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OCTOPORT

Model HC-1032

ASSEMBLY 595-4090

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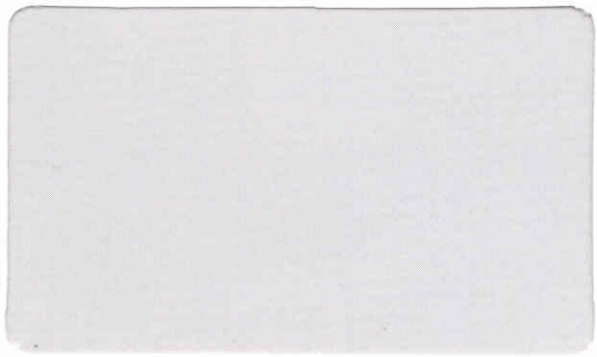
HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information **616-982-3411**
Credit **616-982-3561**
Replacement Parts **616-982-3571**

Technical Assistance Phone Numbers
(8:00 A.M. to 4:30 P.M. Eastern Time, Weekdays Only)

Education Products **616-982-3980**
Amateur Radio **616-982-3296**
Test Equipment, Weather Instruments,
Clocks **616-982-3315**
Television **616-982-3307**
Home Products, Stereo, Security, Telephone,
Marine, Automotive **616-982-3496**
Computer — Hardware **616-982-3309**



YOUR HEATHKIT 1 YEAR LIMITED WARRANTY

Consumer Protection Plan for Heathkit Consumer Products

Welcome to the Heath family. We believe you will enjoy assembling your kit and will be pleased with its performance. Please read this Consumer Protection Plan carefully. It is a "LIMITED WARRANTY" as defined in the U.S. Consumer Product Warranty and Federal Trade Commission Improvement Act. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Heath's Responsibility

PARTS — Replacements for factory defective parts will be supplied free for 1 year from date of purchase. Replacement parts are warranted for the remaining portion of the original warranty period. You can obtain warranty parts direct from Heath Company by writing or telephoning us at (616) 982-3571. And we will pay shipping charges to get those parts to you . . . anywhere in the world.

SERVICE LABOR — For a period of 1 year from the date of purchase, any malfunction caused by defective parts or materials will be corrected at no charge to you. You must deliver the unit at your expense to the Heath factory, any Heath/Zenith Computers and Electronics center (units of Veritechnology Electronics Corporation), or any of our authorized overseas distributors.

TECHNICAL CONSULTATION — You will receive free consultation on any problem you might encounter in the assembly or use of our Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

NOT COVERED — The correction of assembly errors, adjustments, calibration, and damage due to misuse, abuse, or negligence are not covered by the warranty. Use of corrosive solder and/or the unauthorized modification of the product or of any furnished component will void this warranty in its entirely. This warranty does not include reimbursement for inconvenience, loss of use, customer assembly, set-up time, or unauthorized service.

This warranty covers only Heath products and is not extended to other equipment or components that a customer uses in conjunction with our products.

SUCH REPAIR AND REPLACEMENT SHALL BE THE SOLE REMEDY OF THE CUSTOMER AND THERE SHALL BE NO LIABILITY ON THE PART OF HEATH FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO ANY LOSS OF BUSINESS OR PROFITS, WHETHER OR NOT FORESEEABLE.

Some states do not allow the exlusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Owner's Responsibility

EFFECTIVE WARRANTY DATE — Warranty begins on the date of first consumer purchase. You must supply a copy of your proof of purchase when you request warranty service or parts.

ASSEMBLY — Before seeking warranty service, you should complete the assembly by carefully following the manual instructions. Heathkit service agencies cannot complete assembly and adjustments that are customer's resonsibility.

ACCESSORY EQUIPMENT — Performance malfunctions involving other non-Heath accessory equipment (antennas, audio components, computer peripherals and software, etc.) are not covered by this warranty and are the owner's responsibility.

SHIPPING UNITS — Follow the packing instructions published in the assembly manuals. Damage due to inadequate packing cannot be repaired under warranty.

If you are not satisfied with our service (warranty or otherwise) or our products, write to our Director of Customer Service, Heath Company, Benton Harbor MI 49022. He will make certain your problems receive immediate, personal attention.

