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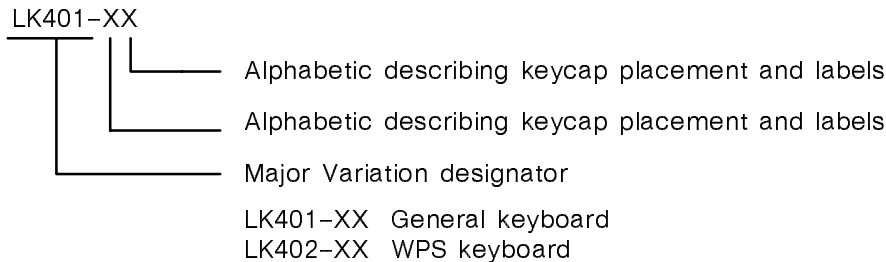
1.0 PRODUCT DESCRIPTION

1.1 General Description

This specification covers the detailed requirements for a detachable 108-key keyboard which will operate with the VT400 family of terminals and subsequent terminals. This keyboard fills the requirements for separate Alt & Compose keys adjacent to the space bar. Two lighted indicators (LED's) are provided to indicate Hold Screen and Shift Lock. The LK400 family of keyboards uses a capacitive switching array for accurate key switch closure sensing and a rubber spring sheet giving tactile feel to the keys. This keyboard is not intended to be a direct replacement for the LK201, but is electrically and firmware functionally compatible. The LK401 will be customer installable.

1.2 Model Designations

All LK400 Family keyboards are designated by a model number which describes the keyswitch groups implemented, keycap placement and labeling. The keyboards described in this document are designated LK401-XX or LK402-XX. The LK401 being the General keyboard and the LK402 being the WPS variations.



1.3 Country Designations

The vendor shall provide two basic keyboard models described as follows:
(See K-DD-LK400-0-0 Drawing Directory for a complete list)

LK401-XX General Model – with universal graphics

LK401-AA US/UK	LK401-PA US/UK
LK401-AB Flemish (Belgium)	LK401-PB Flemish
LK401-AC Canadian (French)	LK401-PC Canadian (French)
LK401-AD Danish	LK401-PD Danish
LK401-AF Finnish	LK401-PF Finnish
LK401-AG Austrian/German	LK401-PG German
LK401-AH Dutch	LK401-PH Holland
LK401-AI Italian	LK401-PI Italian
LK401-AK Swiss French	LK401-PK Swiss-French
LK401-AL Swiss German	LK401-PL Swiss-German
LK401-AM Swedish	LK401-PM Swedish
LK401-AN Norwegian	LK401-PN Norwegian
LK401-AP Belgian/French	LK401-PP Belgian/French
LK401-AS Spanish	LK401-PS Spanish
LK401-AV Portuguese	LK401-PV Portuguese
LK401-AT Hebrew	

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The above models will be provided by the vendor and shipped to Digital in the US and Digital's Field Distribution Center in Europe.

LK402-XX WPS Model – with WPS graphics & Gold key

LK402-AA US/UK
 LK402-AB Flemish (Belgium)
 LK402-AC Canadian (French)
 LK402-AQ Canadian (English)
 LK402-AD Danish
 LK402-AF Finnish
 LK402-AG Austrian/German
 LK402-AH Dutch
 LK402-AI Italian
 LK402-AK Swiss French
 LK402-AL Swiss German
 LK402-AM Swedish
 LK402-AN Norwegian
 LK402-AP Belgian/French
 LK402-AS Spanish

The above models will be provided by the vendor and shipped to Digital in the US and Digital's Field Distribution Center in Europe.

1.4 Dimensions

The overall nominal dimensions for the keyboard are width 18.8 inches, depth 7.5 inches and maximum height including keycaps 1.75 inches.

1.5 Home Row Height

The height from the desktop to the finger contact surface of the home row keys shall be 1.181 + /- .197 inches (30 + /- 5 millimeters) per GS requirements. (Ref. DIN STD ZH1/618)

1.6 Weight

The weight of the keyboard including the interconnecting cable will be less than 4.5 pounds.

1.7 Shape

Unsculptured keys will be mounted in rows on a curved base. The curved base will produce a sculptured keyboard profile without the necessity of sculptured keycaps.

1.8 Color

The keyboard will be Digital Light Gray as described in DEC STD 092-XXXX-068.
All LK401-P variations will be Olivetti inter color #CN02.

1.9 Cable

The keyboard assembly will be connected to the terminal via a coiled cable which will be 6 feet long when uncoiled. The cable will have a 4-pin modular connector at the system end for all keyboard models.

Cable color for LK401-P variations will be Olivetti inter dark #CN03.

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1.10 DIGITAL Product Identity

The LK401 keyboard appearance shall meet DIGITAL's corporate identity requirements as specified by DIGITAL's Industrial Design Group. These requirements will cover the following design aspects:

Shape

Color

Finish/Texture

Material (See section 4.3.1, Product Safety)

* Product Label (Ref. Digital Artwork # 3631441-0-0)

* LED Symbols & Logo (Ref. Digital Artwork # 7438657-0-1)

* Bottom Panel Artwork (Ref. DEC D-SS-7438658-0-1)

* Keycap Artwork font shall be Helvetica Condensed type

* Corrugated carton artwork (Ref. DEC A-PS-9908604-0-0)

* Artwork shall be provided by DIGITAL.

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent referenced herein.

2.1 Compliance to Standards and Regulations

The products covered by this specification shall comply with the following standards and regulations.

2.2 Product Safety

DEC STD 119 – DIGITAL Product Safety

2.3 Electromagnetic Compatibility

DEC STD 103 – Electromagnetic Compatibility (EMC) Hardware Design Requirements
Class B

FCC Rules and Regulations, Part 15 – Radio Frequency Devices, Subpart J

2.4 Communications

EIA Standard RS-423 – Electrical Characteristics of Unbalanced Voltage Digital Interface
Circuits

2.5 Acoustic Noise

DEC STD 102 – Environmental Standard for Computers and Peripherals, Section 4

2.6 Ergonomics

DEC STD 092 – Finish and Color Standard

DEC STD 105 – Keyboards, Section 3

2.7 Environment

DEC STD 102 – Environmental Standard for Computers and Peripherals

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2.8 Language

DEC STD 107 – DIGITAL Standard for Terminal Keyboards. This Digital standard will be revised to include the keyboards described in this document.

