Ramtek

Trackball Controller

Hardware Reference Manual

TRACKBALL CONTROLLER

Hardware Reference Manual

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Ramtek

2211 Lawson Lane
Santa Clara, California 95050

WARNING: This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with this manual, the equipment may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference. The user, at his own expense, is required to take whatever measures may be required to correct the interference.

CONTENTS

FIGURES

Chapter 1

GENERAL INFORMATION

1.1 INTRODUCTION

This hardware reference manual provides the information necessary for a qualified technician to install, operate, and maintain the Ramtek trackball controller. Do not perform any maintenance if a maintenance agreement or warranty is in effect. Any maintenance performed could invalidate an agreement or warranty. If you need only user information without maintenance, read only chapters 1, 2, and 3.

1.2 HOW TO USE THIS MANUAL

The material in this manual is arranged in a logical sequence that anticipates reader needs. If you go directly to desired information, you may find you need additional information previously given.

1.2.1 Manual Organization

This manual contains the following chapters and appendix:

- Chapter 1. GENERAL INFORMATION - Introductory information, FCC requirements, Ramtek service, and safety information.
- Chapter 2. PHYSICAL DESCRIPTION - A physical description of the trackball controller and list of specifications.
- Chapter 3. INSTALLATION AND OPERATION - Receiving, installation, and operating instructions, checkout procedures, and reshipping instructions.
- Chapter 4. FUNCTIONAL DESCRIPTION - A functional description of the controller.
- Chapter 5. MAINTENANCE - Preventive and corrective maintenance procedures.
- Chapter 6. PARTS LIST - A parts list and ordering procedures.
- Chapter 7. FOLDOUT ILLUSTRATIONS - Illustrations larger than one page.
- Appendix. GLOSSARY - A glossary of terms used in this manual.

1.2.2 Conventions Used In This Manual

Digital byte values are given in hexadecimal (H). All numbers not so marked are in decimal. Signal mnemonics are all capitals. An asterisk denotes a low-active signal (logic 0). All other signals are high-active (logic 1).

1.2.3 Reader Comment Form

A reader comment form is provided for user feedback. Please enter any comments, suggestions, or complaints on the form. Include page, paragraph, figure, or table number as applicable. The reader comment form is at the back of the manual.

1.3 FCC REQUIREMENTS

The trackball controller complies with FCC requirements for a Class A computing device when installed and operated as directed in this manual. To minimize radio-frequency (RF) interference, tighten the screws that fasten all connectors. Do this during installation and any time you remove and reinsert connectors.

Observe the following precautions when installing and operating the trackball controller:

1. Operate the controller in accordance with the instructions in this manual.

2. Make sure the controller is always operated with the factory-installed cover securely fastened.

3. All modifications to the controller must comply with specified limits of the FCC rules.

4. Properly maintain the controller.

5. Make sure that all cables are shielded and shields are connected to chassis ground at both cable ends.

1.4 RAMTEK SERVICE

Ramtek customer service includes field service, software support, and sales support for supplies, accessories, and add-on components. In addition, we have a well-staffed training organization that fully qualifies customer personnel to operate, maintain, and program Ramtek products. Technical documentation support includes all aspects of hardware and software.

1.4.1 Field Engineering Support

Ramtek maintains a complete Field Engineering Department that provides on-site service, depot repair facilities, and a full staff of technical specialists. For special situations or problems that cannot be resolved by our field offices, Ramtek specialists are available for phone consultation or for on-site consultation, if necessary.

Ramtek maintenance agreements cover complete on-site service, including all parts, labor, and expenses for field engineer on-site support. If a one-year maintenance agreement is purchased with the controller, we provide on-site installation and checkout in lieu of the 90-day F.O.B. factory warranty. If installation is purchased with the controller, we not only install hardware

but also upgrade the 90-day factory warranty to on-site. On-site service is also available on a time and material basis.

We maintain a full service depot for repair or exchange of parts during or after the warranty period. Obtain prior approval and a return material authorization (RMA) number before returning any merchandise. Parts must be shipped prepaid.

For additional information regarding service offered by our Field Engineering Department, call your local Ramtek office or call Field Engineering at (408) 988-2211.

1.4.2 Software Support

Ramtek offers a unique software support department staffed with highly qualified analysts to assist users. For prompt software support, direct all inquires to your local sales representative.

1.4.3 Training

The Education Department at Ramtek headquarters in Santa Clara, California, conducts regularly scheduled hardware and software training classes. In some circumstances we give on-site training.

1.4.4 Technical Documentation

Ramtek Technical Publications staff write and produce hardware and software documentation to support Ramtek products. To receive prompt documentation support, direct all inquiries to your sales representative.

1.5 SAFETY

Only qualified maintenance technicians should service or adjust internal components.

1.5.1 Electrical Safety

Careless handling could result in damage to electrical components. Be careful when servicing equipment with power applied.

1.5.2 Fire Safety

Fire detection systems designed for installations requiring fire protection or special building construction are listed in the National Fire Protection Association (NFPA) Standard Number 75.

To obtain a copy of this standard, write to:

National Fire Protection Association
470 Atlantic Avenue
Boston, Massachusetts 02210

Fire control requirements are normally included in local building codes. Your insurance carrier can recommend appropriate fire control apparatus.

Chapter 2

PHYSICAL DESCRIPTION

2.1 GENERAL DESCRIPTION

The trackball controller is an interactive peripheral device that is used with Ramtek colorgraphic display equipment, from which the controller normally receives +12 volt operating power. If the display equipment does not supply power, a jack on the controller can accept power from an AP01 power supply, part number 510350-01, which is available as an option.

The trackball controller (figure 2-1) has a trackball and four switches that can control a cursor on a cathode ray tube (CRT) screen. The trackball can be manually rotated to move the cursor in any direction. The switches can turn the cursor on and off, make the cursor blink, and send data to a host computer to indicate trackball movement and switch status.

2.2 MAJOR COMPONENTS

The trackball controller (part number 509440-01) connects to colorgraphic display equipment with a single interface cable and can be positioned on any level surface near the CRT for convenient use. Table 2-1 lists major controller components (figure 2-2).