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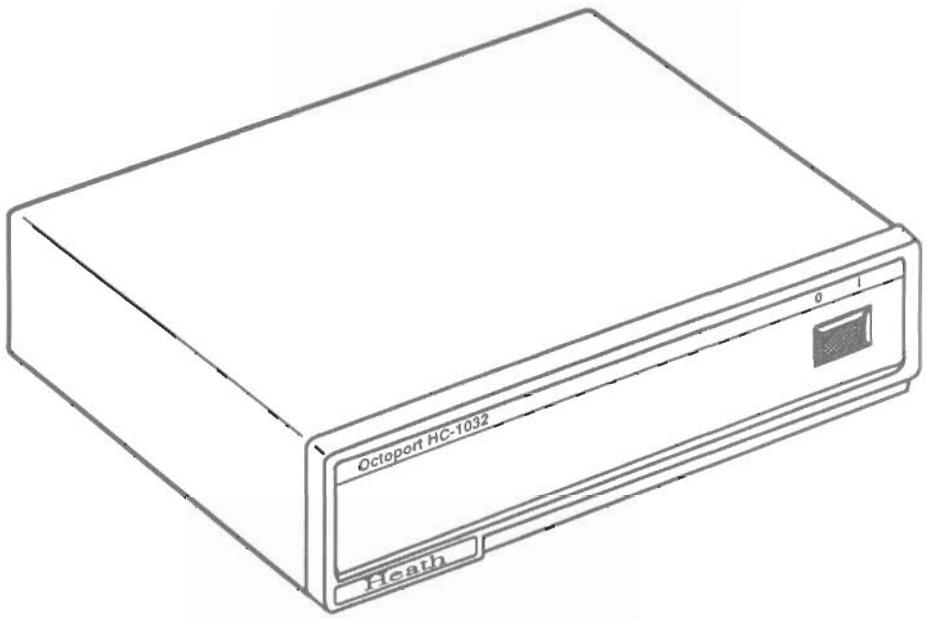
OCTOPORT

Model HC-1032

ASSEMBLY 595-4090



HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

Table of Contents

INTRODUCTION

NOTE: You can use the Octoport with all Centronics-compatible parallel peripherals, and most serial peripherals that make proper use of the RS-232C interface standard. This includes most printers, plotters, modems, and many other devices. It does not include peripherals such as a mouse or other pointing devices which make non-standard use of handshake lines.

The Heathkit Model HC-1032 Octoport is an intelligent switch box that allows you to connect and switch between computers, terminals, modems, printers, or other devices without ever flipping a switch or swapping a cable. You can combine up to eight computers and peripherals together, in pairs, in any logical arrangement you choose, and maintain up to four paths simultaneously. You can configure the Octoport from your computer or terminal by connecting to one of its serial ports, and then issuing "link" commands from the keyboard.

The Octoport also allows you to convert from serial to parallel and from parallel to serial, as well as from one baud rate to another.

Six RS-232 serial devices and two Centronics-compatible parallel devices are supported. You can configure each serial port to match the characteristics of the peripheral equipment. One of the two parallel ports is permanently configured as an output. The other parallel port can be jumper-configured as either an input or an output.

Use the Octoport in a small office as a LAN (Local Area Network) to permit several users to share printers, plotters, and modems, and to transfer files and messages to each other. A mailbox function is also available to leave memos for other serial ports.

You can give each port a name which describes the person or peripheral using that port. These names, along with any mailbox memos and configuration data, are saved in a battery-backed RAM (random access memory) so they will not be lost when you turn the Octoport off, or if there is a power failure.

A "timeout" feature automatically unlinks a port from the network after a selected time if no activity occurs on it. This frees any peripheral device should someone forget to unlink when they are finished using it.

The Octoport automatically fulfills a "link" request to a linked port as soon as that port becomes available (unlinked). Consequently, you can use the DOS (disk operating system) print spooler or a printer buffer to accomplish a number of jobs from different users, one after another.

NOTE: You will need two AA batteries to use in your Octoport. For longer life, we recommend that you use alkaline batteries (NEDA #15A).

Representative manufacturers and their type numbers are:

Bright Star 7524
Burgess AL9
Eveready E91
Mallory MN1500
Marathon 15A
RCA V51334
Ray-O-Vac 815

SPECIFICATIONS

SERIAL PORTS

Connectors	9-pin "D" connector (male pins).
Baud Rates	150, 300, 600, 1200, 2400, 4800, and 9600 baud.
Handshaking	XON/XOFF and/or hardware (input, output enables).
Other	ECHO on/off, QUIET on/off.

PARALLEL PORTS

Connectors	25-pin "D" connector (female pins). Centronics compatible.