2.9 Packaging & Labels

DEC STD 043-0 Packaging Requirements for DIGITAL Products, Parts, Assemblies and Materials

DEC STD 047 – Bar Code Symbology Criteria

DEC STD 102 – Environmental Standard for Computers and Peripherals, Section 2

DEC A-PS-9908604-0-0 – Carton, Corrugated

DEC K-PA-3701175-0-DBU – Packaging Assembly, Keyboard

2.10 Related Documents

DEC STD 060 – Design and Certification of Hardware Products to National and International Regulations and Standards

DEC STD 009 – Product Engineering Specification

2.11 Mechanical Documents

Cover	E-MD-7438657-0-DBU Rev. A
Base	E-MD-7438658-0-DBU Rev. A
Keytop, 1 Unit	E-MD-7438661-0-DBU Rev. A
Keytop, 1 Unit (Home Row)	E-MD-7438662-0-DBU Rev. A
Keytop, 1 1/2 Width	E-MD-7438663-0-DBU Rev. A
Keytop, 1 1/2 Stepped	E-MD-7438664-0-DBU Rev. A
Keytop, Double	E-MD-7438665-0-DBU Rev. A
Keytop, Vertical	E-MD-7438666-0-DBU Rev. A
Keytop, Return	E-MD-7438667-0-DBU Rev. A
Spacebar 7 Unit	E-MD-7438668-0-DBU Rev. A

3.0 PRODUCT REQUIREMENTS

3.1 KEYCAPS

3.1.1 Keycap Actuation (distance in inches, force in grams)

<u>Characteristic</u>	<u>Keys</u>	<u>Spacebar</u>
Total travel	.125" +/- .020"*	.125" +/- .020"*
Travel to peak force	.040" +/- .020"	.040" +/- .020"
Peak force	55g + 25g/-20g	75g + 30g/-20g
Overtravel force	75g max.**	105g max.
Actuation point	.070" +/- .025"***	.070" +/- .025"***
Release point	.040" min.	.040" min.

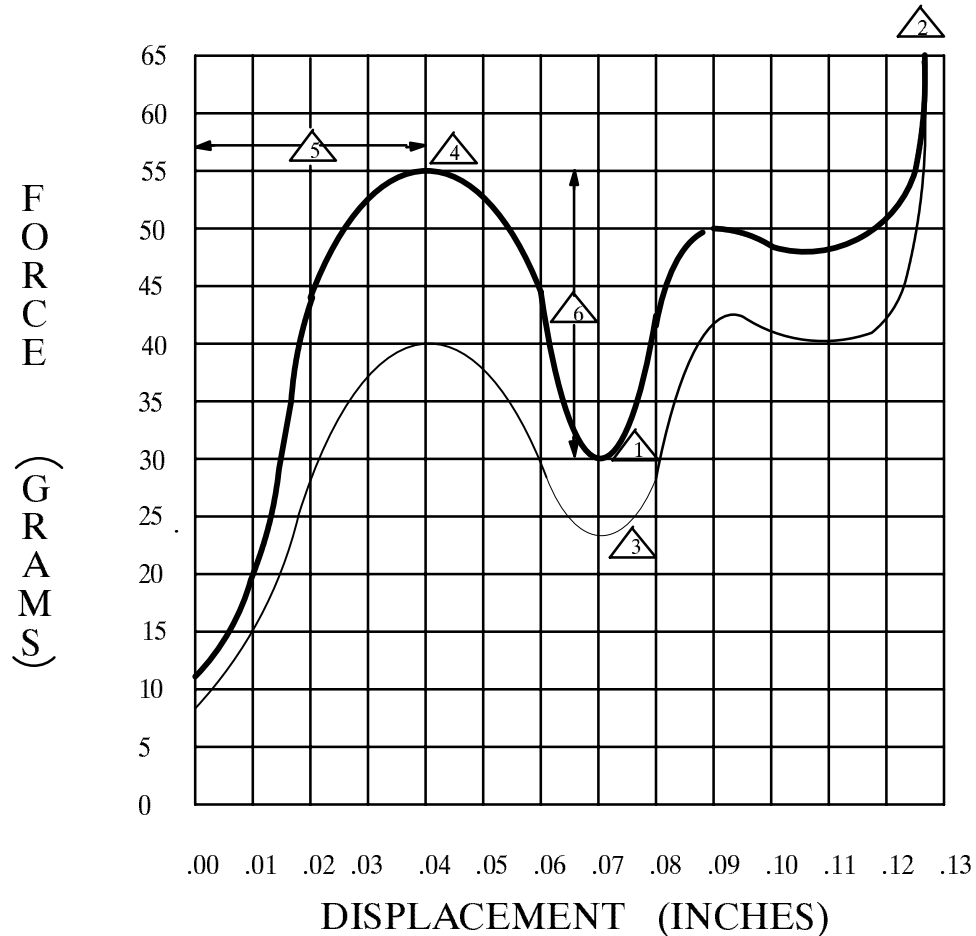
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* Overtravel .015 inches min.

** Key to key variation 35g max. on any keyboard

*** Operate point to occur .025 inches max. after completion of tactile drop

NOTE: Characteristics to be measured with an actuator speed of .2 to .5 inches per minute.



△1 Electrical Operating Point

△2 Full Over Travel

△3 Electrical Release Point

△4 Peak Force

△5 Travel to Peak Force

△6 Tactile Drop Off = 35% of Peak Force
(Typical - Not Toleranced)

Downstroke

Upstroke

Figure 3.1 Force Displacement Curve

3.1.2 Wobble

The top of the keypad will not have lateral motion in excess of + or - 0.020 inches in the horizontal and vertical directions.

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3.1.3 Keytop Size

The single width keytops shall be nominally 0.50 inches square.

3.1.4 Keytop Shape

The keys will have a concave surface shape. The F and J keytops and the numeral 5 keytop on the numeric keypad will have a different surface whose shape is tailored for home row finger registration. This shall not be a raised "bump" or "ridge" which may cause finger irritation.

3.1.5 Key Spacing

The single width keys shall be spaced 0.75 inches nominally from center to center.

3.1.6 Finish

The keycaps shall have a uniform finish on the tops and the sides.

3.1.6.1 Texture

The keytop shall have a textured surface for non-skidding action but also not require frequent cleaning.

3.1.6.2 Reflectance

The keycaps shall reflect less than 45% of the incident light.

3.1.6.3 Color

The function keys located as the top row of keys, the cursor keys and the six keys located directly above the cursors will be Digital Nantucket Gray color per DEC STD 092-XXXX-240, except for LK401-P variations, which will be Olivetti inter dark #CN03. The remainder of the keys, which include the typewriter mass and the numeric keypad, will be the Digital Light Grey color per DEC STD 092-XXXX-068, except for LK401-P variations, which will be Olivetti inter dark #CN03.

