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Litho U.S.A. CP35049

Operator's Manual

KB5151 KEYBOARD
for the IBM-PC or -XT

by **key tronic**
The Responsive Input Company

for warranty information see back cover

DSI

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KTC 98-00048-002

A word about R.F. interference from the FCC . . .

This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient the receiving antenna.
- Relocate the computer away from the receiver.
- Move the computer with respect to the receiver.
- Move the computer away from the receiver. Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to identify and Resolve Radio-TV Interference Problems"

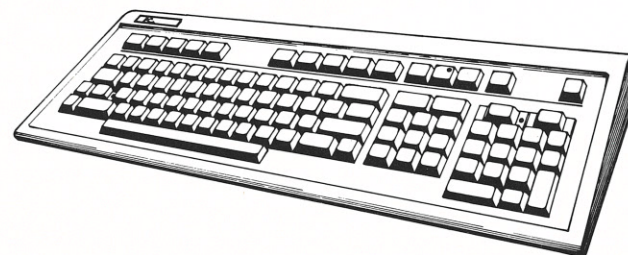
This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 004-000-00345-4.

This equipment is supplied with a shielded cable. It must use a shielded cable in order to meet FCC Class B emission limits. (See Parts List).

Introduction

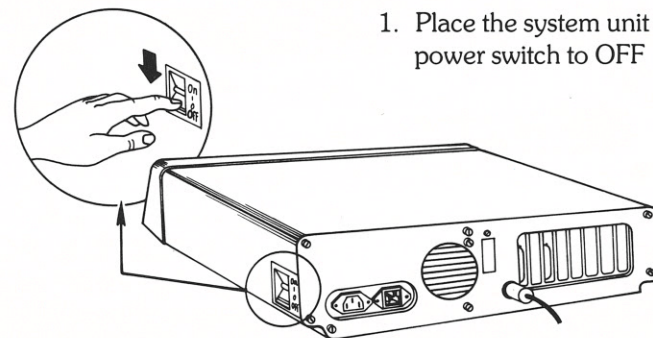
The Key Tronic Model KB5151 Keyboard is a direct replacement for the IBM* PC and IBM* XT Personal Computer Keyboards. There are no software modifications or special interfaces needed. Using it is the same as described in the IBM Personal Computer *Guide to Operations Handbook* you received with your Personal Computer. Install according to the instructions found in this Manual.

Key Tronic, the World Leader in keyboards, has listened to the market commentary on the IBM design and has chosen to include some features not found on the original. These selections enhance ease of operation and in no way alter the normal function or use of the Personal Computer.



Installation

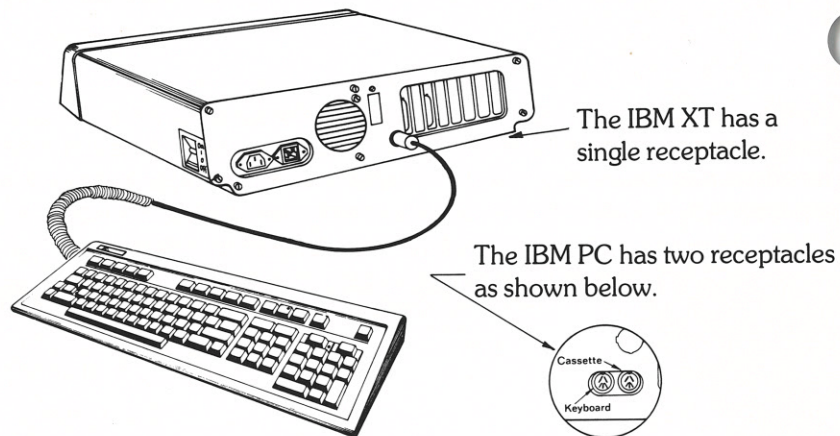
To install the KB5151, Proceed as follows.