GENERAL

Ports	Six serial, two parallel (one output, one input or output).
Port Names	Up to 8 characters. Defaults are P0 through P7.
Linkages	Can LINK any two ports (excluding two parallel outputs).
Timeout	1 to 9 minutes. Selected ports can be made to automatically unlink after a specified period of inactivity.
Command Level	May be entered with a Break sequence, or optionally with a series of three consecutive, user-specified characters, preceded and followed by at least a one-second pause.

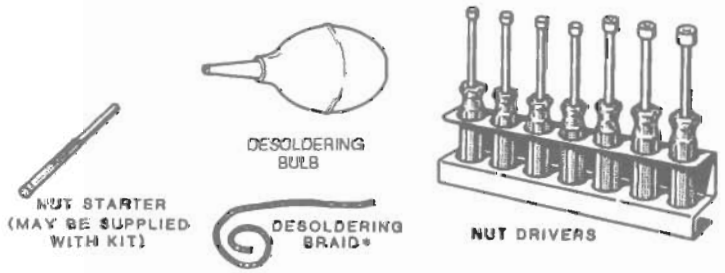
Buffer Size	256 bytes per port.
Miscellaneous	Assistance, Help, and Status commands. Auto-Link is possible if target port is not available when a LINK request is made.
Power Supply	Wall cube (9 volt AC @ 1-ampere).
Weight	4 lbs (1.814 kg).
Dimensions	6" x 8" x 3" (15.2 x 20.3 x 7.6 cm).

ASSEMBLY NOTES

TOOLS

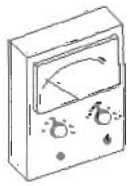
You will need these tools to assemble your kit.

OTHER HELPFUL TOOLS



*To Remove Solder from Circuit Connections

SOLDERING IRON (22 to 25 WATTS)



VOM, VTVM, OR DMM

ASSEMBLY

1. Follow the instructions carefully. Read the entire step before you perform each operation.

2. The illustrations in the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue to use that Pictorial until you are referred to another Pictorial for another group of steps.

3. Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.

4. Position all parts as shown in the Pictorials.

5. Solder instructions are generally given only at the end of a series of similar steps. You may solder more often if you desire.

6. Each circuit part in an electronic kit has its own component number (R2, C2, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

   — In the Parts List,

   — At the beginning of each step where a component is installed,

   — In some illustrations,

   — In the Schematic,

   — In the section at the rear of the Manual.

7. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

SAFETY WARNINGS:

Avoid eye injury when you cut off excessive lead lengths. Hold the leads so they cannot fly toward your eyes.

Solder contains lead, which can be harmful to your health. Try to avoid breathing in the fumes while you are soldering, and wash your hands with soap and water after handling the solder.

SOLDERING

Soldering is one of the most important operations you will perform while assembling your kit. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board foil. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

It is easy to make a good solder connection if you follow a few simple rules:

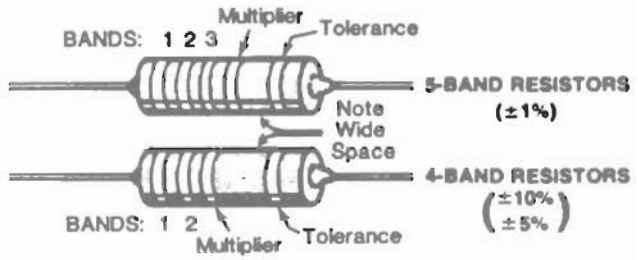
1. Use the proper type of soldering iron. A 22- to 25-watt pencil soldering iron with a 1/8" or 3/16" chisel or pyramid tip works best.

2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called "tinning," and it will protect the tip and enable you to make good connections. When the solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned.

NOTE: Always use rosin core, radio-type solder (60:40 tin-lead content) for all of the soldering in this kit. This is the type we have supplied with the parts. The Warranty will be void and we will not service any kit in which acid core solder or paste flux has been used.

IDENTIFYING RESISTORS

Resistors are identified in Parts Lists and steps by their resistance value in Ω (ohms), kΩ (kilohms), or MΩ (megohms). They are usually identified by a color code of four or five color bands, where each color represents a number. See the "Resistor Color Code" chart. These colors are given in the steps in their proper order (except the last band, which indicates a resistor's "tolerance"; see the "Resistor Tolerance Chart"). You do not need to memorize the color codes.