3.1.7 Legends

The marking of the keys and keyboard must be of a permanent nature. The marking must be clearly legible during the life of the keyboard. Keycap artwork will be supplied by Digital.

3.1.7.1 Key Top Characters

There will be a maximum of four characters or two lines of type per key on the key top. Minimum character height shall be 0.1 inches. Where two are required, they will be placed at the upper left and lower left of the keycap. The unshifted legend will appear at the lower left and the shifted legend at the upper left of the keycap. Only the upper case letter will appear at the upper left of the alpha keys.

3.1.7.2 Front Surface Printing

There will be provision for front surface lettering with a maximum of two lines or .240 inches provided for all keycaps.

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3.1.7.3 Foreign Language Characters

Translations of keycap characters into the appropriate National Language will be made. Keycap legends for these keyboards will be supplied by Digital.

3.2 KEYSWITCH LAYOUT

The keyswitch layout for the LK401 model keyboard will appear as shown in Figure 3.2. The keyswitch designators conform to ISO 4169, Office Machines–Keyboards–Key Numbering System and Layout Charts.

3.2.1 Alpha Keys

The alpha keys will be located on the lower left portion of the keyboard in the conventional typewriter configuration 48 graphic key layout as per DEC STD 107.

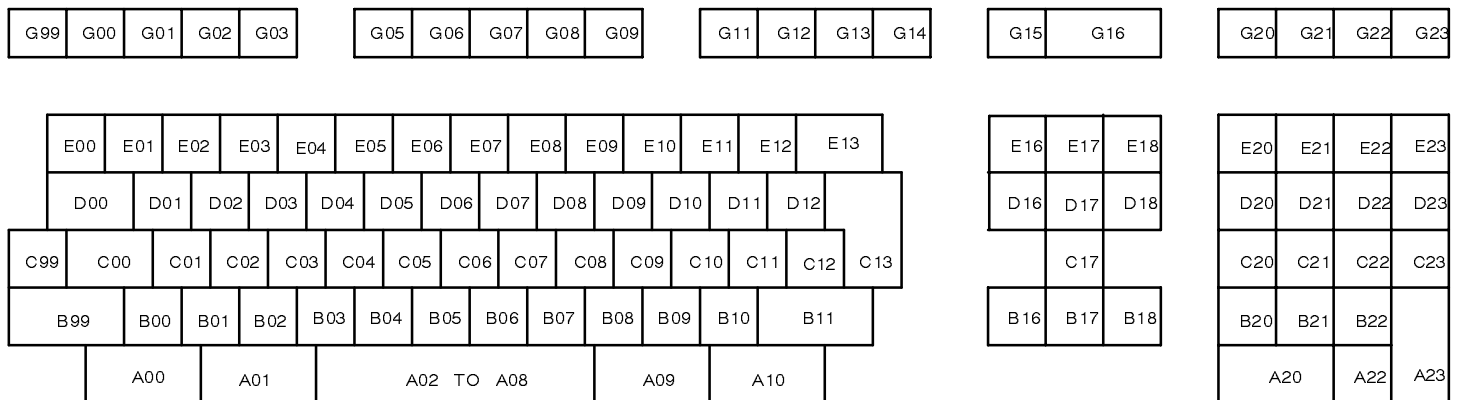


Figure 3.2 Keyswitch Layout

3.2.2 Auxiliary Keypad

The layout of the auxiliary keypad is illustrated in Figure 3.3. The arrangement shown in Figure 3.3 is used to document the codes transmitted by the keyboard to the terminal.

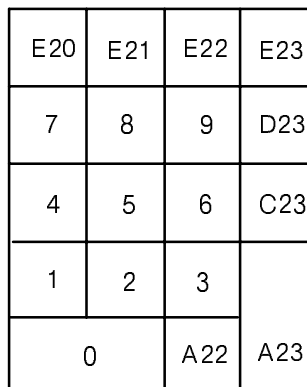


Figure 3.3 Auxiliary Keypad Layout

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3.2.3 Function Keys

These keys are positioned so that their function can be easily distinguished by their location.

3.2.4 Cursor and Basic Editor Keys

Space will be provided between the typewriter keypad and the auxiliary keypad for the cursor arrow keys and six other special function keys located above the cursors. The layout of this group of keys is shown in Figure 3.4.

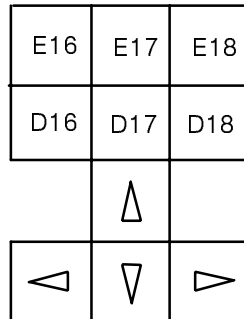


Figure 3.4 Cursor Control Key Layout

3.3 KEYBOARD OPERATION

The operator uses the keyboard to transmit encoded keying events to a buffer in the terminal. A keying event is transmitted when:

1. any key is newly pressed
2. any of a certain set of keys is released
3. certain keys are held down and are generating auto repeat keying events

3.3.1 Shift Lock/Caps Lock Operation

The LOCK key will normally be a down-only function key which will signal its activation as would any other key and will have no mechanical latching action. The usage of that event to implement Caps Lock or Shift Lock is determined by the terminal to which the keyboard is attached.

3.3.2 Keyboard Firmware

A more detailed discussion of the keyboard firmware will be found in the LK400 Keyboard Firmware Requirements. What is presented here is a short description of some of the basic functional capabilities of the keyboard firmware. Any discrepancy between the descriptions here and the Firmware Requirements will be decided by the description in the Firmware Requirements.

The firmware in the keyboard executes three concurrent tasks. The first task consists of detecting any changes in the state of the keyboard matrix, referred to as the process of scanning the keyboard. The second task consists of transmitting the results of the keyboard scan to the terminal. The third task consists of receiving information from the terminal. This information may be relative to either controlling peripheral hardware on the keyboard or may be relevant to transmission parameters.

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3.3.2.1 Timing Requirements

The firmware is designed to detect a keystroke lasting for as little as 20 milliseconds as well as provide noise and contact bounce filtering.

The keyswitch matrix will be scanned at a 120 hertz rate. The latency of event detection, i.e., the time of delay between actual keyswitch closure and detection, will be between 1/120 and 1/60 second. (An additional 1/500 second is required for transmission of the event from the keyboard to the terminal.) The minimum time a key must be kept down in order to be detected is approximately 9 ms.

The scan interval assures that keyswitch bounce will not cause multiple events.

The recommended time delay for the terminal to display the character after receipt of the event is less than 100 milliseconds. The time for the initiation of the keyclick in the keyboard is less than 1 millisecond after the keyboard detects the event.