Table 2-1. Major Components

Component	Part Number
Peripheral base	509441-01
Top cover	509445-01
Base cover	509443-01
PCB assembly	509633-01
Switch panel assembly	509534-01
Trackball unit	1001101-01
Interface cable assembly	509716-XX
Trackball cable assembly	509676-01

2.2.1 PCB Assembly

The PCB assembly (figure 2-3) consists of integrated circuits (ICs) and associated components mounted on a printed circuit board (PCB). The board consists of four layers of epoxy glass laminate. Discrete components and IC sockets are mounted on one side of the board and soldered to copper-foil circuit traces etched on the board. An alphanumeric coordinate grid is etched on the component side to facilitate component location. Component rows are

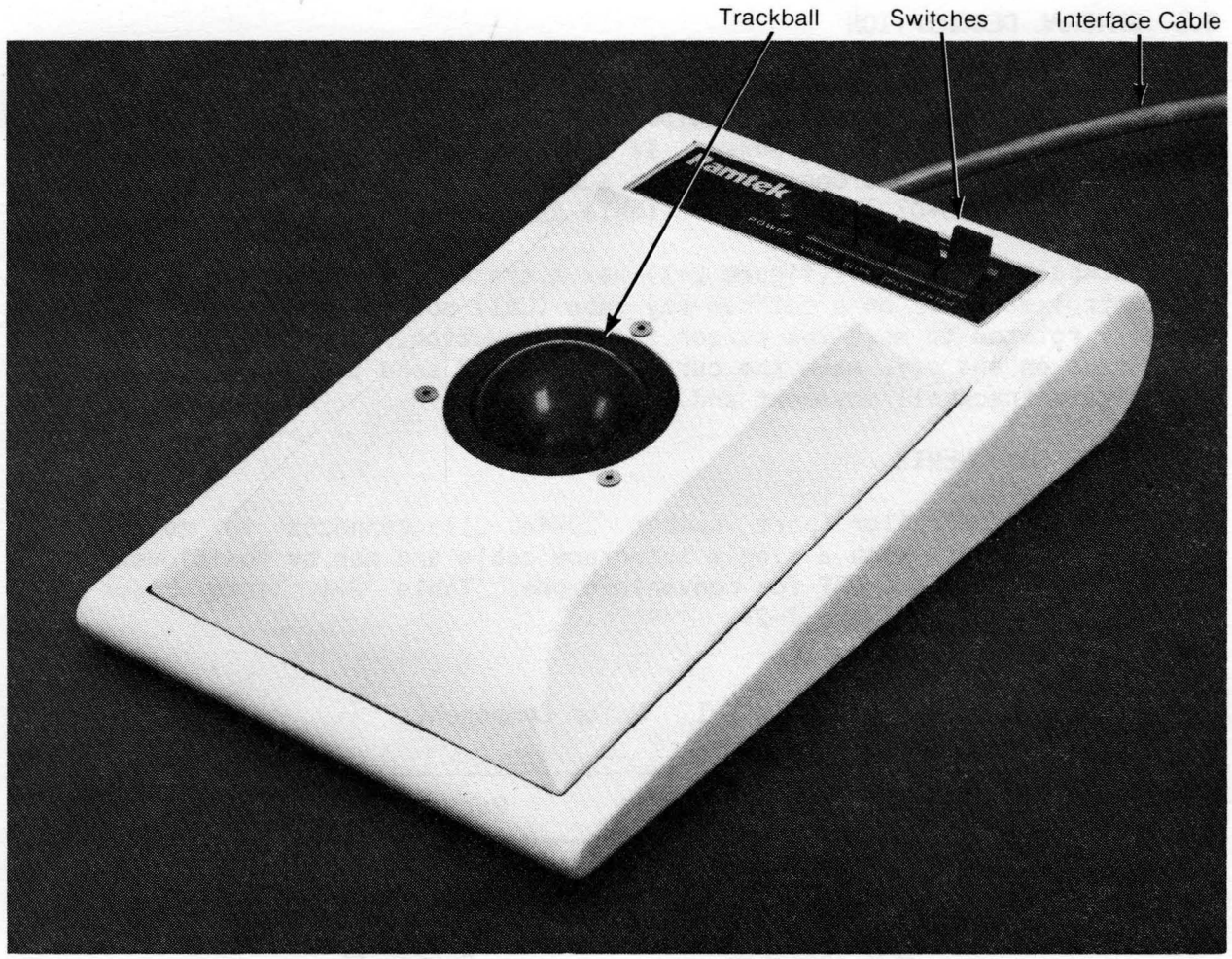

Figure 2-1. Trackball Controller

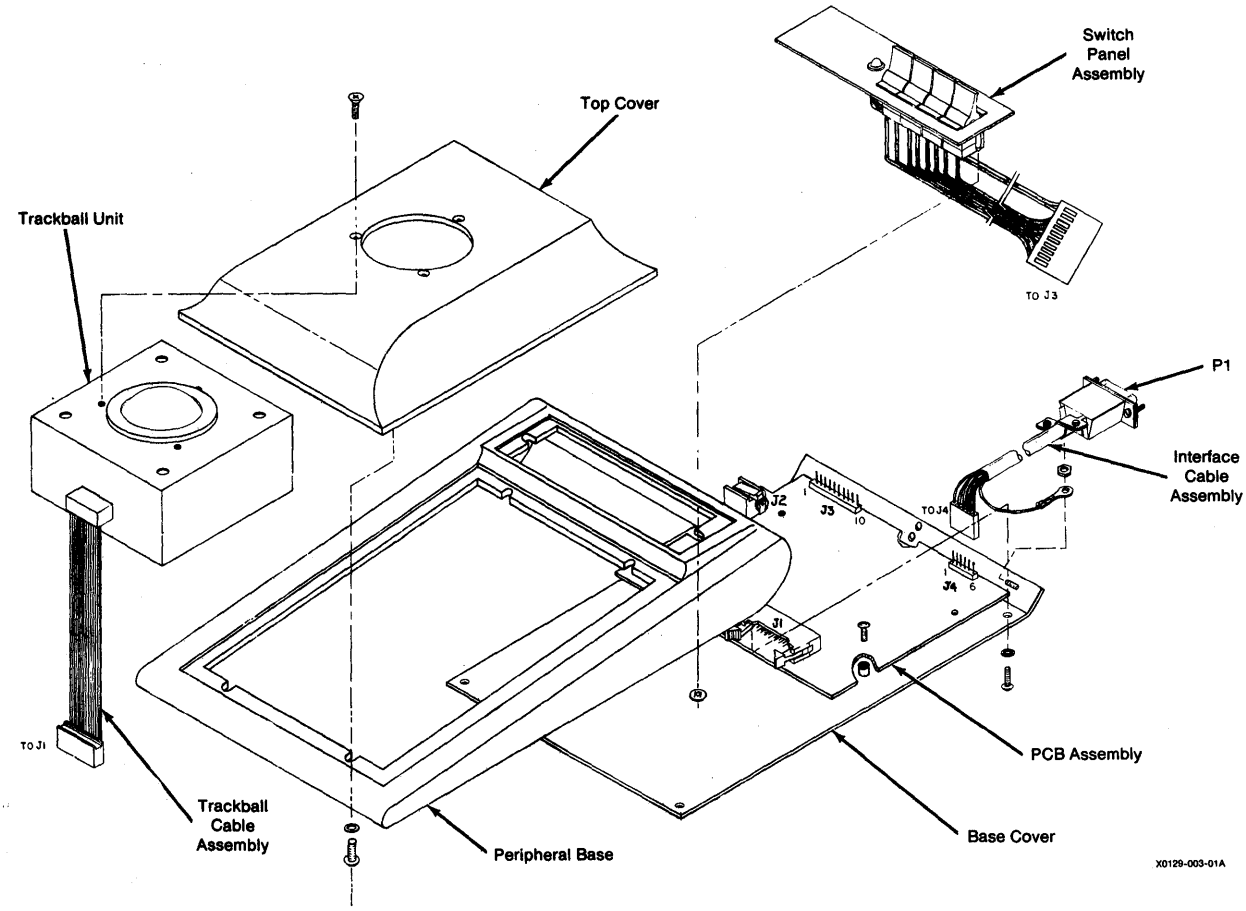

