cursor	**E**NABLE, **D**ISABLE
P9	Cursor Blink	**E**NABLE, **D**ISABLE
P10	XON/XOFF	**E**NABLE, **D**ISABLE
P11	Handshake	**E**NABLE, **D**ISABLE
P12	Echo	**E**NABLE, **D**ISABLE
P13	Escape Mode	**A**NSI, **P**RIVATE
P14	CR/LF Mode	**N**ORMAL, NEW **L**INE
P15	Self-Test	**E**NABLE, **D**ISABLE
P16	Shift Lock	**E**NABLE, **D**ISABLE
P17	Scroll On	**0** (LAST CHR) or **1** (LAST CHR +1)
P18	Viewing Angle	**1** (Min) , **2** , **3** , **4** , **5** , **6** , **7** , **8** (Max)
P19	Break Command	**E**NABLE, **D**ISABLE
P20	Screen Size	**0** (32 x 16) or **1** (24 x 8)
P21	Menu Mode	**N**ON-DESTRUCT, **D**ESTRUCTIVE
P22	Backlight [1]	O**N**, **T**IMED, O**F**F

Example

The following command will enable communications at 9600 baud, 8 data bits, even parity and 1 stop bit. In addition it will disable the parity error symbol, use fast repeat, disable the key click, disable the KNP function, enable the cursor, disable cursor blink, enable XON/XOFF protocol, and enable handshaking. It will also use ANSI escape mode commands, set CR/LF Mode to normal, enable self-test, disable the shift lock, set the scroll on to the last character, set the viewing angle to 4, disable the break command, use a 32 x 16 screen size, set the menu mode to non-destruct mode and turn on the backlight.

Esc [1z 9; 8; E; 1; D; F; D; D; E; E; D; E; E; A; N; E; D; 0; 4; D; 0; N; O Esc [0z

Programming Key Commands

You can issue ANSI host commands to reprogram any keys, except for **SHIFT** and **CTRL**, to transmit a single character or a string of characters. However, if you have restricted access to the Parameter menu, you cannot use these commands.

Program Key

Syntax Esc [5z K*n*; C1; C2; . . . C*n* Esc [0z

Notes This command reprograms a key , where K*n* is the key position as defined in Table 5-2 and C1, C2 . . . C*n* are the character values in ASCII Hex notation ("A" = 41, "B" = 42, etc.).

For example, to program a non-shifted key in Row 1, Column 1 with the string "STOP," issue the following command:

Esc [5z K01; 53; 54; 4F; 50 Esc [0z

When programming keys, there is a limit of 222 bytes of available memory. In addition to the number of characters programmed (one character per byte), each key requires an additional two bytes of memory. For example, programming the string "STOP" uses six bytes.

A key programmed without data is effectively inoperative (no output or key click), but still uses two bytes of key memory. The only way to free memory is to re-program keys to their default settings.

Should the terminal encounter an error during key programming, it will terminate the programming operation without allocating memory and return the following error string:

Esc [0x ERROR CODE= *XX* PARAMETERS UNCHANGED Esc [1x3

Where *XX* is one the following ASCII Hex error codes:

01	=	K*n* improper
02-F0	=	C1 . . . C*n* format error
FE	=	Not Enough memory available
FF	=	Key memory data corrupted

After the terminal successfully receives the Esc [0z termination command, it inserts the programming information into memory. Should you remove power within 0.75 seconds of this time, all programmed key data may become corrupt and subsequently require you to load the default parameters.

Report Key Settings

Syntax Esc [4z

Notes This command sends a list of keys programmed with values other than the default values to the host using the format:

Esc [0x K*n*; C1; C2; . . . C*n*; K*n* C1; C2; . . . C*n* Esc [1x

Where K*n* is the key position as defined in Table 5-2 and C1, C2 . . . C*n* are the character string values in ASCII Hex notation ("A" = 41, "B" = 42, etc.).

For example, an un-shifted key in Row 1, Column 1 programmed with the string "STOP" will return:

Esc [0x K01; 53; 54; 4F; 50 Esc [1x

Table 5-2: Key Positions (ASCII Hex Values)

Modifier Key/Row		Col 1	Col 2	Col 3	Col 4	Col 5
Normal	1	01	02	03	04	05
	2	06	07	08	09	0A
	3	0B	0C	0D	0E	0F
	4	10	11	12	13	14
	5	15	16	17	18	19
	6	1A	05	1C	1D	1E
	7	1F	0A	21	22	23
	8	24	0F	26	27	28
	9	29	14	2B	2C	2D
SHIFT	1	2E	19	30	31	32
	2	33	1E	35	36	37
	3	38	39	3A	3B	3C
	4	3D	3E	3F	40	41
	5	42	43	44	45	46
	6	47	48	49	4A	4B
	7	4C	4D	4E	4F	50
	8	51	52	53	54	55
	9	56	57	58	59	5A
CTRL	1	5B	5C	5D	5E	5F
	2	60	61	62	63	64
	3	65	66	67	68	69
	4	6A	6B	6C	6D	6E
	5	6F	70	71	72	73
	6	74	75	76	77	78
	7	79	7A	7B	7C	7D
	8	7E	7F	80	81	82
	9	83	84	85	86	87
SHIFT+CTRL	1	88	89	8A	8B	8C
	2	8D	8E	8F	90	91
	3	92	93	94	95	96
	4	97	98	99	9A	9B
	5	9C	9D	9E	9F	A0
	6	A1	A2	A3	A4	A5
	7	A6	A7	A8	A9	AA
	8	AB	AC	AD	AE	AF
	9	B0	B1	B2	B3	B4

Legend: ▩ 20-key keypad, ▨ 30-key keypad, □ 45-key keypad

Custom Character Commands

You can customize most display characters in both the ASCII Character set and the ProTerm Extended Character set as defined in Appendix A, with the exception of characters with hex values 00 through 20 and 80. A working knowledge of binary and hexadecimal notation is helpful for use of this feature.

Program Custom Character

Syntax Esc [5z C*n*; R1; R2; . . . R*n* Esc [0z

Notes This command is case sensitive, where C*n* is the character number as defined in one of the character sets found in Appendix A. R1; R2; . . . R*n* represent the corresponding row numbers for either a 16 x 32 screen (8 rows) or a 24 x 8 screen (16 rows) which contain ASCII hexadecimal characters (see Examples).

To display user characters, you must set the Data Bits parameter to 8 and enable Echo. You can then send the Esc [5z command to the terminal or program a key to output the character. For example, to program the F1 key to display Character C1, you would define the key output value as Hex 81.

When programming custom characters, you must have the correct screen size set. If you switch display modes, the characters will not appear.

Examples Program Character C1 as a box for a 16 x 32 Screen

Bit	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*0*	*Hex*
R1	1	1	1	1	1	0	0	0	F8
R2	1	0	0	0	1	0	0	0	88
R3	1	0	0	0	1	0	0	0	88
R4	1	0	0	0	1	0	0	0	88
R5	1	0	0	0	1	0	0	0	88
R6	1	0	0	0	1	0	0	0	88
R7	1	1	1	1	1	0	0	0	F8
R8	0	0	0	0	0	0	0		00

Legend: ■ Bit on, □ Bit off , ▢ Bit ignored

Esc [5z C1; F8; 88; 88; 88; 88; 88; F8; 00 Esc [0z

Bit 7 of each byte represents the leftmost column of the character.

As shown above, the hex values for the high order and low order byte are concatenated; the results are the values entered for each row (for example, F8h = 11111000).