3.3.2.2 Key Event Mode Selection

There are four modes in which key events can be transmitted. These mode are:

1. Key down only
2. Key down with auto repeat
3. Key down and key up
4. Key down with auto repeat and key up

The keys are divided into functional groups which can be software controlled by terminal to operate in any of the above four modes.

These fourteen functional groups are:

1. 48 graphic keys and Spacebar on the typewriter mass
2. Numeric keypad
3. Delete Character (E12)
4. Return (C13) and Tab (D00)
5. Shift (B99 and B11), CTRL (C99), A01, and A09
6. Lock (C00), A00 and A10
7. Horizontal cursors (B16 and B18)
8. Vertical cursors (B17 and C17)
9. Six keys directly above the cursor keys (D16–D18 and E16–E18)
10. G99–G04 Function keys
11. G05–G09 Function keys
12. G10–G14 Function keys
13. G15–G16 Function keys
14. G20–G23 Function keys

The keyswitch designators are located on Figure 3.2, LK401 Keyswitch Layout.

3.3.2.2.1 Auto Repeat Encoding

There are four sets of programmable auto repeat parameters. Each of the above fourteen functional groups which are operating in either auto repeat mode maybe associated with any of the four sets.

A unique code will be used as the repeat code. This repeat code will be sent at a constant rate which is settable as described below. Every transmission of this code will imply that the previous auto repeating character should be displayed once more.

Only one character at a time will be auto repeated.

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3.3.2.2.2 Key Down/Key Up Encoding

When the key down/key up mode is requested, the transmission of the key matrix position in the range of 64 to 255 will indicate a key down. There will be single "all keys up" code which will indicate all down/up keys are up. If, when a down/up key is released and any down/up key up-mode key is still down, the appropriate key matrix position will be transmitted. Otherwise, the "all keys up" code will be transmitted. This also applies to down/autorepeat/upkeys.

3.3.2.3 N-Key Rollover

The keyboard will transmit all keying events provided the output buffer does not overflow.

3.3.2.4 Simultaneous Keying Events

It is possible that more than one keying event may be detected in one scan period. When this happens, the events will be transmitted to the terminal in the order in which they were detected. A buffer will be provided to store 4-32 simultaneous keying events. Events which cannot be transmitted due to buffer limitations will be transmitted on the next scan period.

3.3.3 Transmission

3.3.3.1 Transmit Encoding

The frame structure will be ten signal elements having equal time intervals:

One "0" (spacing) start element.

Eight data elements, and,

One "1" (marking) stop element.

The encoding of the keystroke indicates the physical position of the key. This information is sent as a single 8 bit byte. This number will range from 64 to 255 decimal.

3.3.3.2 Transmission Rate

The transmission rate within each frame is 4800 Baud.

3.3.4 Receiving

The terminal controls keyboard characteristics by using the receive capability of the keyboard electronics.

The protocol for the transmission of codes from the terminal to the keyboard can be found in the LK400 Keyboard Firmware Requirements.

The terminal can initiate the keyclick and does initiate the bell tone.

3.3.4.1 Flow Control

The terminal is able to inhibit and resume the transmission from the keyboard.

3.3.4.2 Auto Repeat

The auto repeat timeout interval and rate for any of the keyswitch groups listed above can be set by the terminal as described in the LK400 Firmware Requirements.

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3.3.4.2.1 Timeout Interval

Timeout represents the amount of time the keyboard will wait before auto repeating a character. The timeout interval will be the transmitted number times 5 milliseconds. This would be the second byte transmitted.

3.3.4.2.2 Repeat Interval

This is the effective rate at which characters will be transmitted. The repeat rate will be the transmitted number.

3.3.4.3 Volume Control of Keyclick and Bell

The terminal can set the keyclick levels by transmitting a command byte followed by a volume level parameter or it can allow them to be set to the default values.

The Bell level is set by transmitting the appropriate command byte followed by the same parameters as for the keyclick.

The keyclick and Bell volumes when set to their maximum values will be a minimum of 60 dbA when measured one foot above the keyboard.

Eight levels of volume plus off will be provided for both the keyclick and the bell. The user should be able to set these to their preference via a setup feature on the terminal.

3.3.4.4 Control of LEDs

The terminal can turn the LEDs on and off by command from the terminal.

3.3.4.5 Keyboard Identification

The keyboard will transmit a two-byte code for identification of the keyboard model. Both bytes are in ROM and indicate the revision status of the firmware. This keyboard identification will be sent upon request from the terminal.

The user must identify the keyboard to the terminal, i.e., what natural language, German, French, etc., either in the Set-up mode or through escape sequences when he switches keycaps or keyboards. The hardware ID is hard coded at 00H.

3.3.4.6 Self Test

Upon command from the terminal or on keyboard power up, the keyboard will automatically check its internal logic and transmit a two byte identification code plus a two byte code describing the health of the electronics and firmware. The four bytes transmitted at power up are:

1. Firmware ID
2. Firmware ID – second byte
3. Error code or 0 – Error code can indicate RAM or ROM check sum error or key down condition
4. Keycode or 0 – Indicates specific key down if any.

3.4 KEYBOARD ELECTRONICS

3.4.1 Implementation

A microprocessor will be used to detect key closures and to transmit the associated keying events to the terminal. The key switches will be arranged electrically in a matrix. The matrix

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scanning frequency and baud rate clock will be derived from the chip's internal timer/counters.

3.4.2 Key Click and Bell

The click on/off and volume will be selectable.

The sounder will also be used to produce the Bell tone. Its volume will also be selectable.

3.4.3 Power Consumption

2.0 Watts Maximum. Input: 11.8 V +/- 6% @ 150 ma. measured at the PC board or equivalent. The current draw at idle will be approximately 10 ma.

3.4.4 Indicators (LEDs)

There are two LED indicators implemented on the keyboard. These will be grouped near the upper portion of the keyboard where they will be easily visible to the operator. These indicators will be identified by Icons molded directly into the plastic housing and shall not require a diffusion window to be created for their viewing. The two indicators will have the meaning of:

1. Hold Screen – Indicates that updating of the monitor screen has been suspended. (Hold Screen Key is G99)
2. LOCK – Indicates that the keyboard is in either a CAPS LOCK or SHIFT LOCK condition.

3.5 SERIAL INTERFACE REQUIREMENTS

The serial interface shall contain the functionality presented in this section. The intent is for compatibility with Digital's keyboard input ports.

3.5.1 Cable

The cable shall be a four wire conductor made of #26 gage wire. The shape shall be oval and coiled over most of the length. The usable length shall be six feet long. The uncoiled length on the system end shall be 5 inches. The uncoiled length on the keyboard end shall be 22 inches. Details of this cable shall meet the general requirements of the Digital part specified in A-PS-1700294-0-0.