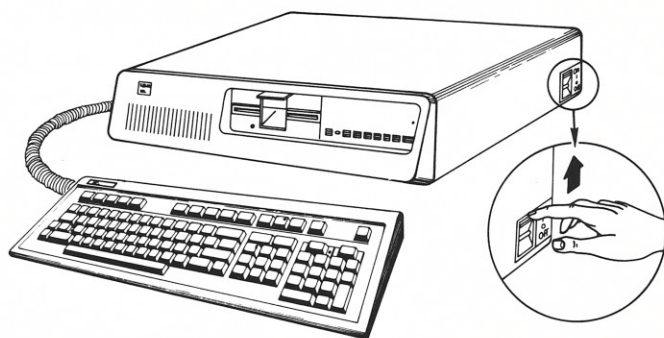
1. Place the system unit power switch to OFF

* IBM is a registered trademark of the International Business Machines Corporation.

- Unplug your existing keyboard and replace it with your KB5151 Keyboard.



- Place the power switch to ON and a brief tone will be heard.



Your KB5151 Keyboard is now ready to use.

Added Features

Many new features have been incorporated to make your KB5151 easier to use.

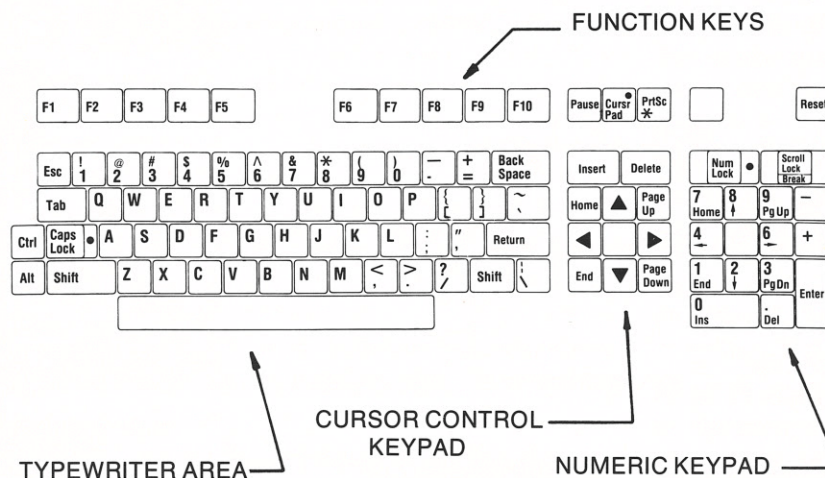
A frequent cause of operating errors is the inadvertent setting of the Numerical Lock or the Capitals Lock key. To help reduce the number of such errors, the KB5151 adds STATUS LEDs to these keys. You can now tell at a glance which modes these keys are in, greatly reducing chance entry of false data or commands. We think you will be pleased with the improvement.

An apparent difference can also be seen in the general layout of the unit. A separate cursor movement pad, plus dedicated function keys across the top, are two of the primary changes to enhance use of the IBM PC.

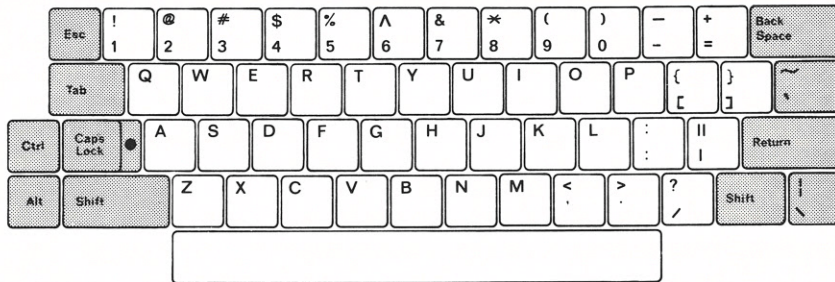
The KB5151 design also returns certain keys to standard locations, and replaces some symbolic legends with conventional alpha legends. Our surveys show that this style reduces the problem created by the need to relearn a keyboard for one application. Refer to the charts and diagrams that follow to identify the exact features included, and what the specific changes are.