Program Character C1 as a box for an 8 x 24 Screen

Bits	7	6	5	4	3	2	1	0	Hex
R1	0	0	0	0	0	0	0	0	00
R2	1	1	1	1	1	1	1	0	FE
R3	1	1	1	1	1	1	1	0	FE
R4	1	1	0	0	0	1	1	0	C6
R5	1	1	0	0	0	1	1	0	C6
R6	1	1	0	0	0	1	1	0	C6
R7	1	1	0	0	0	1	1	0	C6
R8	1	1	0	0	0	1	1	0	C6
R9	1	1	0	0	0	1	1	0	C6
R10	1	1	0	0	0	1	1	0	C6
R11	1	1	0	0	0	1	1	0	C6
R12	1	1	0	0	0	1	1	0	C6
R13	1	1	0	0	0	1	1	0	C6
R14	1	1	1	1	1	1	1	0	FE
R15	1	1	1	1	1	1	1	0	FE
R16	0	0	0	0	0	0	0	0	00

Legend: ■ Bit on, □ Bit off ,

Esc [5z C1; 00; FE; FE; C6; C6; C6; C6; C6; C6; C6; C6; C6; FE; FE; 00 Esc [0z

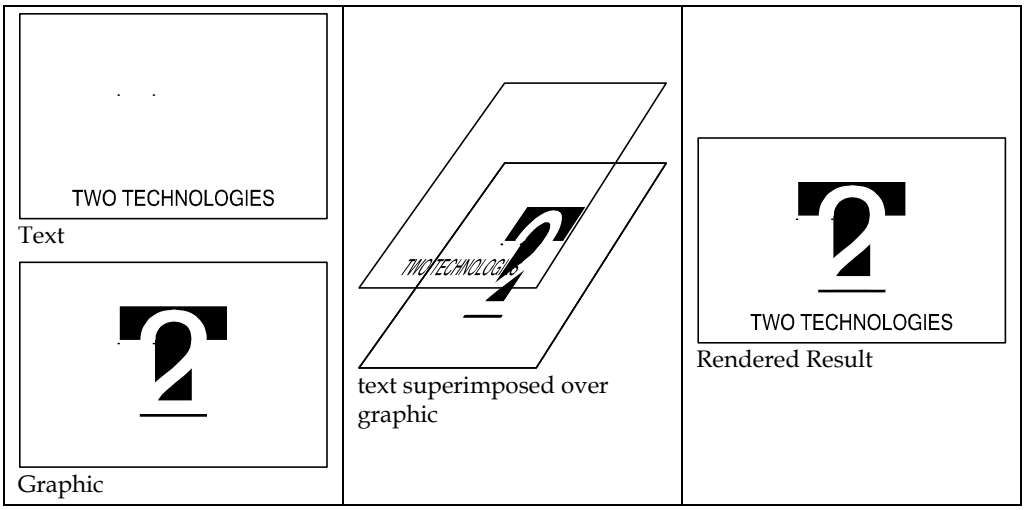
Bit 7 of each byte represents the leftmost column of the character.

As shown above, the hex values for the high order and low order byte are concatenated; the results are the values entered for each row (for example, FEh = 11111110).

Graphics Mode

The ProTerm can display graphics by either downloading a proprietary graphics file or by manipulating graphic pixels to two graphic memory locations (Buffer0 and Buffer1) that are independent of text memory. As a result, the ProTerm superimposes the text over the images (see figure below). It cannot however, display the contents of both graphics buffers simultaneously. If you do not want to superimpose text over the image, you must first clear the text.

Figure 5-1: Graphics Rendering



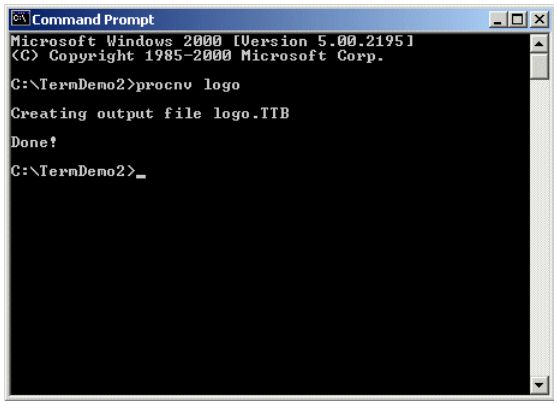
***Note**: When overlaying text and graphics together, make sure the image does not wash out the text.*

Graphic Files

Before you can download graphic files from the host, you must convert the source file to a format (*.ttb) that the ProTerm can process using the PROCNV.EXE file conversion command line utility (available from Two Technologies).

The source bitmap files must be monochrome (black and white) and 192-pixels wide x 128-pixels high. Each pixel is one bit. Each byte is eight bits. Total files size is 3072 bytes.

Figure 5-2: PROCNV.EXE



The syntax to convert a file is:

procnv *bitmap_filename (no extension)*

For example, procnv logo

Graphics Mode Commands

***Note**: To facilitate faster transfer and the displaying of graphics, enable handshaking and use a baud rate between 19200 and 57600 bps.*

Load Binary Data to Graphics Buffer

Syntax Esc [5z GL0; <*transmission_string*> Esc [0z
Esc [5z GL1; <*transmission_string*> Esc [0z

Notes Use the above commands to download image files from a host PC to one of two buffers in the ProTerm memory, where GL0 indicates Buffer 0, GL1 indicates Buffer 1 and *transmission_string* is a string of ASCII characters that represent the hex values of the image's data bytes. For example, A = 41h (turns on Bit 6 and Bit 0 in a data byte).

When using communications programs, such as HyperTerminal, you can send the TTB file as a text file instead of specifying the *transmission_string*.

Upon completion of an image download, you must issue a Display Buffer command to view the image on the terminal. However, in some cases, the graphic buffer may display during the download and give the appearance of a scrolling display.

You can download one image while displaying the other.

Text processing will slow while the terminal displays an image, especially when switching between screen sizes (24 x 8 to 32 x 16 or vice versa).

Display Buffer Contents

Syntax Esc [5z GD0 Esc [0z
Esc [5z GD1 Esc [0z

Notes Use the above commands to display the contents of the graphics buffers, where GD0 indicates Buffer 0 and GD1 indicates Buffer 1.

Should you attempt to display the contents of a graphics buffer prior to loading or clearing new data, what ever random pattern has been stored will display.

Clear Buffer Contents

Syntax Esc [5z GB0 Esc [0z
Esc [5z GB1 Esc [0z

Notes Use the above commands to clear the contents of the graphics buffers, where GB0 indicates Buffer 0 and GB1 indicates Buffer 1.

Real-Time Graphic Commands

An alternative method to displaying images on the ProTerm is the direct manipulation of display pixels in real time.

Set Pixels

Syntax Esc [5z GS0; *Pr; Pc* Esc [0z
Esc [5z GS1; *Pr; Pc* Esc [0z

Notes Use the above commands to set a pixel in real-time, where GS0 indicates Buffer 0 and GS1 indicates Buffer 1, *Pr* is the hex value of the row position (along the horizontal axis) and Pc is the hex value of the column position (along the vertical axis).

You should clear the buffer prior to displaying the contents of the buffer.

Reset Pixels

Syntax Esc [5z GC0; *Pr; Pc* Esc [0z
Esc [5z GC1; *Pr; Pc* Esc [0z

Notes Use the above commands to clear a set pixel in real-time, where GC0 indicates Buffer 0 and GC1 indicates Buffer 1, *Pr* is the hex value of the row position (along the horizontal axis) and Pc is the hex value of the column position (along the vertical axis).

Graphics Mode Command Examples

Example 1

The following example shows a series of commands that will clear the buffer contents, transfer a graphics image and display the contents on the display:

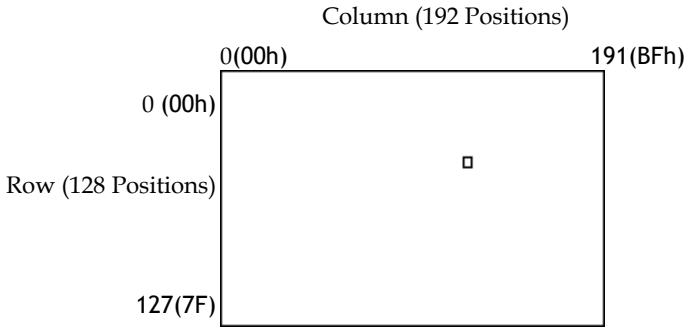
Esc [5z GB0 Esc [0z Esc [5z GL0; *image_contents* Esc [0z Esc [5z GD0 Esc [0z

***Note**: image_contents is either a TTB file or a string of ASCII characters that represent the hex values of the image's data bytes.*

Example 2

The following example shows a series of commands that that will clear the buffer contents and draw a small box on the display:

Esc [5z GB0 Esc [0z Esc [5z GS0; 72;32 Esc [0z Esc [5z GS0; 72;33 Esc [0z Esc [5z GS0; 72;34 Esc [0z Esc [5z GS0; 72;35 Esc [0z Esc [5z GS0; 72;36 Esc [0z Esc [5z GS0; 73;32 Esc [0z Esc [5z GS0; 73;36 Esc [0z Esc [5z GS0; 74;32 Esc [0z Esc [5z GS0; 74;36 Esc [0z Esc [5z GS0; 75;32 Esc [0z Esc [5z GS0; 75;36 Esc [0z Esc [5z GS0; 76;32 Esc [0z Esc [5z GS0; 76;33 Esc [0z Esc [5z GS0; 76;34 Esc [0z Esc [5z GS0; 76;35 Esc [0z Esc [5z GS0; 76;36 Esc [0z



Advanced Control Mode

Advanced Control Mode (ACM) enables you to restrict the input and output of the terminal's keypad by assigning specific hex values to each key press and each subsequent key release, making it ideal to control devices or applications in environments where safety is a primary concern. While in ACM, the following terminal features and functions are affected:

- **Terminal Parameters—** to use ACM, you must ensure that the Data Bits parameter is set to eight data bits.