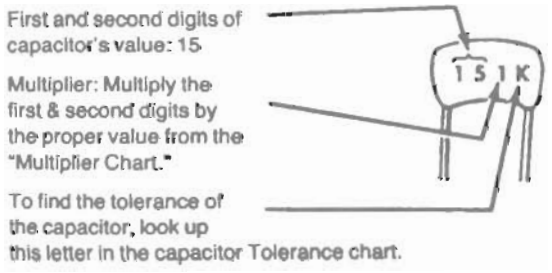
Occasionally, a "precision" or "power" resistor may have the value stamped on it. The letter R, K, or M may also be used at times to signify a decimal point, as in

2R2 = 2.2 Ω
2K2 = 2.2 kΩ, or 2200 Ω
2M2 = 2.2 MΩ

Precision resistors may also be marked as shown in the following examples. The values of the multipliers are shown in the "Multiplier Chart," and the tolerance values are shown in the "Resistor Tolerance" chart.

IDENTIFYING CAPACITORS

Capacitors should be called out by their capacitance value in µF (microfarads) or pF (picofarads) and type: ceramic, Mylar®, electrolytic, etc. Some capacitors may use the E.I.A. (Electronic Industries Association) marking system described in the following example:



RESISTOR COLOR CODE

	Band 1	Band 2 (if used)	Band 3	Multiplier
Color	1st Digit	2nd Digit	3rd Digit	
Black	0	0	0	1
Brown	1	1	1	10
Red	2	2	2	100
Orange	3	3	3	1,000
Yellow	4	4	4	10,000
Green	5	5	5	100,000
Blue	6	6	6	1,000,000
Violet	7	7	7	10,000,000
Gray	8	8	8	100,000,000
White	9	9	9	—
Silver	—	—	—	.01
Gold	—	—	—	.1

RESISTOR TOLERANCE

	COLOR OR LETTER	
± 10%	SILVER	
± 5%	GOLD	J
± 2%	RED	G
± 1%	BROWN	F
± 0.5%	GREEN	D
± 0.25%	BLUE	C
± 0.1%	VIOLET	B
± 0.05%	GRAY	

MULTIPLIER CHART

FOR THE NUMBER:	MULTIPLY BY:	FOR THE NUMBER:	MULTIPLY BY:
0	1	4	10,000
1	10	5	100,000
2	100	8	0.01
3	1000	9	0.1

CAPACITOR TOLERANCE CHART

LETTER	10 pF OR LESS	OVER 10 pF
B	± 0.1 pF	
C	± 0.25 pF	
D	± 0.5 pF	
F	± 1.0 pF	± 1%
G	± 2.0 pF	± 2%
H		± 3%
J		± 5%
K		± 10%
M		± 20%

EXAMPLES: 151 K = 15 X 10 = 150 pF
759 = 75 X 0.1 = 7.5 pF

NOTE: The letter "R" may be used at times to signify a decimal point, as in: 2R2 = 2.2 (pF or µF).

CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack 1 and check each part against the following list. The key numbers correspond to the numbers on the "Circuit Board Parts Pictorial." Do not remove components that are supplied on a tape from the tape until you use them in a step. Return any part that is in an individual envelope back into the envelope after you have identified it until that part is called for in a step. Do not throw away any packing material until you account for all the parts.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual.

A replacement part may look slightly different than the original part, or may have different printing on it. In any case, the performance of the replacement part will meet or exceed the requirements of the original part. For example: A 15-volt capacitor (10 µF, 15 V) may be replaced with a 25-volt capacitor (10 µF, 25 V).

RESISTOR PACK

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A1	9-177	1	4700 Ω (4.7K OR 472)	RP103

CAPACITORS

Ceramic

B1	21-22	2	220 pF (220)	C115, C117
B2	21-786	1	.1 µF (104) axial-lead	C183

Electrolytic

B3	230-900-1	2	1 µF	C144, C152
B3	25-924	1	2.2 µF	C151
B3	25-917-1	1	10 µF	C114
B3	25-885	4	100 µF	C148, C149, C150, C160
B4	25-877	1	2200 µF	C142

WIRE — CABLES

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
C1	348-1	24"	Magnet wire	
C2	347-55	6"	8-wire ribbon cable (may be individual wires)	
C3	134-2014	6	6-wire cable w/9-pin connector	
C4	134-2015	2	25-wire cable w/connector	

HARDWARE

NOTE: Hardware is shown full size in the Parts Pictorial so you can place any screw, nut, etc., you are uncertain about over the illustration. The hardware may be packed in more than one envelope. Open all of the hardware envelopes before you check the screws, nuts, lockwashers, etc. against the Parts List.