Keyboard

The Keyboard is divided into four sections; the Function Keys, the Typewriter Area, the Cursor Control Keypad and the Numeric Keypad.



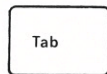
Typewriter Area



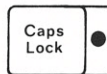
Key Tronic has enhanced the Personal Computer Keyboard by returning some keys to the familiar typewriter locations, replacing some symbols with legends, and eliminating extra keystrokes.

Differences from the original Personal Computer Keyboard are shown in the shaded areas and described as follows. A cross reference list of symbol-to-legend is provided after the detailed explanations.

On the left-hand side of the typewriter area . . .



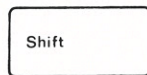
The TAB legend replaces the former arrow symbols.



The CAPS LOCK key is relocated and a LED indicator has been added to show its status. When the LED is ON, the letters A through Z in the typewriter area appear in uppercase. Please read the *CAPS LOCK LED and NUM LOCK LED Application Note* of the Technical Data.

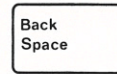


The ALT key is relocated.



The left SHIFT key is relocated and legends replace the former arrow symbols on both SHIFT keys.

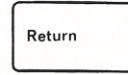
On the right-hand side of the typewriter area . . .



The BACK SPACE legend replaces the former arrow symbol.



The GRAVE key is relocated.



The RETURN key is moved to the Home row and RETURN legend replaces the former arrow symbol.



The SHIFT legend replaces the former arrow symbol.



The BACKSLASH key is relocated.

Function Keys

All of the Function keys are relocated. New keys are shown and described as follows.



PAUSE is a new key that duplicates the CTRL/NUM LOCK operation.



The CURSOR PAD key is a new press ON/press OFF key that simultaneously actuates the Cursor Control Keypad and the Numeric Keypad. The key includes a LED indicator that when ON indicates the Cursor Control Keypad activated and the Numeric Keypad locked into the numeric mode. Please see the Application Note on the Cursor Control Keypad in the Technical Data Section of this manual.



The PRINT SCREEN key is relocated from the typewriter area. The function remains the same.

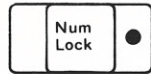


The RESET key is a new key used in conjunction with the CTRL key. CTRL/RESET duplicates the CTRL/ALT/DELETE combination. A heavier (6 oz.) keypress is required to operate the RESET key.

NOTE: The PRT SC (PRINT SCREEN) key has been moved from the Typewriter Area to the Function Key location directly above the Cursor Control Keypad.

Numeric Keypad

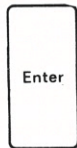
The Numeric Keypad is relocated. New keys are shown and described below.



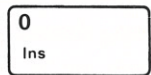
The NUM LOCK has an LED indicator added to show when it is in the numeric mode (LED ON). Please read the *CAPS LOCK LED and NUM LOCK LED Application Note* found in the Technical Data Section of this Manual.



The PLUS key is relocated.



An ENTER key is added and functions the same as the RETURN key.

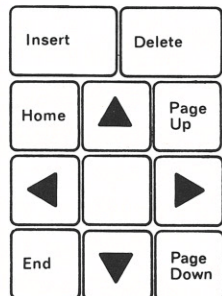


The ZERO/INSERT is slightly relocated.



The DECIMAL POINT/DELETE key is slightly relocated.

Cursor Control Keypad



A new Cursor Control Keypad is added at the former location of the IBM Numeric Keypad. This new Keypad is controlled by the CURSOR PAD key, whose status is indicated by an LED. Default status on power up is inactive (LED OFF), and cursors/numbers are available on the Numeric Keypad. Pressing the CURSOR PAD key turns ON its LED, activates the Cursor Control Keypad, and engages NUM LOCK (LED ON). Cursors are then available on the Cursor Control Keypad, and numbers only on the Numeric Keypad. The NUM LOCK cannot be disengaged so long as the CURSOR PAD is active.