  While in ACM mode, terminal echo and key repeat are disabled.

  You cannot save ACM settings. If power is lost, the terminal will revert to Normal mode.

- **Menu Access—**access to the Parameter Setup menu, the Key Output Definition Setup menu and Contrast Control is disabled.

- **ENQ Acknowledgement—**when the host enables ACM, the terminal's response to an ENQ (05h) becomes a DLE (10h) instead of an ACK (06h). This response will enable the host to verify that the terminal is in ACM.

  The host should then periodically check for DLE at a fixed time interval as required for your application (such as 25 ms) to verify ACM and connection of the terminal. Communication must be set to eight data bits.

- **Key Codes—**while in ACM, the terminal makes a distinction between a key press and key release when transmitting data to the host.

  For key presses, the terminal sends the default hex value of the key (i.e., A = 41h, B = 42h, etc.). Any keys redefined in Normal (non-ACM) mode will return to their default settings until the suspension of ACM activities.

  For key releases, the terminal adds a hex value of 80 to the default hex value (i.e., A = 41h + 80h = C1, B = 42h + 80h = C2, etc.).

  For example, pressing F1 sends 11h, while releasing F1 sends a 91h.

- **nKey Rollover—** while in ACM, you can press any combination of keys in any order, and the terminal will send the resultant key codes in tandem (i.e., pressing CTRL, SHIFT and F1 will send 11h, 7Ch, and 5Ch) and then the corresponding key codes in tandem, when you release the keys (91h, FCh, and DCh).

  However, if a combination of three pressed keys results in a pressed key sharing a common column or row with another pressed key (i.e., form a corner), the terminal will not transmit the resulting key codes because the matrix system used by the terminal for key detection will find a "Ghost" key as illustrated below:

Figure 5-3: Ghost Key

- **Modifier Keys—**while in ACM, the **CTRL** and **SHIFT** keys will not work as modifier keys; they can only change the mode indicator on the display as shown in the table below.

Table 5-3: ACM Mode– SHIFT and CTRL Key Results

Command	*Function*	*Key*	*Indicator*	*Press*	*Release*
Esc [4v	Disabled	SHIFT	None	5C	DC
	Disabled	CTRL	None	7C	FC
Esc [5v	Enabled	SHIFT		5C	DC
	Disabled	CTRL	None	7C	FC
Esc [6v	Disabled	SHIFT	None	5C	DC
	Enabled	CTRL		7C	FC
Esc [7v	Enabled	SHIFT		5C	DC
	Enabled	CTRL		7C	FC
	Enabled	CTRL, SHIFT		5C, 7C	DC ,FC

ACM Control Commands

Only the host can enable/disable ACM.

Because the host can send a request for ACM at any time, even while the operator is pressing or releasing keys, you should ensure that the host receives all keys press codes, their corresponding release codes and the proper ENQ response prior to any mode change.

Enable ACM

Syntax Esc [1v

Disable ACM

Syntax Esc [21v

Shift and Ctrl Key Control Commands

Disable Shift, Disable Ctrl

Syntax Esc [4v

Enable Shift, Disable Ctrl

Syntax Esc [5v

Disable Shift, Enable Ctrl

Syntax Esc [6v

Enable Shift, Enable Ctrl

Syntax Esc [7v

Example: Using ACM in a Robotic Environment

The following example shows the use of ACM in an industrial environment where safety during operation is a primary concern.

In this scenario, the ProTerm controls a robotic free-swinging arm (Figure 5-4), where:

1. The host transmits an ENQ (05h) every 25 ms to the terminal to determine its state (Normal mode or ACM).
2. The terminal in response will either send an ACK (06h) to indicate Normal mode or a DLE (10h) to indicate DLE. If a timeout occurs for any reason, the host will stop the robotic arm.
3. In Normal mode, you can perform operations such as displaying graphics and switching to ACM (Esc [1v).
4. In ACM, you can press a key to move the arm and release a key to stop the arm. You can also switch back to Normal mode (Esc [21v).

A flowchart (Figure 5-5) appears on the following page.