D1	810-14	4	M2.5 x 5 mm screw
D1	810-9	1	M3 x 6 mm screw
D2	810-23	2	M3 x 10 mm screw

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
HARDWARE (Cont'd.)				
D3	810-5	4	M2.5 nut	
D3	811-6	2	M3 nut	
D4	812-14	4	M2.5 lockwasher	
D4	812-15	3	M3 lockwasher	
D5	231-421	1	M3 threaded spacer	
CONNECTORS — PLUGS — SOCKETS				
E1	230-8467	13	Wire socket	
E2	432-866	4	Spring connector	
E3	432-1041	17	Jumper socket	
E4	432-1265	17	3-pin plug	
E5	432-1451	1	4-pin plug	
E6	432-1216	1	4-hole socket	
E7	434-230	1	8-pin IC socket	
E7	434-298	10	14-pin IC socket	
E7	434-299	2	16-pin IC socket	
E7	434-311	3	20-pin IC socket	
E7	434-312	4	28-pin IC socket	
E7	434-253	4	40-pin IC socket	
TRANSISTORS — INTEGRATED CIRCUITS (ICs)				
F1	417-801	2	MPSA20 transistor	Q103, Q105
F1	417-874	1	2N3906 transistor	Q104
F2	417-818	1	MJE181 transistor	Q101
F2	417-819	1	MJE171 transistor	Q102
F3	442-53	1	NE555 IC	U125
F4	442-54	1	UA7805 IC	U124
F1	442-627	1	78L05 IC	U126
F3	443-794	3	MC1488 or 75188 IC	U102, U104, U106
F3	443-795	3	MC1489 or 75189 IC	U101, U103, U105
F3	443-1175	2	74HC32 IC	U114, U118
F3	443-1308	1	74HC04 IC	U113
F3	443-1309	1	74HC74 IC	U120
F3	443-1311	1	74HC138 IC	U116
F3	443-1331	2	74HC373 IC	U121, U123
F3	443-1382	1	74HC374 IC	U122
F3	443-1383	1	74HC123 IC	U119
F3	443-1703	1	84C0006 IC	U112
F3	443-1704	2	84C3006 IC	U110, U111
F3	443-1705	3	84C4206 IC	U107, U108, U109
F3	443-1553	1	6264/5864 IC	U115
F3	444-852	1	Programmed EPROM (available only from Heath Company)	U117
MISCELLANEOUS				
G1	75-152	2	Transistor insulator	
	85-3419	1	Circuit board (may be located in the bottom of the carton)	
G2	150-507	1	4.9152 MHz crystal oscillator	Y101
G3	214-71	2	Battery holder	
G4	215-677	2	Heat sink	
G5	352-13	1	Silicone grease	
G6	412-644	1	LED	D114
G7	436-60	1	Power socket	S101
G8	475-33	4	RF core	L104 - L107
G9	490-111	1	IC puller	
G10	230-8469	1	Metric nut starter	
G10	490-5	1	Standard nut starter	
G11	490-185	1	Desoldering braid	
	597-260	1	Parts Order Form*	
		1	Assembly Manual (see Page 1 for part number.)	
			Solder	
Binder Parts (Previously assembled)				
	597-4460	1	Binder cover	
	701-233	1	3-ring assembly	
	485-70		Binder fastner	

NOTE: Transistors and integrated circuits may be marked for identification in any one of the following four ways:

1. Part number.
2. Type number. (For integrated circuits, this refers only to the numbers and letters shown in **BOLD** print. Disregard any other numbers or letters shown on the IC.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

CAUTION: Some of the integrated circuits can be easily damaged by static electricity. DO NOT remove ICs that are installed in conductive foam pads until you are instructed to do so.

*May be packed inside the Assembly Manual. Set them aside for use later.

TAPED COMPONENTS

The remaining parts are supplied on taped strips. It is not necessary to check them against the following list.

RESISTORS

All 5% resistors have four color bands (last band gold). The fourth band is a tolerance band and will not be called out.