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3.5.2 Connector

The connector shall be a 4 pin male modular telephone type. Details of the connector are per A-PS-1218831-0-0.

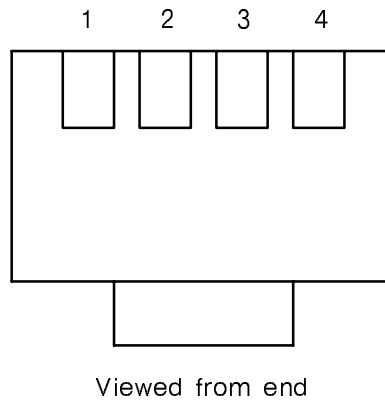


Figure 3.5 Connector

3.5.3 Interface Signals

WIRE	FUNCTION	SIGNAL LEVEL
1	Received Data Signal	EIA RS-423 like
2	Power Return/Signal Reference	0 V DC
3	Power Input	+12 V DC
4	Transmitted Data Signal	EIA RS-423 like

The waveform of the transmitted data signal will have a trapazoidal shape where the slopes of the trapazoid will be adjusted so that the limits of the FCC Rules and Regulations, Part 15 will be met.

3.5.3.1 Received Data Signal

The keyboard shall receive signals on this circuit which represent serially encoded commands and data being sent to the keyboard.

3.5.3.2 Power Return/Signal Reference

This is the keyboard ground reference line. It is used for both power return and signal reference.

3.5.3.3 Power Input

This line supplies power to the keyboard.

3.5.3.4 Transmitted Data Signal

The keyboard shall send signals on this circuit which represent serially encoded keystroke data and responses to commands being sent from the keyboard.

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3.5.4 Baud Rate

The keyboard shall have a baud rate of 4800 baud only.

3.5.5 Signal Format

The signal format shall be bit serial, character asynchronous, consisting of a start bit (space), 8 data bits (1 = mark, 0 = space), and a stop bit (mark). The data bits shall represent a command, data, or a response to a command. The least significant bit is leading.

4.0 PRODUCT QUALIFICATION

4.1 ENVIRONMENTAL REQUIREMENTS

4.1.1 Operating Conditions

Per DEC STD 102 Class B, Section 3.1, 10–90% relative humidity, noncondensing, at 10 to 40 Degrees Centigrade range.

4.1.2 Storage Conditions

Per DEC STD 102, Section 3.2, –40 to 66 Degrees Centigrade range at 10–90% relative humidity.

4.1.3 Immunity to Contamination

During normal operation, the keyboard shall not become functionally disabled due to dirt, or dust.

4.1.4 Impact Resistance

Per DEC STD 102, Section 5.0, 40G shock for 30 milliseconds.

4.1.5 Vibration Resistance

Per DEC STD 102, Section 6.0 – 6.2.

4.2 RELIABILITY AND MAINTAINABILITY

4.2.1 Mean Time Between Failures (MTBF)

The keyboard electronics shall have a MTBF greater than 450,000 power-on hours.
Expected usage: 60% Power-on Duty Cycle (438 hrs/month) 5% input Duty Cycle (22 hrs/month)

No preventive maintenance, either by user or service person, shall be necessary to achieve the specified MTBF.

4.2.2 Mean Time to Repair (MTTR)

This keyboard is a whole option swap. The mean time to repair is the time to install another keyboard. (.1 hrs.)

4.2.3 Keyswitch Life

The standard keys and space bar must operate smoothly for 20 million operations with 90% of the keyboards surviving without evidence of keyswitches sticking or binding. The special

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keys, double and 1 1/2 width, which are considered low usage keys, must be operate smoothly for a minimum of 5 million cycles with 90% of the keyboards surviving without evidence of these keyswitches sticking or binding. Loss of tactile feel is considered a failure.

4.2.4 Keyswitch Bounce

Keyswitch contact bounce shall not effect the output of the keyboard.

4.2.5 Keyswitch Actuation Frequency

All keys must operate properly for actuation frequencies up to 10 cycles per second.

4.2.6 Error Rate

Occurrences of incorrect coded outputs, missed outputs, or double entries shall not exceed the ratio of one per 100,000 events. For typing at 65 words/min. for 3 hours/day and assuming 6 characters/word, this results in less than one error per day.

4.2.7 Spare Parts

The reliability of replacement keyboards shall be the same as new keyboards. There are no spare parts since this keyboard is a whole option swap.

4.2.8 Tools and Test Equipment

No special tools or test equipment shall be needed to install this keyboard. This keyboard is customer installable.

4.3 STANDARDS, REGULATIONS, AND APPROVALS

The product covered by this specification shall comply with the following standards and regulations. All tests shall be conducted by the vendor and be subject to DIGITAL approval and verification.

4.3.1 Product Safety

The keyboard plastics must meet the flammability requirements as specified by UL94 HB. The PCB module, rawboard, must meet or exceed UL94 V1. The PCB module, stuffed, must meet or exceed UL94 V2.

The keyboard shall meet all SELV requirements and all other applicable requirements of the following documents:

DEC STD 119 – DIGITAL Product Safety (Covers UL 478, UL 114, CSA 22.2 No. 220, VDE 0804, IEC 435, GS-Mark)

UL Standard 478 – Electrical Data Processing Units and Systems

CSA Standard C22.2 – Canadian Electrical Code, Part II, Safety Standard for Electrical Equipment.

*IEC 380 – Safety of Electrically Energized Office Equipment

*IEC 435 – Safety of Data Processing Equipment

* Recently replaced by EN60950

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4.3.2 Electromagnetic Compatibility

DEC STD 103 – Electromagnetic Compatibility (EMC) Hardware Design Requirements
FCC Rules and Regulations, Part 15 – Radio Frequency Devices, Subpart J(B–level).

VDE 0871 – Limits of Radio Interference from Radio Frequency Apparatus and Installations, Class B.

VDE 0875 – Regulations for the Radio Frequency Suppression of Appliances, Machines, and Installations for Radio Frequencies from 0 to 10 KHz, Class B

Radio Protection Mark is not a requirement.

Note: This product must meet DEC STD 103 which imposes a stricter limit on interference than FCC Part 15J.

4.3.3 Environment

DEC STD 102 – Environmental Standard for Computers and Peripherals (Class B, with operating temperature range of 10 to 40 degrees C and 10 to 90 percent relative humidity)

4.3.4 Approvals

The product covered by this specification shall be designed such that it shall obtain the following listings, certifications, and approvals:

1. (Safety) Listing against UL 1950, CSA 22.2 No. 220, IEC 950, and GS–Mark.
2. (EMI/RFI) Internal certification of compliance to FCC B level and compliance to VDE 0871 and VDE 0875.