Symbol/Legend Cross Reference Chart

IBM SYMBOL	KEY TRONIC LEGEND	IBM SYMBOL	KEY TRONIC LEGEND
ON THE TYPEWRITER LEFT SIDE		ON THE TYPEWRITER RIGHT SIDE	
	Tab		Back Space
	Shift		Return
AT THE CURSOR CONTROL KEYPAD AREA			Return
	Insert		Shift
	Delete		

Technical Data

NOTE: The following material is for those who are interested in the technical areas of the KB5151.

Power Requirement

+5 VDC @ 500ma. Maximum

Interface Protocol

See Schematic for pinout data. Protocol is Serial TTL.

Application Notes

CURSOR CONTROL KEYPAD APPLICATION NOTE

Question: Why do the LEDs occasionally get out of sync, causing the Cursor Control Keypad to produce numbers?

To answer this question it is necessary to understand some of the details concerning the operation of KB5151 Keyboard.

The KB5151 enhances cursor control functions by adding a separate Cursor Control Keypad. This feature relies on the IBM PC Shift key convention* of the Basic Input/Output System (BIOS). In BIOS, the SHIFT keys are always recognized as commands for toggling a key function, i.e., while in the Caps Lock mode, a shifted (SHIFT key held down) "A" will produce a lowercase "a." This feature also applies to the Numeric Keypad, i.e., when the Numeric Keypad is in the numeric mode (indicated by the NUM LOCK LED being illuminated), a shifted "4" will produce a left cursor. Likewise, when the Numeric Keypad is in the cursor mode (indicated by the NUM LOCK LED being extinguished) a shifted left cursor will produce a "4."

* Standard function of the IBM PC determined by software.

The KB5151 also offers LED status indicators for the CAPS LOCK and NUM LOCK keys. How this status is maintained is shown in the following explanation.

The IBM PC uses what is called a "down/up encoded" keyboard scheme. This means that every key produces one code when pressed and another code upon release, each key having a unique pair of codes. You may realize at this point that a "shifted" or "control" character (i.e., SHIFT key + "A" key, or the CONTROL key + "A") does not produce a new code, but rather a series of down and up codes produced by the operator and recognized by the system as a command for a different function. For example: the SHIFT key down code plus the "A" key down code is recognized as a capital A.

When the IBM PC system receives a down code from the SHIFT key, the status of the system is changed by altering the value at a specific memory location. This value should correspond to the status on the keyboard. However, some software can inadvertently or purposely modify this specific memory location used for system status. The keyboard has no way to respond to a system status change initiated by software.

In some cases, software will modify the "system status" when initializing (which is in violation of BIOS usage rules). It can clear system status at that time (NUM LOCK function — OFF, CAPS LOCK function — Off, Scroll Lock function — Off). If the user should leave one or more LEDs On while invoking an application program that clears system status, the problem of the keyboard indicating the wrong status occurs since the LEDs are left On and the system status is programmed Off. Therefore, it is the user's responsibility to insure that the LEDs are Off before invoking an application. This includes anytime the user exits to an external routine and then returns to that application.

It is possible in some cases for software to modify system status while in run time. The KB5151 user must then resort to the recovery scheme outlined as follows.

- (1) Deactivate the CURSR PAD key (CURSR PAD LED should be Off) if resetting the NUM LOCK LED. It is not necessary to deactivate CURSR PAD key if resetting the CAPS LOCK LED.
- (2) Press and hold the RESET key (this will not reset the IBM PC).
- (3) Press and release the NUM LOCK or CAPS LOCK key, whichever key shows incorrect LED status, and then release the RESET key.

CURSOR CONTROL KEYPAD APPLICATION NOTE

On power up, the Numeric Keypad (NK) originates both cursor commands and numeric entry, and the Cursor Control Keypad (CCK) is inactive. The IBM PC BIOS initially recognizes NK codes as cursor commands. Pressing the SHIFT key transmits a "down" code that flips the BIOS to recognize inputs as numeric; releasing it transmits an "up" code that reverts the BIOS to cursor mode.