Figure 5-4: Using ACM in a Robotic Environment

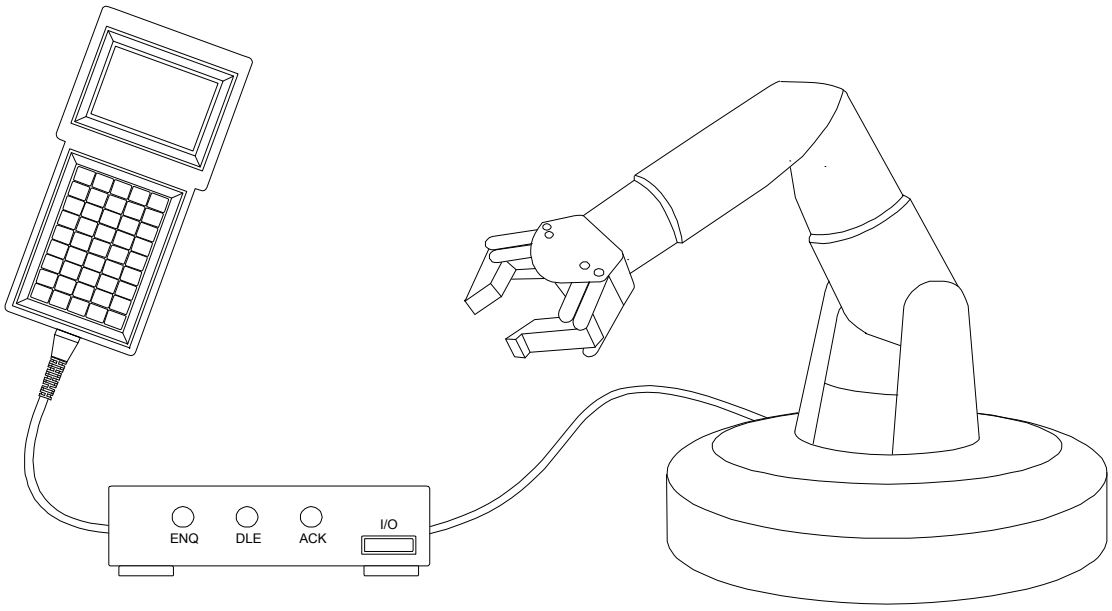
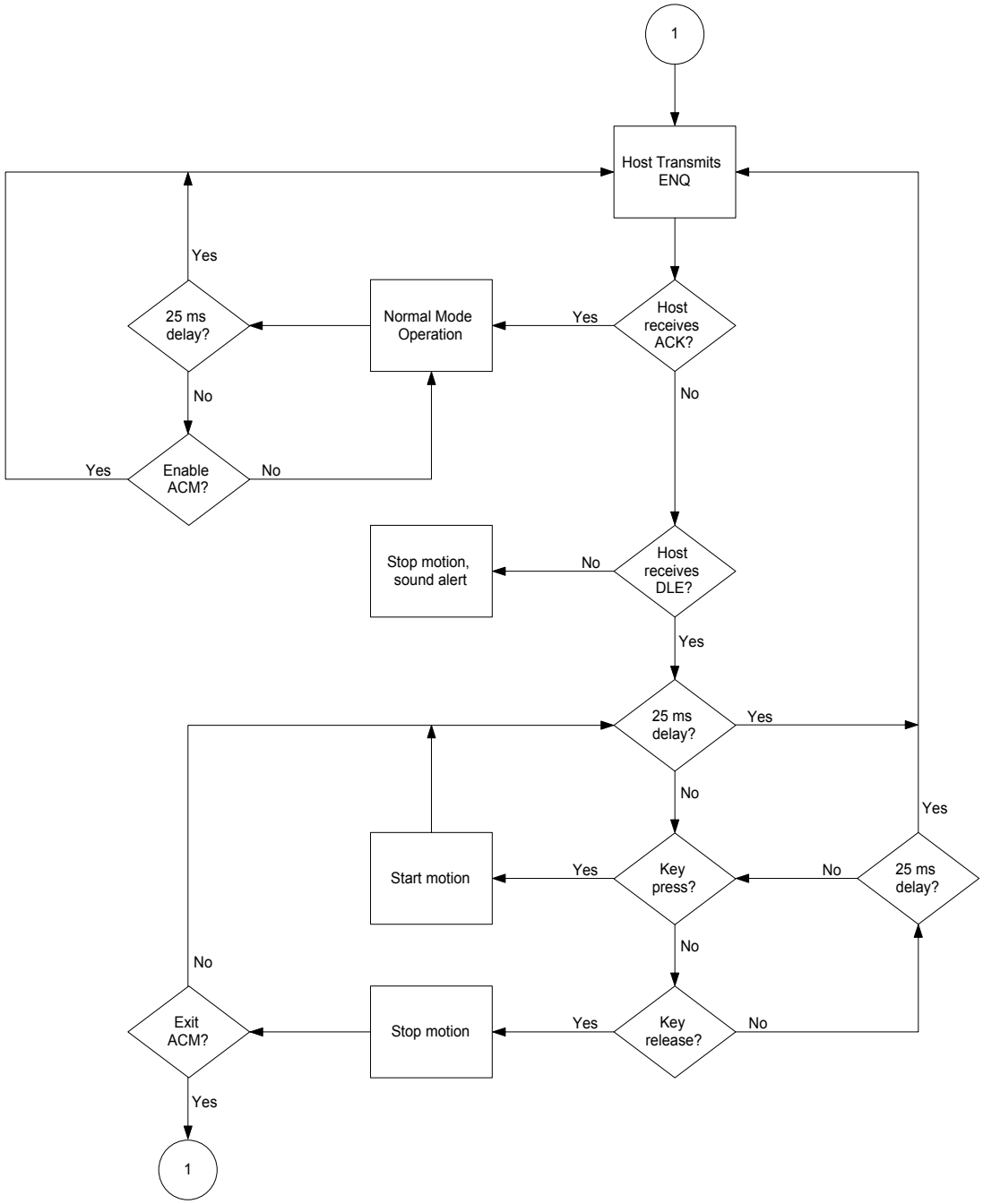


Figure 5-5: Using ACM in a Robotic Environment Flowchart



ANSI Mode Host Command Summary

The following table is a summary of the available ANSI mode host commands.

Table 5-4: ANSI Mode Host Command Summary

Type	*Command*	*Syntax*
Cursor	Cursor Up	Esc [*Pn* A
	Cursor Down	Esc [*Pn* B
	Cursor Right	Esc [*Pn* C
	Cursor Left	Esc [*Pn* D
	Cursor Position	Esc [*Pr*; *Pc* f or Esc [*Pr*; *Pc* H
	Cursor Home & Clear Display	Esc [1 s
	Save Cursor Position	Esc [s
	Restore Cursor Position	Esc [u
	Enable Cursor	Esc [4t
	Disable Cursor	Esc [5t
	Enable Cursor Blink	Esc [6t Esc [3; 0z
	Disable Cursor Blink	Esc [7t Esc [3; 1z
	Invisible Cursor	Esc [3; 4z
Erasure	Erase Cursor to End of Line	Esc [K
	Erase Start of Line to Cursor	Esc [1K
	Erase Entire Line	Esc [2K
	Erase Cursor to End of Display	Esc [J
	Erase Start of Display to Cursor	Esc [1J
	Erase Entire Display	Esc [2J
Character Attributes	Set Blink Attribute	Esc [2s or [5; m
	Clear Blink Attribute	Esc [3s
	Set Reverse Video Attribute	Esc [7; m
	Clear All Character Attributes	Esc [0; m
Sound	Short Bell	Esc [0q
	Long Bell	Esc [1q
	Alert	Esc [2q
	Key Click	Esc [3q

Type	*Command*	*Syntax*
Display Attributes	Set Screen Size to 32 x 16	Esc [1 ; 0z
	Set Screen Size to 24 x 8	Esc [1 ; 1z
	Adjust LCD Contrast	Esc [v
	Enable Backlight [1]	Esc [8t
	Disable Backlight [1]	Esc [9t
Reset	Reset Terminal	Esc c
Reports	Perform Self-Test & Return Results	Esc [4n
	Return Last Self-Test Results	Esc [5n
	Return Cursor Position	Esc [6n
	Send Device Attributes	Esc [c
	Send Identifier String	Esc [p
Key	Enable Key Repeat	Esc [?8h
	Disable Key Repeat	Esc [?8l
	Enable Key Click	Esc [0t
	Disable Key Click	Esc [1t
	Enable KNP Function	Esc [2t
	Disable KNP Function	Esc [3t
LED Control[2]	LED 1 Off	Esc [6q
	LED 1 On	Esc [7q
	LED 2 Off	Esc [8q
	LED 2 On	Esc [9q
	LED 3 Off	Esc [10q
	LED 3 On	Esc [11q
	LED 4 Off	Esc [12q
	LED 4 On	Esc [13q
	All Off	Esc [16q
Escape Mode	Switch to Private Mode	Esc [?2l
CR/LF Mode	Normal Mode	Esc [20l
	New Line Mode	Esc [20h
Parameter Modification	Set Parameters	Esc [1z P1 ; . . . Esc [0z
	Set and Save Parameters	Esc [2z P1 ; . . . Esc [0z
	Set Defaults	Esc [3z Esc [0z

Type	*Command*	*Syntax*
Program Keys	Report Key Settings	Esc [4z Esc [0z
	Program Keys	Esc [5z *Kn*; *Cn*; . . . Esc [0z
Custom Characters	Program Custom Character	Esc [5z C*n*; *Rn;* . . . Esc [0z
Graphics	Load Binary Data to Graphic Buffer 0	Esc [5z GL0; . . . Esc [0z
	Load Binary Data to Graphic Buffer 1	Esc [5z GL1; . . . Esc [0z
	Display Graphic Buffer 0	Esc [5z GD0 Esc [0z
	Display Graphic Buffer 1	Esc [5z GD1 Esc [0z
	Clear Graphic Buffer 0	Esc [5z GB0 Esc [0z
	Clear Graphic Buffer 1	Esc [5z GB1 Esc [0z
	Set Pixel in Graphic Buffer 0	Esc [5z GS0; *Pr*; *Pc* Esc [0z
	Set Pixel in Graphic Buffer 1	Esc [5z GS1; *Pr*; *Pc* Esc [0z
	Reset Pixel in Graphic Buffer 0	Esc [5z GC0; *Pr*; *Pc* Esc [0z
	Reset Pixel in Graphic Buffer 0	Esc [5z GC1; *Pr*; *Pc* Esc [0z
Advance Control Mode	Enable ACM	Esc [1v
	Disable ACM	Esc [21v
	Disable SHIFT and CTRL	Esc [4v
	Enable SHIFT and Disable CTRL	Esc [5v
	Disable SHIFT and Enable CTRL	Esc [6v
	Enable SHIFT and CTRL	Esc [7v

1. Only if the terminal has an optional backlit display
2. Only if the terminal has optional LEDs

CHAPTER 6

PRIVATE MODE HOST COMMANDS

Introduction

As previously discussed, the ProTerm's design allows a host to control its functions by sending Escape commands. When set to Private mode, the ProTerm will recognize the simple compact command set discussed in this chapter. For example, sending an Esc H (Hex 1B 48) will move the cursor to the home position. A command summary appears at the end of this chapter.