Figure 2-2. Trackball Controller, Exploded View

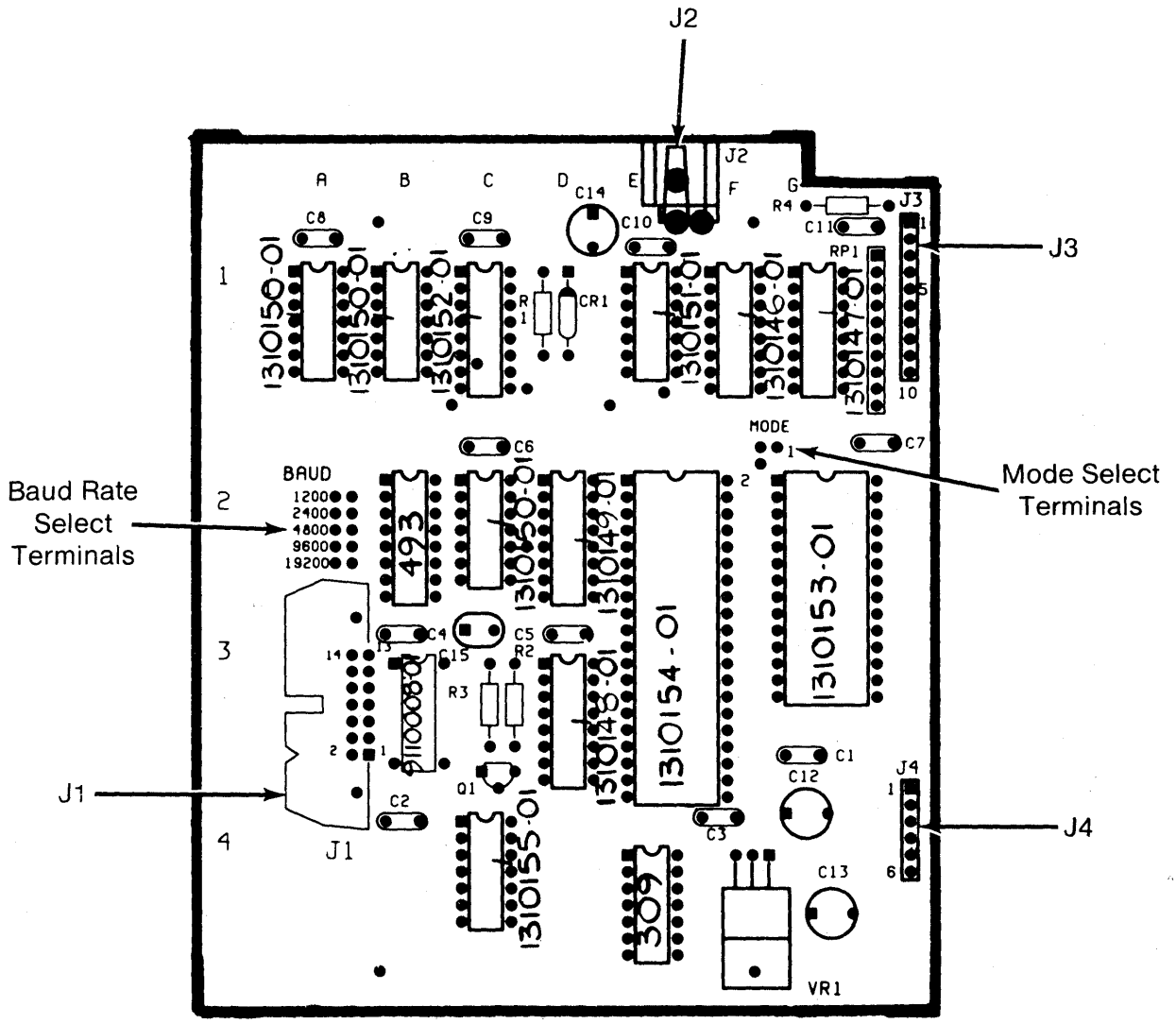

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Figure 2-3. PCB Assembly, Component Side

identified by number, and columns by letter. Coordinate designations are referenced in text and appear on the schematic diagram. The PCB assembly has four connectors. Table 2-2 shows connector functions.

Table 2-2. Connectors

Connector	Function
J1	Connects to trackball unit
J2	Connects to alternate +12 volt power source
J3	Connects to switch panel
J4	Connects to display equipment

2.2.2 Switch Panel Assembly

This assembly consists of four paddle switches and a light-emitting diode (LED) mounted on a panel, plus a cable assembly. Three switches are two-position; the fourth switch is momentary. The cable assembly connects the panel-mounted components to connector J3, which plugs into J3 on the PCB assembly.