Engaging NUM LOCK (LED ON) recodes the BIOS to see numeric inputs unless the SHIFT key is pressed and held for cursor code.

Engaging CURSR PAD (LED ON) activates the CCK, freezes NUM LOCK in the locked condition (LED ON), and sets the BIOS to numeric mode.

During key status polling, the KB5151 will automatically identify the zone (CCK, NK or the remainder of the keyboard) and make one of two decisions;

- (1) On the first key for a given zone, the proper shift code plus the up-down code is sent.
- (2) On subsequent key entries from that zone, only the up-down code is sent. If the user moves to the alternate zone, condition (1) applies.

CAPS LOCK LED AND NUM LOCK LED APPLICATION NOTE

The NUM LOCK and CAPS LOCK status (of the PC) are maintained in the system RAM. It is possible for an application program to overwrite or otherwise alter the contents of this RAM location. If this should happen, the keyboard CAPS LOCK or NUM LOCK indicators would not show the correct mode status of the PC. This situation can be corrected by pressing and holding the RESET key without the CONTROL key (this will *not* reset the PC), and then pressing and releasing the CAPS LOCK or NUM LOCK key, whichever LED shows incorrect status.

APPLICATION SOFTWARE NOTE

Key Tronic's implementation of separate cursor and numeric pads is dependent on an IBM BIOS convention. It is possible that some software packages will not honor the IBM convention and as a result fail to produce cursors with the KTC cursor pad. In these cases, until a fix is implemented by the vendor, the numeric keypad should be used with the cursor pad disabled. Additionally, some software packages do not break convention but rather enhance it to create additional cursor ability. In these cases both the software vendor and KTC should be notified so that a resolution can be implemented.

Keyboard

The Keyboard has an attached cable that connects to a DIN connector at the rear of the host computer. This is a shielded five-wire cable containing +5 VDC, two signal lines, a reset line, and a ground line.

Capacitive key switches are used with a microprocessor performing the keyboard scanning.

The Keyboard interface is accomplished by having the keyboard return scan codes rather than ASCII codes. For example, key 16 produces scan hex code 01 on make and hex code 81 on break. Break codes are formed by adding hex 80 to the make codes. The keyboard I/O driver can define keyboard keys as shift keys or typematic, as required by the application.

The microprocessor in the keyboard performs several functions.

- Keyswitch scanning.
- Maintaining serial communications with the host.
- Executing hand-shake protocol required by each scan code transfer.

The following pages show the keyboard interface connector information and the keyboard with the scan hex codes. The key number is used to identify key location in regard to the Schematic Key matrix.