***Note**: Do not use spaces between characters in Escape commands. Any spacing shown for Escape commands in this chapter is for clarity only unless otherwise noted.*

Cursor Commands

Cursor Up

Syntax Esc A

Notes This command moves the cursor up one position. The cursor will not move beyond the start or end of a line, nor will it scroll the display.

Cursor Down

Syntax Esc B

Notes This command moves the cursor down one position. The cursor will not move beyond the start or end of a line, nor will it scroll the display.

Cursor Right

Syntax Esc C

Notes This command moves the cursor one position to the right. The cursor will not move beyond the start or end of a line, nor will it scroll the display.

Cursor Left

Syntax Esc D

Notes This command moves the cursor one position to the right. The cursor will not move beyond the start or end of a line, nor will it scroll the display.

Cursor Home & Clear Display

Syntax Esc E

Enable Cursor

Syntax Esc F

Disable Cursor

Syntax Esc G

Cursor Home

Syntax Esc H

Enable Blinking Cursor

Syntax Esc R

Disable Blinking Cursor

Syntax Esc S

Cursor Position

Syntax Esc Y *Pr Pc*

Notes This command moves the cursor to a specified location where ***Pr*** is the ASCII character equivalent of the row numbers and ***Pc*** is the ASCII character equivalent of the column numbers shown below.

Row	*ASCII*
1	SP
2	!
3	“
4	#
5	$
6	%
7	&
8	‘
9	(
10	)
11	*
12	+
13	,
14	-
15	.
16	/

Column	*ASCII*	*Column*	*ASCII*
1	SP	17	0
2	!	18	1
3	“	19	2
4	#	20	3
5	$	21	4
6	%	22	5
7	&	23	6
8	‘	24	7
9	(	25	8
10	)	26	9
11	*	27	:
12	+	28	;
13	,	29	<
14	-	30	=
15	.	31	>
16	/	32	?

Examples

Esc Y !) Sends the cursor to Row 2, Column 10

Esc Y % 0 Sends the cursor to Row 6, Column 17

Esc Y / ? Sends the cursor to Row 16, Column 32

Erasure Commands

Erase Cursor to End of Line

Syntax Esc K

Notes Includes the character at the cursor location and does not alter the cursor position

Erase Cursor to End of Display

Syntax Esc J

Notes Includes the character at the cursor location and does not alter the cursor position

Erase Entire Line

Syntax Esc M

Notes Includes the character at the cursor location and does not alter the cursor position

Erase Display and Home Cursor

Syntax Esc E

Character Attribute Commands

Set Blink Attribute

Syntax Esc W or Ctrl Z

Notes Characters written subsequent to the setting or clearing of attributes will assume the new attribute characteristics.

Clear Blink Attribute

Syntax Esc X or Ctrl X

Notes Characters written subsequent to the setting or clearing of attributes will assume the new attribute characteristics.

Set Reverse Video Attribute

Syntax Esc w or Ctrl V

Notes Characters written subsequent to the setting or clearing of attributes will assume the new attribute characteristics.

When Reverse Video is set, functions that clear any portion of the screen (e.g., scrolling and erase line) will use a solid fill character.

Clear Reverse Video Attribute

Syntax Esc x or Ctrl W

Notes Characters written subsequent to the setting or clearing of attributes will assume the new attribute characteristics.

Escape Mode Commands

Switch to ANSI Mode

Syntax Esc <

Notes This command causes the terminal to switch from recognizing Private host commands to recognizing ANSI host commands.

Key Attribute Commands

Enable Key Click

Syntax Esc U

Disable Key Click

Syntax Esc V

Enable KNP Function

Syntax Esc N

Disable KNP Function

Syntax Esc O

Sound Commands

Note: *You cannot buffer sound commands. To produce properly spaced chain sounds, the host must delay a short time between issuing sound commands.*

Short Bell

Syntax Esc T

Long Bell

Syntax Esc L

Alert

Syntax Esc Q

Return Commands

Return Terminal Identifier String

Syntax Esc Z

Notes This commands sends the following identifier string to the host:

Esc [0x PT *NN* XM *CCCC* Esc [1x

Where *NN* is the keypad type (20, 30 or 45) and *CCCC* is the four-byte hexadecimal checksum of the terminal's program memory.

Display Attribute Commands

Set Screen Size to 32 x 16

Syntax Esc s

Set Screen Size to 24 x 8

Syntax Esc d

Adjust LCD Contrast

Syntax Esc I

Notes This command increases the contrast one level

Disable Backlight

Syntax Esc f

Notes Applies only to terminals with optional backlit displays

Enable Backlight

Syntax Esc n

Notes Applies only to terminals with optional backlit displays

Private Mode Host Command Summary

The following table is a summary of the available Private mode host commands.

Table 6-1: Private Mode Host Command Summary

Type	*Command*	*Syntax*
Cursor	Cursor Up	Esc A
	Cursor Down	Esc B
	Cursor Right	Esc C
	Cursor Left	Esc D
	Cursor Home & Clear Display	Esc E
	Enable Cursor	Esc F
	Disable Cursor	Esc G
	Cursor Home	Esc H
	Enable Blinking Cursor	Esc R
	Disable Blinking Cursor	Esc S
	Cursor Position	Esc Y Pr Pc
Erasure	Erase Cursor to End of Line	Esc K
	Erase Cursor to End of Display	Esc J
	Erase Entire Line	Esc M
	Erase Display and Home Cursor	Esc E
Character Attributes	Set Blink Attribute	Esc W
	Clear Blink Attribute	Esc X
	Set Reverse Video Attribute	Esc w
	Clear Reverse Video Attribute	Esc x
Escape Mode	Switch to ANSI Mode	Esc <
Key Attributes	Enable Key Click	Esc U
	Disable Key Click	Esc V
	Enable KNP Function	Esc N
	Disable KNP Function	Esc O
Sound	Short Bell	Esc T
	Long Bell	Esc L
	Alert	Esc Q
Return	Return Terminal Identifier String	Esc Z
Display Attributes	Set Screen Size to 32 x 16	Esc s
	Set Screen Size to 24 x 8	Esc d
	Adjust LCD Contrast	Esc I
	Disable Backlight [1]	Esc f
	Enable Backlight [1]	Esc n

1. Only if the terminal has an optional backlit display

CHAPTER 7

CONTROL CODES

In addition to ANSI and Private mode commands, the ProTerm will also respond to the following control codes:

Table 7-1: Control Codes

Code	*Hex*	*Dec.*	*ASCII*	*Function*
Ctrl E	05	5	ENQ	Enquire
Ctrl G	07	7	BEL	Sounds Bell
Ctrl H	08	8	BKSP	Back Space Cursor
Ctrl J	0A	10	LF	Line Feed
Ctrl K	0B	11	VT	Cursor Down
Ctrl M	0D	13	CR	Cursor Left to Column 1
Ctrl V	16	22	SYN	Sets Reverse Video Attribute
Ctrl W	17	23	ETB	Clears Reverse Video Attribute
Ctrl X	18	24	CAN	Clears Blink Attribute
Ctrl Z	1A	26	SUB	Sets Blink Attribute
DEL	7F	127	DEL	Delete Character at Cursor

***Note**: When the host transits a **Ctrl E**, the ProTerm will respond with either an ACK (ANSI or Private mode) or a DLE (ACM mode).*

CHAPTER 8

TROUBLESHOOTING

Cursor does not appear on display

Possible Cause: No power to terminal (host supplied)

Solution: Verify proper voltage to terminal

Possible Cause: No power to terminal (adapter supplied)

Solution: Verify wall plug is functional and wiring of adapter (if wired as kit)

Possible Cause: Reversed polarity, improper wiring or wrong cable type

Solution: Check cable and connector wiring

Possible Cause: Cursor not enabled

Solution: Re-enable the cursor by sending an Esc [4t (ANSI mode) or Esc F (Private mode) or by changing the CURSOR parameter setting