5.0 ORDER FILFULLMENT

5.1 PACKING AND SHIPPING

5.1.1 General Requirements

5.1.1.1 Shipping Containers

The shipping container must provide adequate strength for handling, storage, and shipping throughout the distribution system. Additionally it must meet all local and national regulations for the countries where it will be used. It must meet the U.S.A. Uniform Freight Classification Rule 41 and the National Motor Freight Classification Item 222.

5.1.1.2 Dunnage

Packages should be sized to minimize the use of dunnage. Where dunnage is necessary, materials shall be clean with minimal dusting. The use of loose fill in the form of expanded plastics is unacceptable.

5.1.2 Cartons

5.1.2.1 Construction

Cartons used for shipping of items to Digital shall be constructed of corrugated fiberboard (unless otherwise specified), with adequate strength to comply with applicable regulations. Glued, taped or stitched manufacturers joints are required. All shipping containers shall withstand minimum static compression load. Minimum static compression can be determined through the following formula:

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$$L = W \times [(H-h)/h] \times FS$$

L = static load packaged product must withstand.

W = shipping weight of packaged product.

H = 6096 for metric measurement, 240 for U.S. measurement.

h = height of packaged product measured in mm or inches.

FS = 4 design factor of safety.

5.1.2.2 Size

The shipping container size shall result in the optimum cube for shipping, storage and handling while complying with all other requirements of this document.

5.1.2.3 Weight

Shall be 40 pounds maximum for individual cartons, except when a single item weighs more than 40 pounds, it shall be individually packaged.

5.1.2.4 Contents

All items in a carton shall have the same Digital part number.

Each carton shall contain as many items as is safe (ex. weight); multiples of 10 are preferred.

5.1.3 Pallets

5.1.3.1 Construction

Shall be per the National Wood Pallet and Container Association specification, or Digital approved International standard equivalent. Reused pallets shall be in good repair. Each pallet shall be constructed to permit four-way entry by a fork truck and two-way entry by a pallet truck. Wing pallets are acceptable, with approval of the responsible Digital engineer. The top deck board spacing shall be 3.5 inches maximum, the bottom deck shall contain at least three boards (1 x 6 inches minimum).

5.1.3.2 Size

Shall be one of the following, unless otherwise specified:

A. 40" x 48"

B. 42" x 48"

Pallet strength must safely handle a minimum load of 2000 pounds.

5.1.3.3 Method of Unitizing

A. Load Overhang: Pallet load shall not overhang the pallet.

B. Load Underhang: The underhang of a load shall be less than 1" per side in order to achieve maximum cube utilization and load stability during shipping, handling, and storage.

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5.1.3.4 Load Shifting

Load shifting during shipping and handling is unacceptable. The load shall be unitized and firmly secured to the pallet by one or more of the following methods :

- A. Strapping with corner protectors
- B. Stretch or shrink wrap
- C. Stretch netting
- D. Consolidation carton

If straps are used, they shall be parallel to the pallet runners to minimize damage by pallet trucks. Strapping will be secured using crimp seals or tension weld. Load height will be set so that the 90 inch trailer height will be effectively utilized, unless otherwise specified.

5.1.4 Product Protection

Items shall be properly packaged to prevent damage during handling, transit, and storage. Packaging shall be free from all handling hazards such as, protruding staples, and insecure strapping. The packaged item which could be shipped as an unpalletized single unit to an end user, even if it moves in pallet load quantities during a portion of its physical distribution, shall protect the item as specified in Table 1.

5.1.5 Non-operating Shock and Vibration testing per DEC STD 102, section 2.

The following testing will be required as described below:

5.1.5.1 Vibration (Random Vibration)

Random Vibration tests controlled with digital Random Vibration Controllers:

- Tests applied to packaged or skidded product.
- Test duration will be one hour per axis.
- Packaged products weighing 100 lbs. (45 Kg.) or less shall be subjected to the vertical axis excitation in all three axis.

Vertical Axis Excitation:

- 1.19 G's rms (root mean squared) overall from 5–300 Hz.
- Power Spectral Density 0.003 g²/Hz at 5 Hz, increasing at 8db/octave to 0.020 g²/Hz from 10–50 Hz with 8db/octave rolloff from 50–300 Hz.

Longitudinal and Lateral Axes Excitation:

- 0.6998 G's rms (root mean squared) overall from 5–200 Hz.
- Power Spectral Density 0.0011 g²/Hz at 5 Hz, increasing at 8db/octave to 0.007 g²/Hz at 10 Hz. Flat 0.007 g²/Hz from 10–50 Hz with 8db/octave rolloff from 50–200 Hz.

5.1.5.2 Vibration (Repetitive Shock)

- Repetitive Shock (Bounce) tests applied according to NSTA (National Safe Transit Assoc.) with test equipment which complies with ASTM (American Society for Testing of Materials) D-999. Tests applied to packaged or skidded product for durations of exposure determined by total weight.
- Items weighing 100lbs. (45 Kg.) or less receive 14200 total impacts on two faces.

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5.1.5.3 Shock Test (Drop Tests)

- Free Fall Drop Tests are applied to packaged products according to NSTA with test equipment which complies with ASTM D-775. Drop heights determined by total weight and 10 total impacts applied to surfaces in the specified NSTA sequence.
(Impacts shall consist of a corner drop to the bottom corner of the manufacturers joint, an edge drop to each of the edges radiating from that corner, and one flat drop to each of the six faces of the carton.)
- Drop Heights range from 12 in. (31 cm) to 30 in. (77 cm) depending on the weight of the packaged product (see Table 1). Items weighing greater than 100lbs. (45 Kg.) are tested using the NSTA Inclined Impact method.

TABLE 1
IMPACT TEST

GROSS WEIGHT (POUNDS)	DROP HEIGHT (INCHES)
0 – 20.9	30
21 – 40.9	24
41 – 60.9	18
61 – 100	12

5.1.5.4 Test Reports

The supplier shall provide copies of its test reports to Digital. If the supplier has documented proof showing a history of successful shipments of a product and is willing to share that information with Digital, the requirements for laboratory testing may be minimized.

5.1.6 Product Package Description

Product package shall be of a structure and design provided by the Vendor, and qualified and approved by Digital.

5.1.6.1 Marking

All markings shall be legible and large enough to be easily read, and shall not be obscured.
NO vendor markings or reference to vendors product and/or trade name shall appear anywhere.