2.2.3 Trackball Unit

The trackball unit consists of a trackball in a metal housing. The trackball protrudes above the housing and can be rotated by hand in any direction. A connector is mounted on the side of the housing.

2.2.4 Cable Assemblies

Trackball cable assembly connector P1 plugs into the trackball unit, and J2 mates with J2 on the PCB. Interface cable connector P1 plugs into the display equipment, and J4 mates with J4 on the PCB. The interface cable is available in four lengths (table 2-3).

Table 2-3. Interface Cable Lengths

Length in Feet	Part Number
10	509716-01
25	509716-02
50	509716-03
100	509716-04

2.3 SPECIFICATIONS

Electrical, physical, functional, and environmental characteristics of the trackball controller are specified in table 2-4.

Table 2-4. Specifications

Category	Specification
Electrical	
Voltage:	+12 volts dc
Current:	0.2 amp
Power:	1 watt
FCC Classification	
Class A Computing Device:	Complies with Subpart J, Part 15 FCC rules
Dimensions	
Height:	2.5 inches
Width:	6.0 inches
Depth:	10.0 inches
Interface	
Type:	Serial asynchronous at 1200, 2400, 4800, 9600, or 19,200 baud
Code:	1 start bit, 4 data bits, 4 control bits, and 2 stop bits
Voltage level	TTL differential
Environmental	
Ambient temperature	-30 to 60°C (-22 to 140°F) non-operating 0 to 45°C (32 to 113°F) operating
Relative humidity	5 to 90% non-condensing

Chapter 3

INSTALLATION AND OPERATION

3.1 INTRODUCTION

This chapter contains receiving instructions, installation procedures, operating instructions, checkout procedures, and reshipping instructions.

3.2 RECEIVING

The trackball controller is carefully inspected and packed prior to shipment from the manufacturing facility. Unpack and inspect the controller as follows:

1. Examine shipping carton for external damage before accepting delivery. If carton is damaged, unpack controller while shipping agent is present.

2. Carefully unseal carton and remove controller and packing material. Save packing material for possible future use.

3. Inspect controller for scratches, dents, or chipped paint, especially in any places where carton is punctured.

4. Look for screws loosened by vibration during shipment and tighten any loose screws.

5. Inspect interface cable connector P1 for foreign material that may impair electrical contact with mating connector. Remove any foreign material with a soft brush and vacuum cleaner.

3.3 INSTALLATION

The trackball controller may be positioned on any level surface near the CRT screen. Proceed as follows:

1. Plug connector P1 (table 3-1) into mating connector on display equipment. Verify that connector is securely seated to ensure good cable grounding and to minimize radio-frequency interference.

2. Tighten connector holding screws.

3.4 CONFIGURATION

Jumper wires are installed at the baud rate select and mode select terminals. A jumper at one of the five pairs of baud rate terminals selects a baud rate of 1200, 2400, 4800, 9600, or 19,200 as indicated on the PCB. A second jumper straps terminal MODE 1 to the common terminal. Terminal MODE 2 is not used.

Table 3-1. Interface Cable Connector Pin Functions

P1 Pin	Wire Color	Function	J4 Pin
1	--	Not connected	--
2	--	Not connected	--
3	White	Data output +	5
4	Green	Data output -	6
5	Black	Ground	3
6	Red	+12 V	1
7	Blue	+12 V	2
8	--	Not connected	--
9	Black	Ground	4

3.5 OPERATION

The trackball controller (figure 3-1) has four switches, a trackball, and an LED. Table 3-2 explains control and indicator operation.

Table 3-2. Controls and Indicator

Name	Type	Function
VISIBLE	Two-position paddle switch	Turns on cursor when set to ON
BLINK	Two-position paddle switch	Makes cursor blink when set to ON
TRACK	Two-position paddle switch	Sends a data byte to host computer after each trackball movement when set to ON
ENTER	Momentary paddle switch	Sends one data byte to host computer when pressed Stops all operation when held in pressed position
Trackball	Rotating ball	Positions cursor on CRT screen when rotated
POWER	Green LED indicator	Lights when +12 volts of power are received

3.6 CHECKOUT

Check out the trackball controller after installation or after display equipment turn-on. You need special test equipment and engineering knowledge for a complete checkout. Omit any step you are not equipped to perform. A complete