Terminal resets or locks-up

Possible Cause: Low voltage output

Solution: Verify proper voltage to terminal

Possible Cause: Cable resistance too high or wire gauge too small

Solution: Cable should be 26 AWG or larger

Possible Cause: Handshaking between host and terminal

Solution: When using handshaking, verify that the wiring between the host and terminal is correct, that you have the HANDSHAKE parameter enabled and that the handshake line from the host is asserted

When not using handshaking, make sure you have the HANDSHAKE parameter disabled

Terminal not receiving or displaying correct characters

Possible Cause: Parity settings incorrect

Solution: Change PARITY parameter to correct setting

Possible Cause: Data (Stop) bits incorrect

Solution: Change DATA BITS parameter to correct setting

Possible Cause: Incorrect BAUD rate

Solution: Change BAUD parameter to correct setting

Possible Cause: Handshaking between host and terminal

Solution: When using handshaking, verify that the wiring between the host and terminal is correct, that you have the HANDSHAKE parameter enabled and that the handshake line from the host is asserted

When not using handshaking, make sure you have the HANDSHAKE parameter disabled

Possible Cause: Reversed polarity, improper wiring or wrong cable type

Solution: Check cable and connector wiring

Terminal displays PE character

Possible Cause: Incorrect parity setting

Solution: Change the PARITY setting on the terminal to match the host or vice versa

Possible Cause: Handshaking between host and terminal

Solution: When using handshaking, verify that the wiring between the host and terminal is correct, that you have the HANDSHAKE parameter enabled and that the handshake line from the host is asserted

When not using handshaking, make sure you have the HANDSHAKE parameter disabled

Terminal generates continuous sound while pressing key

Possible Cause: Handshaking between host and terminal

Solution: When using handshaking, verify that the wiring between the host and terminal is correct, that you have the HANDSHAKE parameter enabled and that the handshake line from the host is asserted

When not using handshaking, make sure you have the HANDSHAKE parameter disabled

Terminal displays double characters

Possible Cause: Echo turned on

Solution: Disable ECHO parameter

Terminal does not perform self-test

Possible Cause: Self-test parameter disabled

Solution: Change SELF TEST parameter to ENABLE

Cannot access parameter mode or function key programming

Possible Cause: Menu lock-out enabled

Solution: Remove power, simultaneously hold **CTRL**, **SHIFT** and **F3,** and reapply power

Possible Cause: Handshaking between host and terminal

Solution: When using handshaking, verify that the wiring between the host and terminal is correct, that you have the HANDSHAKE parameter enabled and that the handshake line from the host is asserted

When not using handshaking, make sure you have the HANDSHAKE parameter disabled

Terminal losing characters

Possible Cause: Handshaking between host and terminal

Solution: When using handshaking, verify that the wiring between the host and terminal is correct, that you have the HANDSHAKE parameter enabled and that the handshake line from the host is asserted

When not using handshaking, make sure you have the HANDSHAKE parameter disabled

Key does not repeat when pressed

Possible Cause: Repeat parameter disabled

Solution: Change repeat parameter to either SLOW, MEDIUM or FAST

Function keys not sending correct values

Possible Cause: Key accidentally reprogrammed

Solution: Reprogram function key

Possible Cause: EEPROM corrupted by line disturbance

Solution: Restore factory defaults and then reprogram parameters and function keys

Possible Cause: Terminal reset to factory defaults after repair

Solution: Reprogram function keys

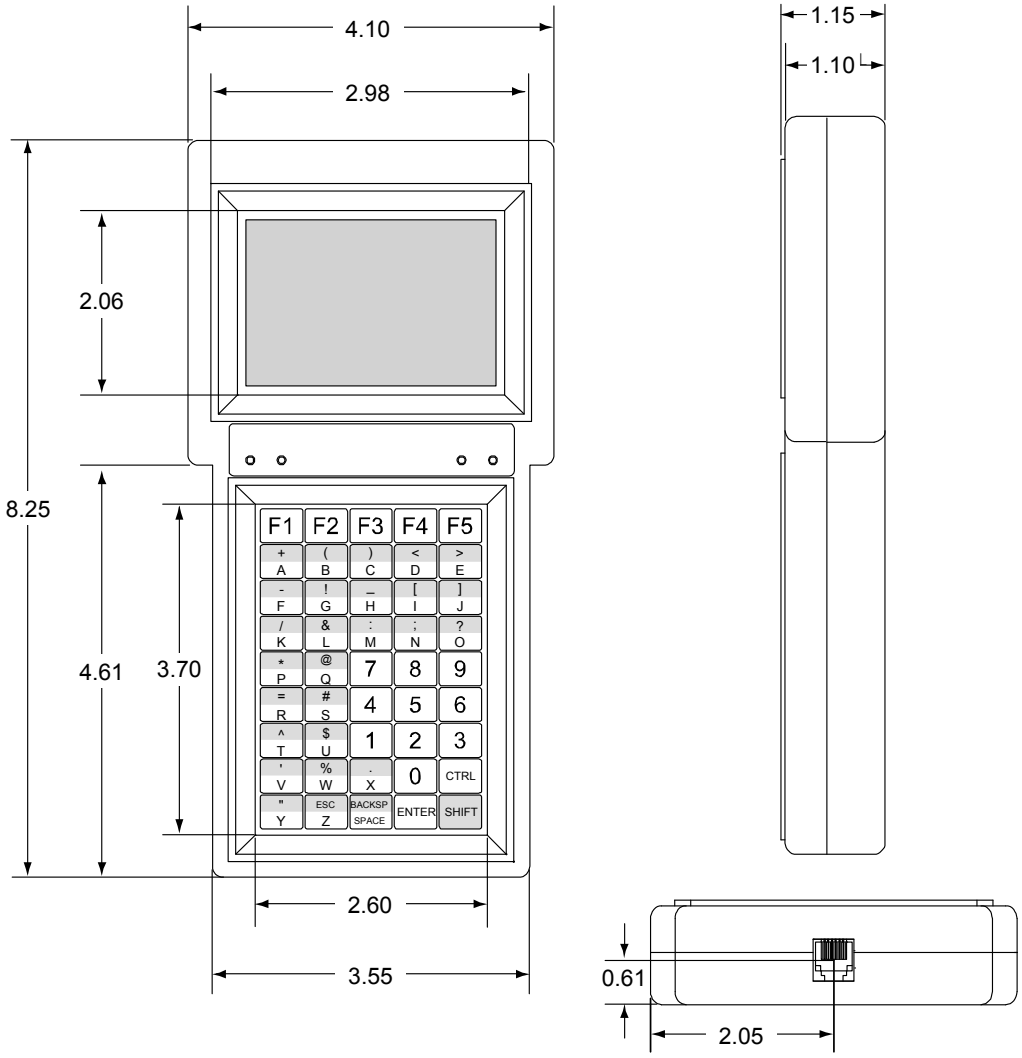
APPENDIX A

Specifications

Display
Supertwist Nematic 192 x 128 Pixel Liquid Crystal Display with Graphics Capabilities
U.S. ASCII Character Set, Dark Characters on Light Background with Blinking and Inverse Video Attributes
8 x 24 or 16 x 32 Display Format (Menu or Host Selectable)
Menu-Controlled Contrast Settings
Backlit or Extended Temperature Backlit Options Available
Keys & Switches
Type: Membrane or Elastomeric
Standard Layouts: 45-key (9 rows x 5 columns), 30-key (6 x 5) and 20-key (5 x 4)
Custom Layouts: 32-key (8 x 4) and 15-key (5 x 3)
Feedback: Tactile and Audible
Programmability: Five Function Keys with Fifteen Definitions
Options: ▪ Emergency Stop: 2 Pole "Press and Twist," Contact Rating: 0.5 A, 28 VDC
Backlit Keypad
Power
Voltage: 5 VDC +/- 5%, 7.5-12 VDC[1] Linear Regulator or 9.5-28 VDC Switching Regulator
Current: 85-90 mA Nominal (RS-232, RS-422) [2] 1. Maximum voltage depends on current draw 2. Some options require additional current (for example, a backlight adds 50 mA)
CPU
Type: Atmel AT89C55WD
Speed: 11.059 MHz
Interface
Type: RS-232, RS-422 or CMOS/LSTTL level
▸ Handshaking: 2 Lines DTR, DTS for RS-232, CMOS/LSTTL
Data Rates: 300 to 19,200 bps and 57,600 bps (9,600 Requires Handshaking)
Parity Range: Even, Odd, Mark, Space, None, Ignore
Control Bits: 1 Start and 1-2 Stop Bits
Interface Connector: 6 Pin Modular