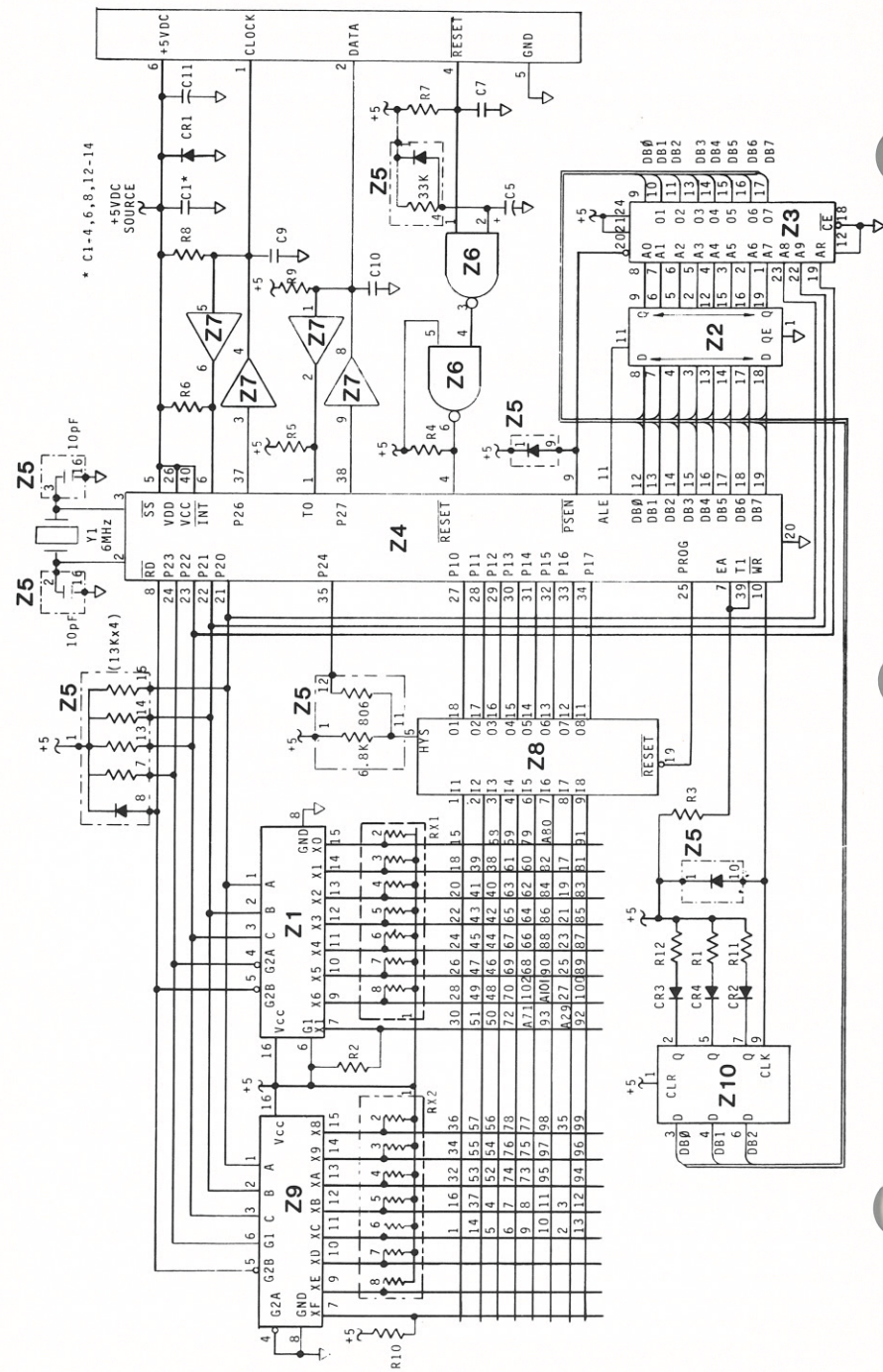
Key Scan Code Chart

BB 1 3B	BC 2 3C	BD 3 3D	BE 4 3E	BF 5 3F	C0 6 40	C1 7 41	C2 8 42	C3 9 43	C4 10 44	11 12	12 13	13 14	No Code 14	15 15		
81 16 01	82 17 02	83 18 03	84 19 04	85 20 05	86 21 06	87 22 07	88 23 08	89 24 09	8A 25 0A	8B 26 0B	8C 27 0C	8D 28 0D	8E 29 0E	D2 30 52	D3 32 53	
8F 37 0F	90 38 10	91 39 11	92 40 12	93 41 13	94 42 14	95 43 15	96 44 16	97 45 17	98 46 18	99 47 19	9A 48 1A	9B 49 1B	9C 50 1C	C7 51 47	C8 52 48	
9D 58 1D	9E 59 1E	9F 60 1F	A0 61 20	A1 62 21	A2 63 22	A3 64 23	A4 65 24	A5 66 25	A6 67 26	A7 68 27	A8 69 28	A9 70 29	CA 54 47	CB 55 48	CC 56 49	
BA 59 3A	BB 60 3B	BC 61 3C	BD 62 3D	BE 63 3E	BF 64 3F	C0 65 40	C1 66 41	C2 67 42	C3 68 43	C4 69 44	C5 70 45	C6 71 46	CD 75 4B	CE 76 4C	CE 77 4D	
AA 79 38	AB 80 39	AC 81 3A	AD 82 3B	AE 83 3C	AF 84 3D	B0 85 3E	B1 86 3F	B2 87 40	B3 88 41	B4 89 42	B5 90 43	B6 91 44	CF 93 4F	D0 94 50	D1 95 51	
100													CF 96 4F	D0 97 50	D1 98 51	9C 9C
B9 39													D2 101 52	D3 102 53	99 99	