5.1.6.2 Product Package

A product package is a package which contains only one DEC Option No. Each individual package shall be labelled on two adjacent sides with human readable and barcode format labels. Refer to Bar Code Labeling section 5.3.

5.1.6.3 P.O. Numbers on Master Cartons

- A. Purchase order numbers shall appear on master cartons when different P.O.'s are being fulfilled in the same shipment.
- B. Handwriting of P.O. numbers is allowed.
- C. P.O. numbers shall not be included on the Master carton barcode labels.

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5.1.7 Pallet Loads

5.1.7.1 Pallet Labeling

Whenever possible all cartons that are combined within a pallet load shall contain identical product Option Numbers. Each pallet load shall be labeled on two adjacent sides with the following information:

- A. Digital Option Number
- B. Quantity
- C. P.O. Number
- D. Number of cartons to pallet load
- E. Vendor Address

Whenever possible all cartons combined within a pallet load shall contain identical Date codes. In the event that unlike date codes are combined on a pallet load, the pallet load shall be chronologically unitized, and marked "UNLIKE DATE CODES"

All pallet load markings shall be done on a peel-off type label.

5.1.7.2 Unpallettized Loads

In the event a product package(s) or consolidated carton(s) is shipped loose-piece (unpallettized), the destination name and address shall not be permanently labeled or marked on either the package or the carton. Only a peel-off type label shall be used.

5.1.7.3 Packing Slips

All packing slips shall be placed within a packing envelope and should be easily accessible and identifiable on each shipment. There should be only one packing slip per P.O. Number. Each packing slip shall contain the following information:

- A. P. O. Number
- B. Item Number
- C. DEC Purchasing Part Number
- D. Quantity (matching the DEC part number)
- E. DEC Option Number
- F. Quantity (matching the DEC option number)

5.1.8 Package Graphics

Vendor logos shall not be preprinted, stenciled, stamped, or marked in any manner on a container that is to be shipped to a Digital customer. Digital will supply the vendor with camera ready artwork and the control drawing with the Digital graphics per DEC A-PS-9908604-0-0. The vendor shall supply Digital with 3 printed cartons for print quality approval.

5.2 QUALITY ASSURANCE PROVISIONS

Items submitted for approval shall be representative of the vendor's normal production. Approval will be granted after the items have been examined, tested and found to meet the requirements of this specification. After approval, items supplied in accordance with the requirements of this specification must be the same as the items submitted for approval.

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5.2.1 Qualification Test

The vendor shall be responsible for performing qualification tests specified in paragraphs 5.2.2 – 5.2.3 and provide valid test data to Digital upon request.

5.2.2 Process Qualification Test

The vendor shall perform process qualification test(s) on his process(es) intended to produce product(s) for shipment to Digital. Process Qualification Tests shall identify any weakness(es) in the vendors process that may result in the production of non-conforming product(s) intended for shipment to Digital.

5.2.3 Product Qualification Test

The vendor shall perform Product Qualification Test(s) to determine that Digital specification requirements are consistently being met. Qualified product(s) shall be only those articles being produced by a qualified process and these products shall consistently meet Lot Acceptance criteria specified in paragraph 5.2.4.

5.2.4 Lot Acceptance

All incoming shipments may be subjected to Lot Acceptance Testing by Digital based on the Quality requirements as expressed in the applicable purchase specification(s). A 100% quality acceptance is to be maintained by the supplier in accordance with the applicable engineering specification(s) and the Digital Base Order Agreement (BOA).

5.2.5 Non-conformance

In the event a lot fails to meet the Lot Acceptance criteria, the lot may be further processed in accordance with Sec: VI "Inspection and Acceptance" of the BOA.

5.2.6 Corrective Action

Upon notification to the vendor by Digital of non-conformance, the vendor shall provide written response within 15 days.

5.2.7 Changes

Upon successful demonstration that paragraphs 5.2.2 and 5.2.3 are consistently being met, the vendor shall comply with Section XII "Changes" of the BOA prior to implementing any change(s).

5.2.8 Warranty

The manufacturer shall warrant that each article shipped shall meet the requirements of this specification.

The warranty period and terms of the warranty covered by the BOA shall be adhered to.

5.3 BAR CODE LABELING

5.3.1 General Requirements

The purpose of this section is to achieve consistent use of BAR codes throughout Digital. All product cartons shall be labeled in BAR CODE format. This includes cartons for individual

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saleable units and Master Pack shipment cartons.

The industry standard "CODE 39" bar code symbology shall be used for all bar coding applications.

The supplier is responsible for maintaining suitable backup documentation for all bar coded symbols.

5.3.2 Format Requirements

All Bar Code information will be printed in the Unaligned Format.

5.3.2.1 Spaces

There shall be no leading spaces in any BAR CODED fields.

5.3.2.2 Hyphens

- A. Hyphens must have characters on both sides.
- B. Hyphens must be included when they separate the two-five-two part number format.
- C. Hyphens must be included when they separate the option and variation.

5.3.2.3 Human Readable Characters

- A. Human readable characters must always be printed with the BAR CODE.
- B. Start and stop characters may or may not be printed in the human readable form. The start and stop character is "***". (*LK401-AA*)
- C. BAR CODE and human readable characters shall be centered on the label.

5.3.2.4 Quiet Zone

A minimum of 0.25 inch quiet zone shall separate BAR CODES.

5.3.2.5 Preferred BAR CODE sizes:

size	BAR CODE	human readable
small	3/16"	5/32"
medium	3/16"	1/4"
large	3/8"	5/8"

5.3.2.6 Location

BAR CODE labels shall not obstruct any nomenclature. The labels shall be placed to facilitate easy scanning and reading.

5.3.2.7 Bar Code Quality

Do not cover the BAR CODE with closure tape.

BAR CODES shall be affixed without being folded, creased, or torn.

Printing of BAR CODES shall be done without defects to maintain readability.

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5.3.2.8 Bar Code Verification

All BAR CODES shall be verified acceptable by Digital prior to supplier use.

5.3.3 Product Label Requirements

The "product" BAR CODE label shall have the following information:

- A. Serial Number – as outlined in section 5.3.8

Additional requirements:

- A. The location shall be on or next to the product label.
- B. Size – small

5.3.4 Product Carton Label Requirements

The "product carton" BAR CODE label shall have the following information:

- A. Option Number – as outlined in section 5.3.6
- B. Revision – as outlined in section 5.3.7
- C. Serial Number – as outlined in section 5.3.8

Additional requirements:

- A. Two (2) labels are required.
- B. Located on two adjacent sides.
- C. Labels affixed in the "tick mark" areas provided on the pre-printed cartons.
- D. Size – small

5.3.5 Pallet Label Requirements (see section 5.1.7)

The BAR CODE label shall have the following information:

- A. Option Number – as outlined in section 5.3.6
- B. Quantity

Additional requirements:

- A. Two (2) labels are required.
- B. Located on two adjacent sides.
- C. Size – large
- D. BAR CODE labels for each carton are visible from the outside of the pallet load.