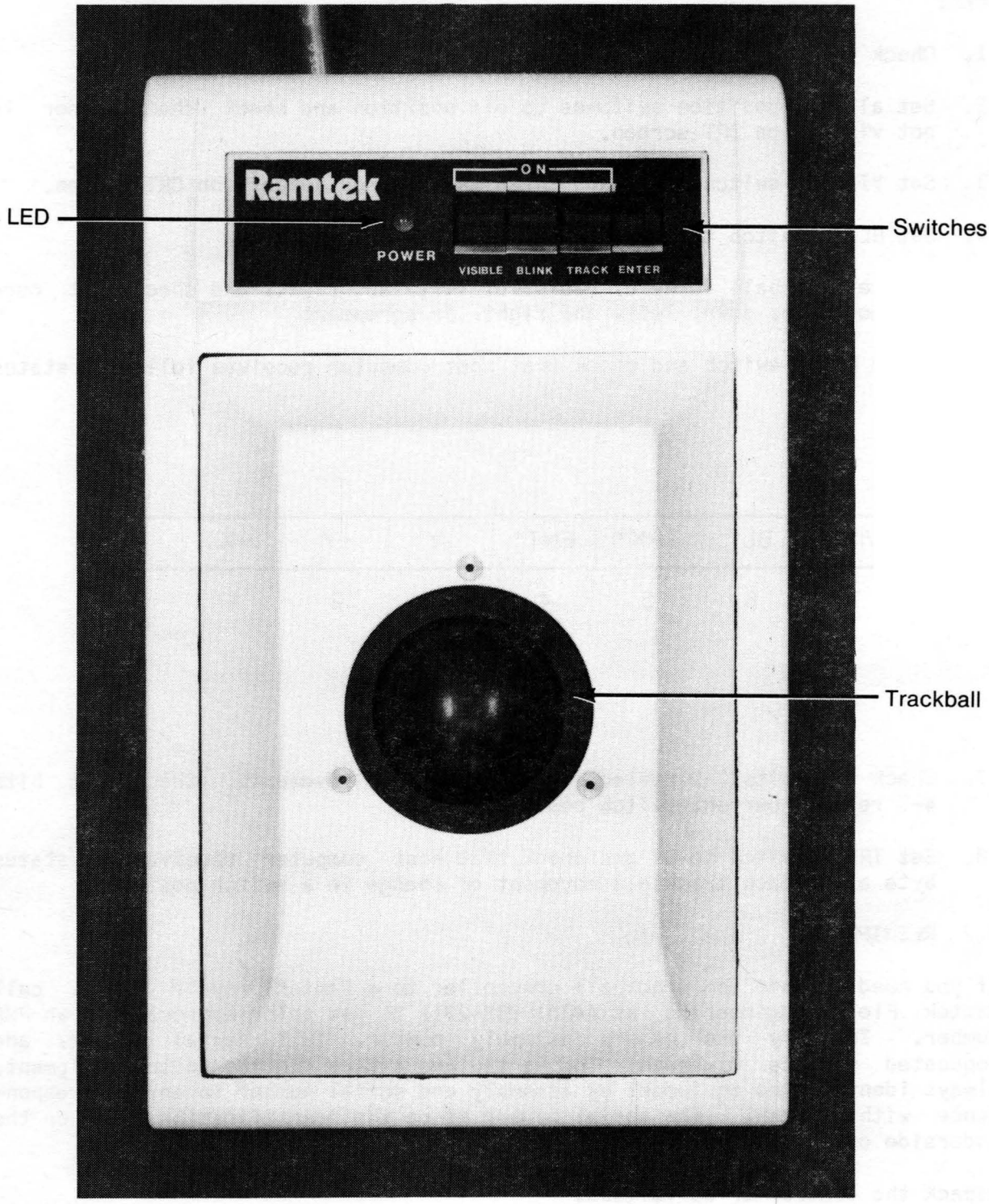

Figure 3-1. Controls and Indicator

checkout is not necessary when performance is satisfactory. Proceed as follows:

1. Check that green POWER LED indicator is lit.

2. Set all two-position switches to off position and check that cursor is not visible on CRT screen.

3. Set VISIBLE switch to ON and check that cursor appears on CRT screen.

4. Set BLINK switch to ON and check that cursor blinks.

5. Rotate trackball forward, backward, left, and right, and check that cursor moves up, down, left, and right, in agreement.

6. Press ENTER switch and check that host computer receives following status byte:

VIS*	BL*	TRK*	ENT*	-Y	+Y	+X	-X
7	6	5	4	3	2	1	0

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7. Check that bits 0-3 reflect latest trackball movements. Check that bits 4-7 reflect current switch positions.

8. Set TRACK switch to ON and check that host computer receives a status byte after each trackball movement or change in a switch position.

3.7 RESHIPPING

If you need to ship the trackball controller to a Ramtek repair depot, call Ramtek Field Engineering at (408) 988-2211 to get prior approval and an RMA number. Identify the owner, assembly number, full serial number, and requested service or repair on a tag and attach the tag to the equipment. Always identify the equipment by assembly and serial number in any correspondence with Ramtek. The serial number is on the identification label on the underside of the controller.

Repack the controller as follows:

1. If you saved original packing material, pack controller in shipping carton as originally packed. If original shipping carton is not available, wrap controller in protective padding and pack in a strong shipping carton or wooden crate.

2. Mark shipping carton "DELICATE INSTRUMENT" and "FRAGILE."

3. Seal carton with strong tape or metal bands.

Chapter 4

FUNCTIONAL DESCRIPTION

4.1 INTRODUCTION

This chapter gives a general description of trackball controller operation followed by functional descriptions of individual functional elements. Figure FO7-1 (foldout in chapter 7) is a schematic diagram of the PCB assembly. In the schematic diagram, components are identified by individual designations such as Q1 or VR1. ICs are identified by coordinate designations such as 2G or 3D. Where two or more components are packaged in a single IC, components are referenced by output pin number. For example, 1A-9 and 1A-5 are flip-flops with outputs connected to pins 9 and 5, respectively, of IC 1A.

4.2 GENERAL FUNCTIONAL DESCRIPTION

The trackball controller consists of three functional units:

- Trackball unit
- Switch panel assembly
- PCB assembly

The trackball PCB assembly has a Zilog Z80L microprocessor that functions as a central processing unit (CPU) and controls PCB operation. CPU 2E receives cursor direction data from the trackball unit via connector J1 and control signals from the switch panel via J3. When the TRACK switch is set to ON, shift register 1F converts parallel data from the CPU into serial data. Line driver 4E sends the serial data to the display equipment via J4 for transmission to the host computer. Counter 2B clocks 1F. Counter 3D controls each parallel-to-serial conversion. Erasable programmable read-only memory (EPROM) 2G stores program data for the CPU.

4.3 DETAILED FUNCTIONAL DESCRIPTION

The PCB assembly consists of the following functional elements:

- CPU 2E
- EPROM 2G
- Switch logic
- Data input logic
- Shift register 1F
- Serial output logic
- Conversion control logic
- Decoder 2D
- Power-on reset circuit
- Timing logic
- Power supply circuit

4.3.1 CPU

The CPU controls PCB operation via the data, address, and control lines. Memory address outputs A0-11 and control output RD* go to EPROM 2G. Control outputs A12-14, MREQ*, and RFSH* go to decoder 2D. Data lines D0-7 are bidirectional. Signal RESET* from the power-on reset circuit resets the CPU at power on. A clock pulse from timing logic oscillator 3B synchronizes CPU operation.

4.3.2 EPROM 2G

EPROM 2G stores program data for the CPU. When signals ROMEN* and RD* go active, 2G transmits on lines D0-7 data stored in locations addressed by the CPU on lines A0-11. Output data bytes go to the CPU.

4.3.3 Switch Logic

Latch 1G receives switch status signals from the switch panel via J3. Signal QUAD* goes active to load the status signals into 1G. Outputs D4-7 go to the CPU.

4.3.4 Data Input Logic

Signal RST* sets flip-flop 1A-9. Each time the trackball moves, a direction signal goes to the PCB via J1. A -Y signal clocks flip-flop 1A-0, which resets. If QUAD* is active, 1C-7 inverts the 1A-9 output to become data bit D3. The +Y, +X, and -Y channels function in the same way. When the CPU is ready to read direction data, QUAD* goes active. After the CPU reads the data, RST* goes active, setting the flip-flops, which are then ready to detect another trackball movement.