Environmental
Storage Temperature: -20° to + 70°C, -30° to + 70°C (w/Ext. Temp Display)
Operating Temperature: 0° to + 50°C, -20° to +60°C (w/Ext. Temp Display)
Humidity: 5-95% (Non-condensing)
Physical
Height: 8.25.inches (209.6 mm)
Width: 4.10 inches (104.1 mm)
Depth: 1.15 inches (29.2 mm)
Weight: 12 ounces (340 grams)
Case: General Electric Cycolac ABS
Specifications are subject to change without notice

Figure A-1: ProTerm Case Dimensions



APPENDIX B

Character Sets

ASCII Character Set

Table B-1 contains the ProTerm ASCII character set and corresponding Decimal, Hex and Two Technology conversion codes:

Table B-1: ASCII Character Set

Dex	Hex	ASCII	Cn	Display
0	00	NUL	n/a	n/a
1	01	SOH	n/a	n/a
2	02	STX	n/a	n/a
3	03	ETX	n/a	n/a
4	04	EOT	n/a	n/a
5	05	ENQ	n/a	n/a
6	06	ACK	n/a	n/a
7	07	BEL	n/a	n/a
8	08	BS	n/a	n/a
9	09	HT	n/a	n/a
10	0A	LF	n/a	n/a
11	0B	VT	n/a	n/a
12	0C	FF	n/a	n/a
13	0D	CR	n/a	n/a
14	0E	SO	n/a	n/a
15	0F	SI	n/a	n/a
16	10	DLE	n/a	n/a
17	11	DC1	n/a	n/a
18	12	DC2	n/a	n/a
19	13	DC3	n/a	n/a
20	14	DC4	n/a	n/a
21	15	NAK	n/a	n/a
22	16	SYNC	n/a	n/a
23	17	ETB	n/a	n/a
24	18	CAN	n/a	n/a
25	19	EM	n/a	n/a

Dec	Hex	ASCII	Cn	Display
26	1A	SUB	n/a	n/a
27	1B	ESC	n/a	n/a
28	1C	FS	n/a	n/a
29	1D	GS	n/a	n/a
30	1E	RS	n/a	n/a
31	1F	US	n/a	n/a
32	20	space	n/a	space
33	21	!	C21	!
34	22	“	C22	“
35	23	#	C23	#
36	24	$	C24	$
37	25	%	C25	%
38	26	&	C26	&
39	27	'	C27	'
40	28	(	C28	(
41	29	)	C29	)
42	2A	*	C2A	*
43	2B	+	C2B	+
44	2C	'	C2C	'
45	2D	-	C2D	-
46	2E	.	C2E	.
47	2F	/	C2F	/
48	30	0	C30	0
49	31	1	C31	1
50	32	2	C32	2
51	33	3	C33	3

Dex	Hex	ASCII	Cn	Display
52	34	4	C34	4
53	35	5	C35	5
54	36	6	C36	6
55	37	7	C37	7
56	38	8	C38	8
57	39	9	C39	9
58	3A	:	C3A	:
59	3B	;	C3B	;
60	3C	<	C3C	<
61	3D	=	C3D	=
62	3E	>	C3E	>
63	3F	?	C3F	?
64	40	@	C40	@
65	41	A	C41	A
66	42	B	C42	B
67	43	C	C43	C
68	44	D	C44	D
69	45	E	C45	E
70	46	F	C46	F
71	47	G	C47	G
72	48	H	C48	H
73	49	I	C49	I
74	4A	J	C4A	J
75	4B	K	C4B	K
76	4C	L	C4C	L
77	4D	M	C4D	M
78	4E	N	C4E	N
79	4F	O	C4F	O
80	50	P	C50	P
81	51	Q	C51	Q
82	52	R	C52	R
83	53	S	C53	S
84	54	T	C54	T
85	55	U	C55	U
86	56	V	C56	V
87	57	W	C57	W
88	58	X	C58	X
89	59	Y	C59	Y

Dec	Hex	ASCII	Cn	Display
90	5A	Z	C5A	Z
91	5B	[	C5B	[
92	5C	\	C5C	\
93	5D	]	C5D	]
94	5E	^	C5E	^
95	5F	_	C5F	_
96	60	`	C60	`
97	61	a	C61	a
98	62	b	62	b
99	63	c	C63	c
100	64	d	C64	d
101	65	e	C65	e
102	66	f	C66	f
103	67	g	C67	g
104	68	h	C68	h
105	69	i	C69	i
106	6A	j	C6A	j
107	6B	k	C6B	k
108	6C	l	C6C	l
109	6D	m	C6D	m
110	6E	n	C6E	n
111	6F	o	C6F	o
112	70	p	C70	p
113	71	q	C71	q
114	72	r	C72	r
115	73	s	C73	s
116	74	t	C74	t
117	75	u	C75	u
118	76	v	C76	v
119	77	w	C77	w
120	78	x	C78	x
121	79	y	C79	y
122	7A	z	C7A	z
123	7B	{	C7B	{
124	7C	|	C7C	|
125	7D	}	C7D	}
126	7E	~	C7E	
127	7F	DEL	C7F	n/a

***Note**: Cn is the character number used when programming custom characters (see Custom Character Commands).*

ProTerm Extended Character Set

The following table contains the ProTerm extended character set and corresponding Decimal, Hex and Two Technology conversion codes:

Table B-2: ProTerm Extended Character Set

Dex	Hex	Cn	Display
128	80	n/a	n/a
129	81	C81	n/a
130	82	C82	n/a
131	83	C83	n/a
132	84	C84	n/a
133	85	C85	n/a
134	86	C86	n/a
135	87	C87	n/a
136	88	C88	n/a
137	89	C89	n/a
138	8A	C8A	n/a
139	8B	C8B	n/a
140	8C	C8C	n/a
141	8D	C8D	n/a
142	8E	C8E	n/a
143	8F	C8F	n/a
144	90	C90	n/a
145	91	C91	n/a
146	92	C92	n/a
147	93	C93	n/a
148	94	C94	n/a
149	95	C95	n/a
150	96	C96	n/a
151	97	C97	n/a
152	98	C98	n/a
153	99	C99	n/a
154	9A	C9A	n/a
155	9B	C9B	
156	9C	C9C	
157	9D	C9D	
158	9E	C9E	
159	9F	C9F	
160	A0	CA0	
161	A1	CA1	!
162	A2	CA2	“
163	A3	CA3	#

Dex	Hex	Cn	Display
164	A4	CA4	$
165	A5	CA5	%
166	A6	CA6	&
167	A7	CA7	‘
168	A8	CA8	(
169	A9	CA9	)
170	AA	CAA	*
171	AB	CAB	+
172	AC	CAC	‘
173	AD	CAD	-
174	AE	CAE	.
175	AF	CAF	/
176	B0	CB0	0
177	B1	CB1	1
178	B2	CB2	2
179	B3	CB3	3
180	B4	CB4	4
181	B5	CB5	5
182	B6	CB6	6
183	B7	CB7	7
184	B8	CB8	8
185	B9	CB9	9
186	BA	CBA	:
187	BB	CBB	;
188	BC	CBC	<
189	BD	CBD	=
190	BE	CBE	>
191	BF	CBF	?
192	C0	CC0	@
193	C1	CC1	A
194	C2	CC2	B
195	C3	CC3	C
196	C4	CC4	D
197	C5	CC5	E
198	C6	CC6	F
199	C7	CC7	G