5.3.6 Option Number Label

The option number shall be BAR CODED in an eight (8) alpha-numeric character field containing the following information:

5 character – option number (LK401)

1 character – dash (-)

2 character – variation identifier (AA)

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5.3.7 Part Revision Label

The product revision level shall be BAR CODED in a four character field containing the following information:

2 character – alpha part revision (use one or two as needed)

2 character – numeric part revision (must contain two digits) (use leading zero)

The first part revision label bar code would read: A01

5.3.8 Serial Number Label

Starting with the site code to the left, the serial number shall be BAR CODED in a ten (10) alpha-numeric character field containing the following information:

2 character – site/supplier code (to be supplied by Digital)

1 character – last number of year

2 character – week of year (01 to 52)

5 character – unique serial number

(alpha-numeric mix)

If date codes are used without serial numbers fill in that portion (five characters) with zeros.

The date of manufacture is the means of identifying product to when it was manufactured to meet traceability requirements.

6.0 DEC STD 009 – ENGINEERING SPECIFICATION TABLES

The following DEC Standard Engineering Specification Tables identify parameters which must be specified and approved by DIGITAL before a product contract can be signed. Applicable sections must be filled out during the planning and development phases of the program.

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6.1 Table 1 – Physical Specification

PARAMETERS	MIN	TYP	MAX	UNITS	SYMBOL
Mounting Code		TT			
Height		4.76		centimeters	cm
		1.88		inches	in
Width		48.3		centimeters	cm
		19.0		inches	in
Depth		19.2		centimeters	cm
		7.56		inches	in
Weight		1.16		kilograms	kg
		2.56		pounds	lb
Shipping Height		5.72		centimeters	cm
		2.25		inches	in
Shipping Width		58.4		centimeters	cm
		23.0		inches	in
Shipping Depth		25.4		centimeters	cm
		10.0		inches	in
Shipping Weight		1.82		centimeters	cm
		4.0		inches	in
Shipping Code		BX			
Data Cable		1.83		meters	m
Type – 4 Wire Phone		72.0		inches	in

6.2 Table 2 – Environmental Specifications

PARAMETERS	MIN	TYP	MAX	UNITS	SYMBOL
Temperature (Operating)	10.0		40.0	degrees Celsius	°C
	50.0		104.0	degrees Fahrenheit	°F
Temperature (Nonoperating)	–40		66.0	degrees Celsius	°C
	–40		151.0	degrees Fahrenheit	°F
Temperature (Storage)	–40		66.0	degrees Celsius	°C
	–40		151.0	degrees Fahrenheit	°F
Temperature Rate of Change (Operating)			10.0	degrees Celsius per hour	°C /h
			50.0	degrees Fahrenheit per hour	°F /h

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6.2 Table 2 – Environmental Specifications (continued)

PARAMETERS	MIN	TYP	MAX	UNITS	SYMBOL
Relative Humidity (Operating)	10.0		90.0	percent relative humidity (noncondensing)	%RH
Relative Humidity (Nonoperating)	10.0		95.0	percent relative humidity	%RH
Relative Humidity (Storage)	10.0		95.0	percent relative humidity (noncondensing)	%RH
Relative Humidity Rate of Change (Operating)			10.0	percent relative humidity per hour	%RH/h
Maximum Wet Bulb Temperature (Operating)			32.0 89.6	degrees Celsius degrees Fahrenheit	°C °F
Maximum Wet Bulb Temperature (Storage)			52.0 126.0	degrees Celsius degrees Fahrenheit	°C °F
Minimum Dew Point Temperature (Operating)	15.0 59.0			degrees Celsius degrees Fahrenheit	°C °F
Minimum Dew Point Temperature (Nonoperating)	23.0 73.4			degrees Celsius degrees Fahrenheit	°C °F
Heat Dissipation		0.60 2.05	1.80 6.14	watts btu/h	W btu/h
Altitude (Operating)			2438 8000	meters feet	m ft
Altitude (Nonoperating)			4877 16000	meters feet	m ft
Mechanical Shock (Operating)	Duration Level		5.00 25.0	milliseconds gravities	ms g
Vibration (Operating)	Freq. Level	5.00 20.0	500.0	Hertz gravities	Hz g
Mechanical Shock (nonoperating)	Duration Level		-- 40.0	milliseconds gravities	ms g

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6.2 Table 2 – Environmental Specifications (continued)

PARAMETERS		MIN	TYP	MAX	UNITS	SYMBOL
Vibration (nonoperating)	Range	5.00		500.0	Hertz	Hz
	Lever		20.0		gravities	g
Acoustics	Oper. LNPE		6.10		Bels	B
	LPA		55.0		Decibels	dbA
	Idle LNPE		5.10		Bels	B
	LPA		46.0		Decibels	dbA

6.3 Table 3 – EMS Specifications

PARAMETERS			QUANTITY	UNITS	SYMBOL
Broadband Radiated EMI	30–88	MHz	40.0	decibels	db/uV
	88–116	MHz	43.5	per	db/uV
	216–1	GHz	46.0	microvolt	db/uV
Conducted EMI	10–450	KHz	97–54	decibels	db/uV
	450–1	MHz	54.0	per	db/uV
	1–30	MHz	48.0	microvolt	db/uV
Narrowband Conducted Transients	Frequency Range V rms into 50 ohms		10–30 1000	Kilohertz Volts	KHz V
Narrowband Radiated Susceptibility	Frequency Range Level		0.01–1000 5.0	megahertz Volts/meter	MHz V/m
ESD Control	Soft Failure		10.0	kilovolts	kV
	Hard Failure		11.5	kilovolts	kV
	Hardware Failure		15.0	kilovolts	kV

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K	PS	3032041–0–0	CX01

6.4 Table 4 – Reliability Specification

PARAMETERS	VALUE	UNITS	SYMBOL
Mean Time Between Failures (MTBF)	450,000 (minimum)	hours	h
Mean Cycles Between Failures (MCBF)	20 million (minimum)	cycles	c
Power-on Duty Cycle	100	percent	%
Functional Duty Cycle	15	percent	%
Overall Error Rate	1/100,000 (maximum)	characters	--

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