XX ◀ Up Code
 x XX ◀ Down Code
 ▲ Key Number

- ① Key #11 (PAUSE) will generate the sequential code string "1D,45,C5,9D" only when depressed. There is no keycode on release.
- ② If the CURSR PAD LED is ON, the Cursor Keypad is activated and the keys generate the indicated hex codes per Cursor Control Application Note.
If the CURSR PAD LED is OFF, the Cursor Keypad is inoperative and no codes are generated from the Cursor Keypad.
- ③ Key #15 (RESET) is active only when Key #58 (CTRL) is held down. Key #15 will generate the sequential hex code string "38,53" only on depression.
- ④ If the NUM LOCK LED is ON, the Numeric Keypad is in the numeric mode. The hex codes that are generated are as indicated on the code chart and in accordance with the Cursor Control Application Note.
If the NUM LOCK is OFF, the Numeric Keypad is in the cursor mode. The hex codes generated are as indicated on the code chart.

KB5151 Schematic



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Key Tronic Keyboard

Parts List

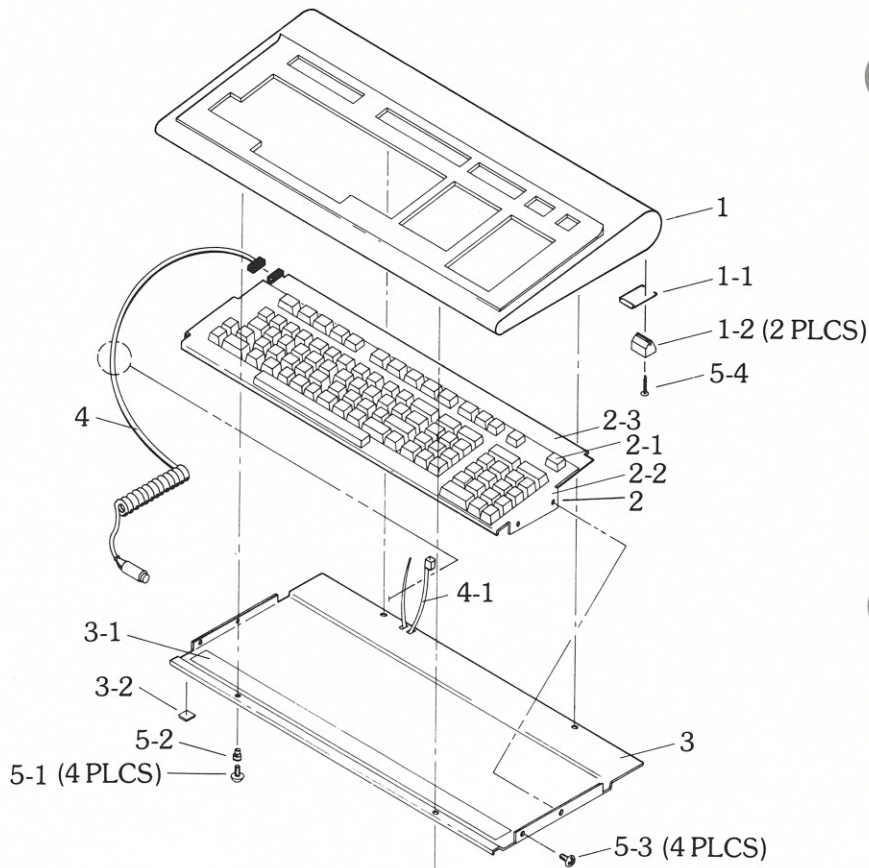
REF. DES.	DESCRIPTION	KTC PART NUMBER*
C1	Ceramic .033 uf 25VDC	Commercial
C2	See C1	" "
C3	See C1	" "
C4	See C1	" "
C5	Tantalum 10uf 10VDC	" "
C6	Ceramic .033uf 25VDC	" "
C7	Ceramic 33 pf 1KV	" "
C8	See C1	" "
C9	Ceramic 33pf 1KV	" "
C10	See C9	" "
C11	Tantalum 10uf 10VDC	" "
C12	See C1	" "
C13	See C1	" "
C14	See C1	" "
CR1	Diode, 1N4148	Commercial
CR2	LED, Red T-1	" "
CR3	See CR2	" "
CR4	See CR2	" "
J1	6 Pin Rt Angle Connector	39-00763-000
R1	120 Ohm 5% 1/4W	Commercial
R2	3.3K 5% 1/4W	" "
R3	See R2	" "
R4	13 K 5% 1/4W	" "
R5	See R2	" "
thru		
R10	See R2	" "
R11	See R1	" "
R12	See R1	" "
RX1	SIP 3.3K x 8	38-00332-006
RX2	See RX1	" "
Y1	Xtal 6.00Mhz DIP	48-00300-118
Z1	74LS138	Commercial
Z2	74LS373	22-74373-003
Z3	EPROM 2796	22-02758-496
Z4	Microprocessor 8035	20-08035-000
Z5	Custom Hybrid Ckt	22-00920-000
Z6	74LS132	Commercial
Z7	7407N	" "
Z8	KTC Custom IC	22-00908-003
Z9	74LS138N	Commercial
Z10	74174	" "