4.3.5 Shift Register 1F

Shift register 1F converts parallel data from the CPU into serial data. Signal SERIAL DATA LD* goes active to load parallel data on lines D0-7 into 1F. After SERIAL DATA LD* goes inactive, the clock pulse received at input C clocks the data out at output G.

4.3.6 Serial Output Logic

Signal SERIAL DATA LD*, when active, resets flip-flop 2C-5 and sets flip-flop 2C-8. This prevents data transmission to the host computer while 1F is being loaded. After SERIAL DATA LD* goes inactive, 2C-5 transfers serial data from 1F to 2C-8, which inverts the data. Pulse BAUDCLK clocks both flip-flops. Transistor Q1 drives differential line driver 4E-6, which sends the data to the display equipment.

4.3.7 Conversion Control Logic

Signal SERIAL DATA LD* goes active to load binary counter 3D with a count of 12. After SERIAL DATA LD* goes inactive, 3D counts baudclock pulses received at input CPD, and counts down to 0. Normally active signal READY FLAG* from output TCD* goes inactive at count 12 and remains inactive until count 0.

Counter 3D, therefore, controls the period of time 12F operates. After STATUSEN* goes active, inverter 1C-13 inverts READY FLAG* to become data bit D1, which goes to the CPU. When STATUSEN* goes inactive, 1C-13 goes to a high-impedance state.

4.3.8 Decoder 2D

Decoder 2D generates five signals that control PCB operations. When signal MREQ* goes active and RFSH* goes inactive, 2D decodes bits A12-14 to derive five control signals.

4.3.9 Power-On Reset Circuit

This circuit resets the CPU and counters 2B and 3D at power on. Gates E1-4 and E1-3 are Schmitt triggers. Pin 6 of E1-4 is at ground potential when power is first applied. Therefore, signals RESET and RESET* go active. After capacitor C14 charges, pin 6 goes to +5 volts, and RESET and RESET* go inactive.

4.3.10 Timing Logic

Oscillator 3B generates the basic clock pulse that clocks the PUC and binary counter 2B. A jumper across one pair of the baud rate select terminals determines the baud rate by selecting one of the counter outputs. The selected BAUDCLK pulse clocks flip-flops 2C-5 and 2C-8. When READY FLAG* is inactive, pulse BAUDCLK also clocks 1F and counter 3D via 1E-11 and 4C-2.

4.3.11 Power Supply Circuit

Voltage regulator VR1 receives +12 volt power from the display equipment via J4-1 and J4-2 and supplies +5 volt regulated power to PCB components. When an APO1 alternate power supply is plugged into jack J2, VR1 receives power from the power supply and is disconnected from J4-1 and J4-2.

Chapter 5

MAINTENANCE

5.1 INTRODUCTION

This chapter explains how to service and maintain the trackball controller. Preventive and corrective maintenance procedures are given. After doing corrective maintenance, verify controller operation by performing the checkout procedures given in chapter 3. Do not perform any maintenance if a maintenance agreement or warranty is in effect, as this could invalidate such agreement or warranty.

CAUTION

Be careful not to cause a static discharge that may damage ICs when handling equipment. Always place one hand on a grounded conductor before touching a PCB.

5.2 PREVENTIVE MAINTENANCE

Preventive maintenance is limited to inspecting and cleaning the controller.

CAUTION

To prevent damage to equipment, disconnect the controller before inspecting or cleaning.

Use a soft brush and vacuum cleaner to remove dust. While cleaning, inspect for damage.

5.3 CORRECTIVE MAINTENANCE

The following corrective procedures should be attempted only by a qualified technician.

CAUTION

To prevent damage to equipment, disconnect the controller before removing or replacing parts or making continuity checks.

If a system problem occurs and you suspect a trackball controller fault, locate the symptom in table 5-1 and perform the suggested procedure. This table applies only to single-fault conditions.

Table 5-1. Fault Isolation Procedures

Symptom	Procedure
Power LED does not light.	Check for +5 V at J3-1. If voltage is normal, check for +5 V at LED. If voltage is normal, replace LED. If no voltage is present, check switch panel cable for continuity. If voltage is abnormally low at J3-1, check for +5 V at VR1-3. If voltage is normal, check that R4 measures 270 ohms. If R4 is normal, check for a short between J3-1 and ground. If voltage is abnormally low at VR1-3, check for +12 V at VR1-1. If voltage is normal, check C12 and C1-C11 for leakage, then check for a short between VR1-3 and ground. If no short exists, replace VR1. If voltage is abnormally low at VR1-1, check for +12 V at J4-2. If voltage is normal, check for continuity between J2-1 and J2-2. If voltage is abnormally low at J4-2, disconnect J4 and check source voltage. If source voltage is normal, check C13 for leakage, then check for a short between J4-2 and ground.
Cursor does not appear when you set VISIBLE switch to ON.	Check for +5 V at J3-1. If voltage is normal, replace switch panel assembly. If symptom persists, sequentially replace 1G, 2E, 1F, 2C, Q1, 4E, 3D, 2B, 2G, 1E, 3B, 4C, interface cable assembly.

Table 5-1. Fault Isolation Procedures (continued)

Symptom	Procedure
	If voltage at J3-1 is abnormally low, check for +5 V at VR1-3. If voltage is normal, check that R4 measures 270 ohms. If R4 is normal, check for a short between J3-1 and ground. If voltage is abnormally low at VR1-3, check C12 and C1-C11 for leakage, then check for a short between VR1-3 and ground. If no short exists, replace VR1.
Cursor does not blink when you set BLINK switch to ON.	Replace switch panel assembly. If symptom persists, sequentially replace 1G, 2E, 2G.
Cursor does not move up or down when you rotate trackball (other directions OK).	Replace trackball unit. If symptom persists, sequentially replace 1A, 1C, trackball cable assembly, 2E, 2G.
Cursor does not move left or right when you rotate trackball (other directions OK).	Replace trackball unit. If symptom persists, sequentially replace 1B, 1C, trackball cable assembly, 2E, 2G.
Cursor does not move in any direction when you rotate trackball.	Replace trackball unit. If symptom persists, sequentially replace trackball cable assembly, 2E, 2G, 1C.
Display equipment does not receive a status byte when you set TRACK switch to ON or press ENTER switch (cursor control normal).	Replace switch panel assembly. If symptom persists, replace 2E or 2G.