All resistors are rated at 1/4-watt unless noted otherwise.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
6-681-12	1	680 Ω, 1/2-watt (blu-gry-brn)	R132
6-102-12	15	1000 Ω (brn-blk-red)	R123, R127, R131, R136 - R139, R141 - R147
6-222-12	1	2200 Ω (red-red-red)	R125
6-472-12	16	4700 Ω (yel-viol-red)	R106, R108 - R116, R117, R118, R119, R121, R122, R140, R148
6-103-12	16	10 kΩ (brn-blk-org)	R100, R101, R102, R103, R104, R105, R107, R110, R120, R126, R128, R129, R130, R133, R134, R135
6-223-12	1	22 kΩ (red-red-org)	R124

CAPACITORS

Axial-Lead Ceramic

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
21-84	1	.001 µF (102)	C146
21-785	22	22 pF (220)	C116, C118 C119, C121 - C129, C131 - C139 C141
21-763	12	330 pF (331)	C101 - C109, C111 - C113
21-786	30	.1 µF (104)	C140, C143, C147, C153 - C159, C161 - C169, C171 - C179, C181, C182

DIODES

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
56-25	1	1N4744 Zener	D117
56-56	4	1N4149	D101, D108, D109, D110
56-655	3	1N6263 or SD101A	D111, D115, D116
57-42	4	1N5401	D102 - D105
57-65	4	1N4002	D106, D107, D112, D113

RF CHOKE

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
475-12	4	1.7 µH	FB101 - FB104

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 1-1 for the following notes and steps.

NOTES:

1. Many circuit board drawings, such as the one shown in Pictorial 1-1, are divided into sections. You will be working on each of these sections in a specific series of steps.

2. In each series of steps, you will install parts in a top-to-bottom, left-to-right, sequence. In some cases, you may be directed to install parts out of sequence due to their various heights. You will install the shorter parts first.

3. Check off each step as you perform it. You may also wish to place a check mark near each component on the Pictorial as you install it.

4. In general, solder instructions are given only at the end of a series of similar steps; you may solder more often if you wish.

5 The circuit boards have foil on both sides, but only one side has component (parts) outlines shown on it. This is called the **"component side,"** while the other side is called the **"foil side."**

( ) Position the circuit board as shown in the Pictorial with the component side up. Always install components on the component side of the circuit board and solder the leads to the foil on the other side, unless a step directs you otherwise.

( ) Remove the "Taped Components Chart" from the last pages (C1 through C4) of the Manual. Make sure you read the instructions at the top of the chart before you use it. Note that it is divided into numbered sections which correspond to the numbered sections on the circuit board pictorial.

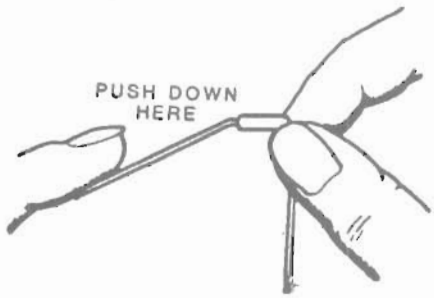
( ) Tape the component strips onto the Taped Components Chart as directed.

In the following steps, you will be given detailed instructions on how to install and solder the first component on the circuit board. Read and perform each step carefully. Then use the same procedure to install the remaining components on the circuit board.

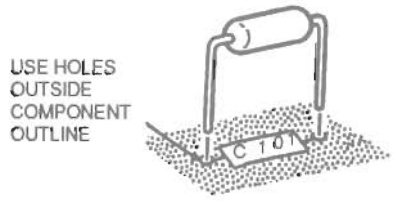
IMPORTANT: The components are in assembly sequence. Make sure that you do not install a component out of sequence; otherwise, the remaining components could also be out of sequence.

Section 1

( ) Cut the first component, a 330 pF (331) axial-lead capacitor, from the Taped Components Chart as outlined in the instructions. Then hold the capacitor by the body as shown and bend the leads straight down with your finger to fit the circuit board hole spacing.



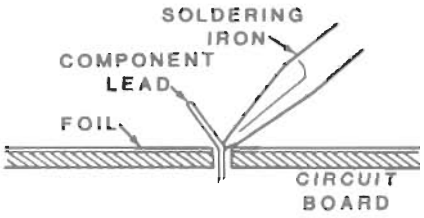
( ) C101: Start the capacitor leads into their circuit board holes at the indicated location. Make sure that you insert the leads in the circuit board holes that are outside the component outline and not into any holes that may be inside the outline.