*When a part number is given, the item is not readily available except from KTC.

Key Tronic Keyboard

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Top Assembly



1	Enclosure	44-00224-097	3-1	Strip, Adhesive	48-00702-002
1-1	Leg, Adjustable	45-00057-000	3-2	Foot, Rubber Black	48-00559-001
1-2	Enclosure, Bail Block	44-00193-000	4	Cable Assembly	48-00828-000
2	Keyboard Assembly	65-02796-51E	4-1	Cable Tie No. 8	Commercial
2-1	Keytop Set	66-02796-001	5	Mounting Hardware	
2-2	Mounting Plate	49-01744-000	5-1	Screw PH 6-32x.250	Commercial
2-3	Printed Circuit Board	01-02796-251	5-2	Shoulder Bushing	47-00381-003
3	Base Plate	49-01693-000	5-3	Screw PH 4-40x.312	Commercial
			5-4	Screw PH 3-28x.625	" "

Keyboard Interface Connector

DESCRIPTION	VOLTAGE	PINS	CONNECTOR
Keyboard Clock	TTL	1	
Keyboard Data	TTL	2	
Keyboard Reset	0	3	
Ground	0	4	
Power Supply	+5VDC	5	

5 Pin DIN at System Unit

Maintenance

The KB 5151 Keyboard is designed and manufactured to operate without preventive maintenance.

The keyboard exterior may be cleaned with a mild household type cleaner, and a soft, damp lint-free cloth or paper towel. NEVER use a petroleum-base solvent which could damage the plastic or painted surfaces.

BE CAREFUL. Do not wipe dirt INTO the keyboard. Do not allow spray cleaner to run into the keyboard.

Use "Problem Determination Procedures" (PD Section) in the IBM *Guide to Operations* to help you solve any difficulty which may arise.

Technical Assistance

If you should encounter problems with the use of this keyboard, first review your system Owner's Manual. If the problem appears to originate from the keyboard, you are welcome to contact our Product Support Specialist (PSS) to obtain technical assistance. To reach the PSS, call our toll free line, 1-800-262-6006, or, if in the state of Washington, (509) 928-8000. If calling from outside the continental U.S.A., call Spokane, Washington, U.S.A., (509) 928-8000.

Packaging Notice

Please retain original packaging for reuse should your unit ever need to be returned for service. The bag and box are a custom designed product to protect the keyboard from electrostatic and mechanical shock in shipment.