Chapter 6

PARTS LIST

6.1 INTRODUCTION

This chapter contains a parts list and ordering information.

6.2 PARTS LISTS

For a list of trackball controller components, refer to chapter 2. Table 6-1 lists PCB assembly components.

Table 6-1. PCB Assembly Components

Part Number	Description
509634-01	PCB, Trackball
1310154-01	IC, 8300, Low Power CPU E2
1310146-01	IC, 74C165, Parallel 8-Bit Shift Reg F1
1310150-01	IC, 74C74, Dual D Flip-Flop C2, A1, B1
1310148-01	IC, 74C193, Sync 4-Bit Binary Counter D3
1301309-00	IC, Dual Diff Line Driver E4
1301493-00	IC, 4040, 12-Bit Binary Counter B2
1310149-01	IC, 74HC138, 3-8 Line Decoder D2
1310153-01	IC, EPROM, 27C64, 8192 x 8 BIT-300ns G2
1310147-01	IC, 4044B, Quad 3st NAND R/S Latch G1
1310152-01	IC, Tri-State Inverter C1
1310151-01	IC, 4093, Quad 2-Input NAND Schmitt E1
1301374-00	IC, 48M05, + Voltage Regulator, B/T VR1
9110008-01	Oscillator, CMOS Clock, 2.4576 MHz B3
1310155-01	IC, 74C04, Hex Inverter C4
3202201-00	Diode, 1N4454, 50V, 100MA CR1
3201122-00	Xstr, 2N2222, NPN, Switch/Amp Q1
3109103-00	Res, CC, 1/4W 5% 10K ohm R1
3109102-00	Res, CC, 1/4W 5% 1000 ohm R3
3109123-00	Res, CC, 1/4W 5% 12K ohm R2
6701104-02	Cap,Cer, .1UF 50V 20% C1-C11
6706016-00	Cap, Tant, 1.0UF 35V 10% C12, C15
6706336-00	Cap, Tant, 33UF 20V 20%, Radial C13, C14
8640162-01	Jack, Pwr, 2.5mm J2
3109271-00	Res, CC, 1/4W 5% 270 ohm R4

6.3 ORDERING INFORMATION

Replacement parts are available from or through your local Ramtek office or representative. Include the following information when ordering components or parts:

- Trackball controller serial number
- Trackball controller assembly number
- Part number (with two-digit dash number and revision level)

The identification label on the underside of the controller shows the serial number.

Chapter 7

FOLDOUT ILLUSTRATIONS

This chapter consists of schematic diagram foldout sheets. This arrangement allows the reader to conveniently refer to a foldout while reading text in another chapter.

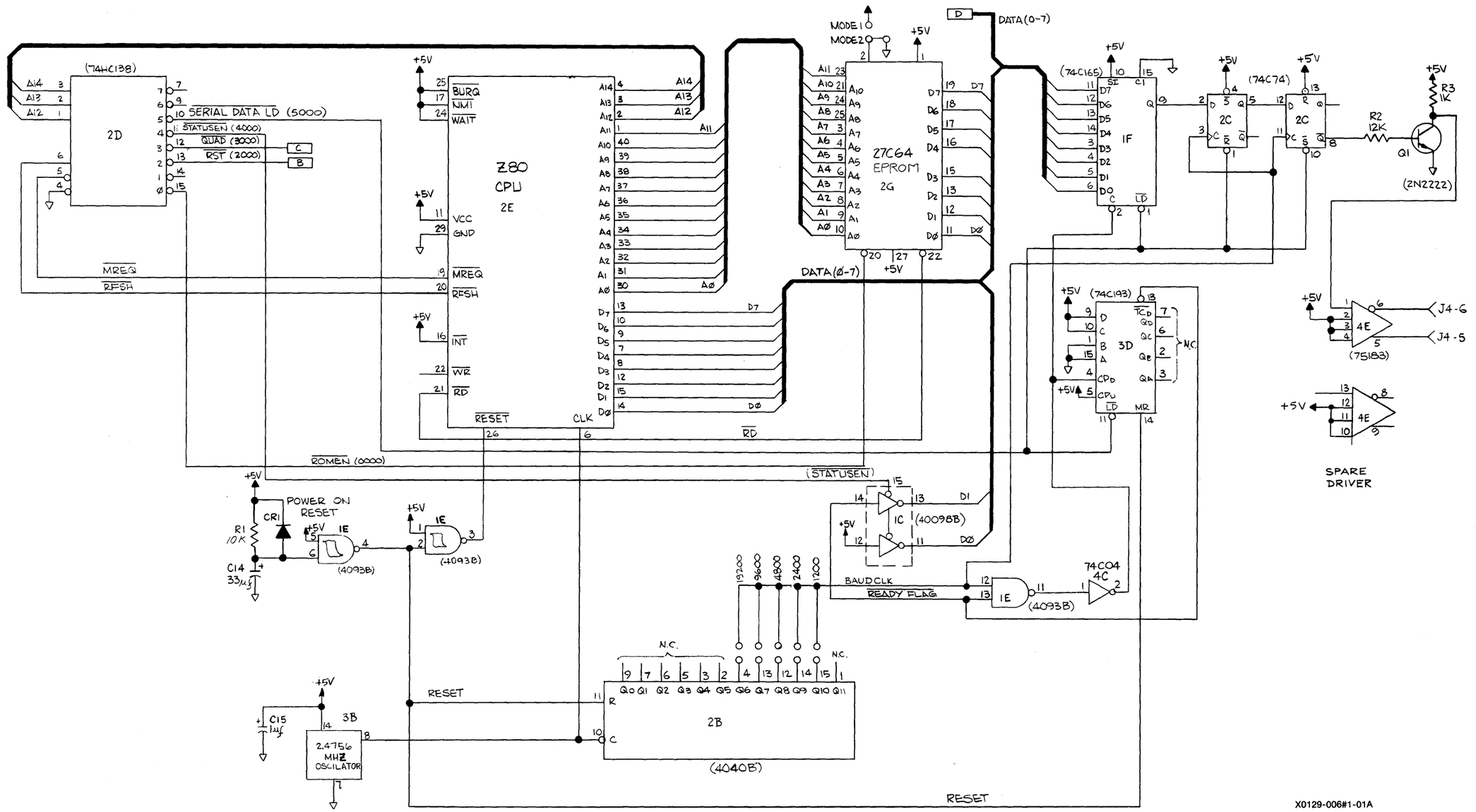

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Figure F07-1. Schematic Diagram (Sheet 1 of 2)