Dex	Hex	Cn	Display
200	C8	CC8	H
201	C9	CC9	I
202	CA	CCA	J
203	CB	CCB	K
204	CC	CCC	L
205	CD	CCD	M
206	CE	CCE	N
207	CF	CCF	O
208	D0	CD0	P
209	D1	CD1	Q
210	D2	CD2	R
211	D3	CD3	S
212	D4	CD4	T
213	D5	CD5	U
214	D6	CD6	V
215	D7	CD7	W
216	D8	CD8	X
217	D9	CD9	Y
218	DA	CDA	Z
219	DB	CDB	[
220	DC	CDC	\
221	DD	CDD	]
222	DE	CDE	^
223	DF	CDF	_
224	E0	CE0	‘
225	E1	CE1	a
226	E2	CE2	b
227	E3	CE3	c

Dex	Hex	Cn	Display
228	E4	CE4	d
229	E5	CE5	e
230	E6	CE6	f
231	E7	CE7	g
232	E8	CE8	h
233	E9	CE9	i
234	EA	CEA	j
235	EB	CEB	k
236	EC	CEC	l
237	ED	CED	m
238	EE	CEE	n
239	EF	CEF	o
240	F0	CF0	p
241	F1	CF1	q
242	F2	CF2	r
243	F3	CF3	s
244	F4	CF4	t
245	F5	CF5	u
246	F6	CF6	v
247	F7	CF7	w
248	F8	CF8	x
249	F9	CF9	y
250	FA	CFA	z
251	FB	CFB	{
252	FC	CFC	|
253	FD	CFD	}
254	FE	CFE	→
255	FF	CFF	←

***Note**: Cn is the character number used when programming custom characters (see Custom Character Commands*

APPENDIX C

Keypad Hex Output Values

45-Key Keypad Hex Output

The following table contains the hex output for a standard 45-key keypad, where "CS" is CTRL + SHIFT (Locked) key output, "C" is CTRL key output, "S" is SHIFT key output and "U" is single key output:

Table C-1: 45-Key Keypad Hex Output Values

Key = Hex	Key = Hex	Key = Hex	Key = Hex	Key = Hex
CS1 = 11 C1[1] = 1B 5B 41 S1 = 06 U1 = 11	CS10 = 11 C10[1] = 1B 5B 42 S10 = 07 U10 = 12	CS19 = 11 C19[1] = 1B 5B 43 S19 = 08 U19 = 13	CS28 = 11 C28[1] = 1B 5B 44 S28 = 09 U28 = 14	CS37 = 11 C37 = __ S37 = 0A U3 = 15
CS2 = 61 C2 = 01 S2 = 2B U2 = 41	CS11 = 62 C11 = 02 S11 = 28 U11 = 42	CS20 = 63 C20 = 03 S20 = 29 U20 = 43	CS29 = 64 C29 = 04 S29 = 3C U29 = 44	CS38 = 65 C38 = 05 06 S38 = 3E U38 = 45
CS3 = 66 C3 = 06 S3 = 2D U3 = 46	CS12 = 67 C12 = 07 S12 = 21 U12 = 47	CS1 = 68 C21 = 08 S21 = 5F U21 = 48	CS1 = 69 C30 = 09 S30 = 5B U30 = 49	CS1 = 6A C39 = 0A S39 = 5D U39 = 4A
CS4 = 6B C4 = 0B S4 = 2F U4 = 4B	CS13 = 6C C13 = 0C S13 = 26 U13 = 4C	CS22 = 6D C22 = 0D S22 = 3A U22 = 4D	CS31 = 6E C31 = 0E S31 = 3B U31 = 4E	CS40 = 6F C40 = 0F S40 = 3F U40 = 4F
CS5 = 70 C5 = 10 S5 = 2A U5 = 50	CS14 = 71 C14 = 11 S14 = 40 U14 = 51	CS23 = 37 C23 = __ S23 = 37 U23 = 37	CS32 = 38 C32 = __ S32 = 38 U32 = 38	CS41 = 39 C41 = __ S41 = 39 U41 = 39
CS6 = 72 C6 = 12 S6 = 3D U6 = 52	CS15 = 73 C15 = 13 S15 = 23 U15 = 53	CS24 = 34 C24 = __ S24 = 34 U24 = 34	CS33 = 35 C33 = __ S33 = 35 U33 = 35	CS42 = 36 C42 = __ S42 = 36 U42 = 36
CS7 = 74 C7 = 14 S7 = 5E U7 = 54	CS16 = 75 C16 = 15 S16 = 24 U16 = 55	CS25 = 31 C25 = __ S25 = 31 U25 = 31	CS32 = 32 C34 = __ S34 = 32 U34 = 32	CS43 = 33 C43 = __ S43 = 33 U43 = 33
CS8 = 76 C8 = 16 S8 = 2C U8 = 56	CS17 = 77 C17 = 17 S17 = 25 U17 = 57	CS26 = 78 C26 = 18 S26 = 2E U26 = 58	CS35 = 30 C35 = __ S35 = 30 U35 = 30	CTRL
CS9 = 79 C9 = 19 S9 = 22 U9 = 59	CS18 = 7A C18 = 1A S18 = 1B U18 = 5A	CS27 = 20 C27 = 20 S27 = 08 U27 = 20	CS36 = 0D C36 = 0D S36 = 0D U36 = 0D	SHIFT

1. While in Private mode, C1, C10, 19 and C28 will not return a 5Bh in the string (e.g., C1 = 1B 41).

30-Key Keypad Hex Output

The following table contains the hex output for a standard 30-key keypad, where "CS" is CTRL + SHIFT (Locked) key output, "C" is CTRL key output, "S" is SHIFT key output and "U" is single key output:

Table C-2: 30-Key Keypad Hex Output Values

Key = Hex	Key = Hex	Key = Hex	Key = Hex	Key = Hex
CS1 = 61 C1 = 01 S1 = 11 U1 = 41	CS7 = 62 C7 = 02 S7 = 12 U7 = 42	CS13 = 63 C13 = 03 S13 = 13 U13 = 43	CS19 = 64 C19 = 04 S19 = 14 U19 = 44	CS25 = 65 C25 = __ S25 = 15 U25 = 45
CS2 = 66 C2 = 06 S2 = 2F U2 = 46	CS8 = 67 C8 = 07 S8 = 28 U8 = 47	CS14 = 68 C14 = 08 S14 = 31 U14 = 48	CS20 = 69 C20 = 09 S20 = 32 U20 = 49	CS26 = 6A C26 = 0A S26 = 33 U26 = 4A
CS3 = 6B C3 = 0B S3 = 2A U3 = 4B	C9 = 6C C9 = 0C S9 = 29 U9 = 4C	CS15 = 6D C15 = 0D S15 = 34 U15 = 4D	CS21 = 6E C21 = 0E S21 = 35 U21 = 4E	CS27 = 6F C27 = 0F S27 = 36 U27 = 4F
CS4 = 70 CS4 = 10 S4 = 2D U4 = 50	CS10 = 71 C10 = 11 S10 = 23 U10 = 51	CS16 = 72 C16 = 12 S16 = 37 U16 = 52	CS22 = 73 C22 = 13 S22 = 38 U22 = 53	CS28 = 74 C28 = 14 S28 = 39 U28 = 54
CS5 = 75 CS5 = 15 S5 = 2B U5 = 55	CS11 = 76 C11 = 16 S11 = 2C U11 = 56	CS17 = 77 C17 = 17 S17 = 3D U17 = 57	CS23 = 78 C23 = 18 S23 = 30 U23 = 58	CS29 = 79 C29 = 19 S29 = 2E U29 = 59
CS6 = 7A C6 = 1A S6 = 1B U6 = 5A	CS12 = 20 C12 = __ S12 = 08 U12 = 20	CS18 = 0D C18 = __ S18 = 0D U18 = 0D	CTRL	SHIFT

20-Key Keypad Hex Output

The following table contains the hex output for a standard 20-key keypad, where "CS" is CTRL + SHIFT (Locked) key output, "C" is CTRL key output, "S" is SHIFT key output and "U" is single key output:

Table C-3: 20-Key Keypad Hex Output Values

Key = Hex	Key = Hex	Key = Hex	Key = Hex
1 = 41	6 = 42	11 = 43	16 = 44
2 = 31	7 = 32	12 = 33	17 = 2B
3 = 34	8 = 35	13 = 36	18 = 2D
4 = 37	9 = 38	14 = 39	19 = __
5 = 2E	10 = 30	15 = 20	20 = __

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