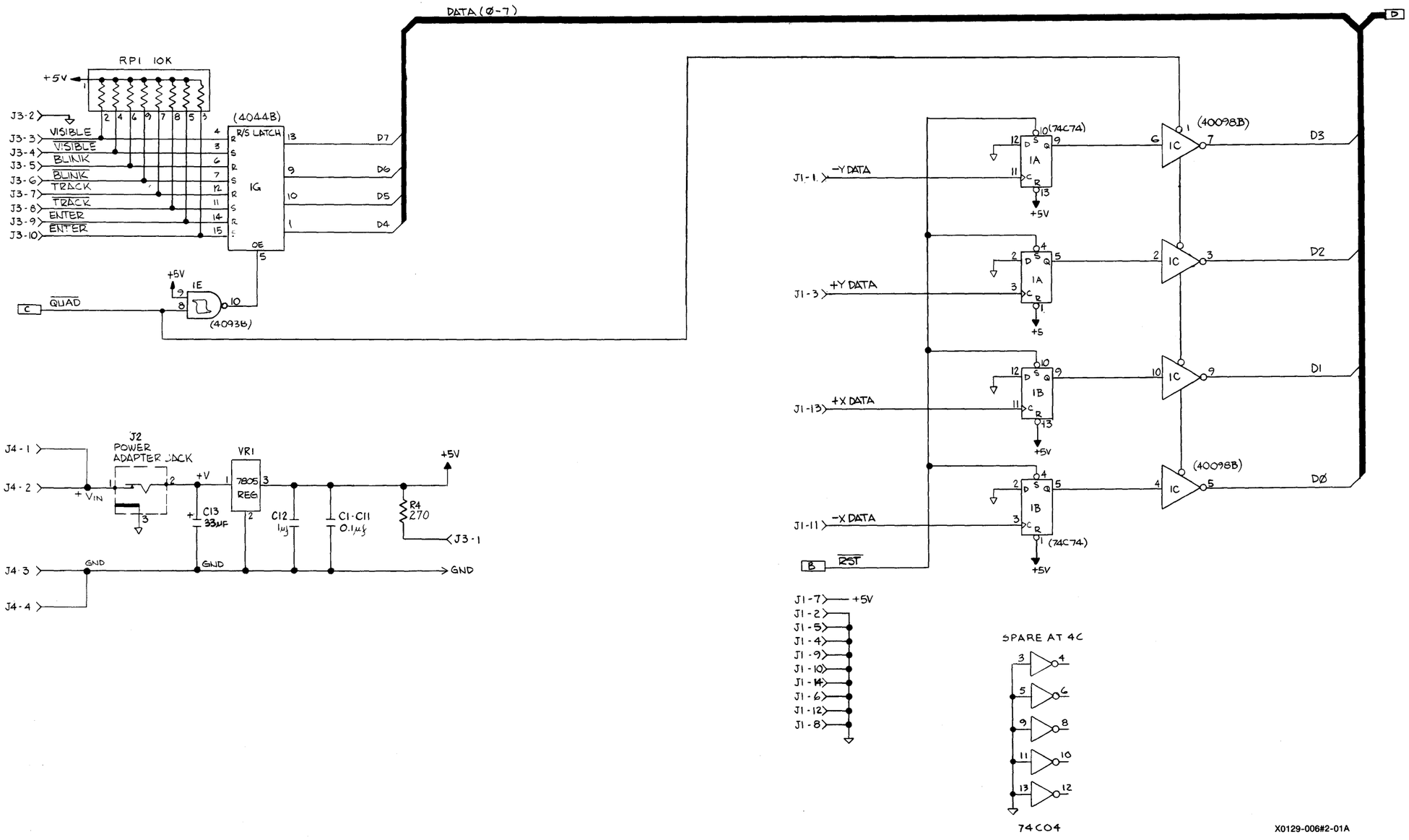

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Figure F07-1. Schematic Diagram
(Sheet 2 of 2)

Appendix

GLOSSARY

This glossary explains terms used in this manual. Some entries are unique Ramtek hardware or software terms.

Baud rate: A measure of data flow equal to the number of signal elements transferred per second. The size of the signal element varies from device to device. Baud rate equals bits per second (b/s) when each signal element is one bit.

Bit: (Binary digit) The smallest discrete information unit used in digital processing. A bit has a value of either 1 or 0.

Byte: A string of bits treated as a unit during digital processing. Traditionally, eight bits comprise a byte.

Coordinate: A value that specifies the location of any point in an n-dimensional matrix. For example, pixels in the Cartesian space of a monitor screen (a plane surface) are indexed by X and Y axis values that specify location in two dimensions relative to a common origin.

CPU: (Central processing unit) A specialized and dedicated digital logic circuit that interprets and executes binary machine instructions. A CPU usually contains several general-purpose registers, an arithmetic logic unit (ALU), one or more stack pointers, and an address counter.

CRT: (Cathode ray tube) An electronic vacuum tube with a phosphor screen that glows when excited by an electron beam. A rapidly modulated electron beam sweeps across the screen to produce a display.

Cursor: A position indicator that indicates where the next data character will appear or where the next read operation should occur on a CRT screen.

EPROM: (Erasable programmable read-only memory) A non-volatile read-only memory circuit programmed and erased with special equipment. EPROMS provide fast random access to frequently needed data and instructions.

Hexadecimal: A number system with a base of 16.

IC: (Integrated circuit) A group of circuit elements inseparably associated on or within a continuous substrate.

LED: (Light-emitting diode) A semiconductor device that lights when drawing current.

PCB: (Printed circuit board) An epoxy and fiberglass substrate that supports analog or digital electronic components connected by copper circuit traces etched on the board.

PROM: (Programmable read-only memory) A nonvolatile, user-programmable memory circuit programmable only once with special equipment. PROMs provide fast random access to frequently needed data and instructions.

Schmitt trigger: A circuit that changes state each time an input signal crosses a specified triggering level. A Schmitt trigger can produce a digital output from a slowly changing analog input.

Shift register: A temporary storage device that shifts stored data right or left in response to a control signal. With parallel loading, a shift register can function as a parallel-to-serial converter.