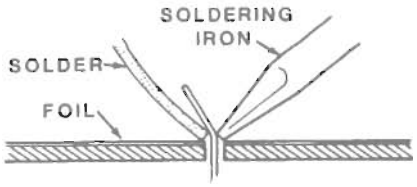
( ) Press the capacitor body against the circuit board and bend the leads outward slightly to hold it in place.

Solder the capacitor leads to the circuit board as follows:

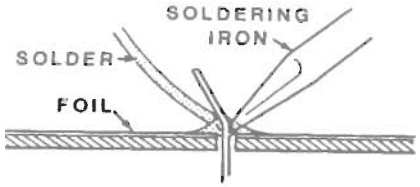
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat both for two or three seconds.



2. Apply solder to the other side of the connection. IMPORTANT: Let the heated lead and the circuit board foil melt the solder.



3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.



NOTE: If you should accidentally fill a circuit board hole with solder and wish to clear it, use the desoldering braid supplied with your kit for this purpose. The instructions are on the package.

( ) Cut off the excess lead lengths close to the connection. **WARNING:** Clip the leads so the ends will not fly toward your eyes.

( ) Check each solder connection and compare it to Detail 1-1A. After you have checked the connections, proceed with the assembly. Use the same soldering procedure for each component.

IMPORTANT: Make sure you installed the first component on Page 1-4 before you proceed, then continue to install components in **Section 1** of the circuit board.

( ) C102: 330 pF (331) axial-lead ceramic capacitor.

Install .1 µF (104) axial-lead ceramic capacitors at the following four locations:

( ) C153.
( ) C156.
( ) C165.
( ) C162.

Install 1000 Ω (brn-blk-red) resistors at the following four locations:

( ) R136.
( ) R135.
( ) R137.
( ) R138.

Install .1 µF (104) axial-lead ceramic capacitors at the following three locations:

( ) C175.
( ) C174.
( ) C157.

( ) R100: 10 kΩ (brn-blk-org) resistor.

( ) Solder the leads to the foil and cut off the excess lead lengths.

Section 2

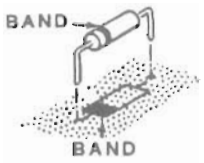
Install 330 pF (331) axial-lead ceramic capacitors at the following four locations:

( ) C105.
( ) C106.
( ) C103.
( ) C104.

Install .1 µF (104) axial-lead ceramic capacitors at the following three locations:

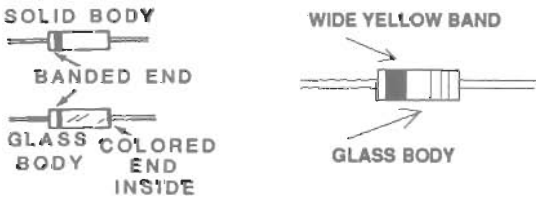
( ) C154.
( ) C158.
( ) C182.

NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. The circuit will not work properly if a diode is installed backwards.



CAUTION: ALWAYS POSITION THE BANDED END OF A DIODE AS SHOWN ON THE CIRCUIT BOARD.

If your diode has a solid body, the band is clearly defined. If your diode has a glass body, do not mistake the colored end inside the diode for the banded end. Look for a band painted on the outside of the glass. The 1N4149 diodes (#56-56) have yel-blk-yel-wht color bands on them. Use the **wide yellow** band as the "banded end" whenever you install these diodes.



( ) D111: 1N6263/5D101A (#56-655) diode.

( ) D110: 1N4149 (#56-56) diode.

Install 1000 Ω (brn-blk-red) resistors at the following four locations:

( ) R141.
( ) R139.
( ) R142.
( ) R143.

Install .1 µF (104) axial-lead ceramic capacitors at the following four locations:

( ) C177.
( ) C176.
( ) C155.
( ) C166.

Install 10 kΩ (brn-blk-org) resistors at the following three locations:

( ) R128.
( ) R130.
( ) R129.

( ) D109: 1N4149 (#56-56) diode.

( ) Solder the leads to the foil and cut off the excess lead lengths.

Section 3

Install 330 pF (331) axial-lead ceramic capacitors at the following four locations:

( ) C107.
( ) C108.
( ) C109.
( ) C111.

Install .1 µF (104) axial-lead ceramic capacitors at the following three locations:

( ) C179.
( ) C178.
( ) C159.

Install 1000 Ω (brn-blk-red) resistors at the following four locations:

( ) R145.
( ) R144.
( ) R146.
( ) R147.

Install 330 pF (331) axial-lead ceramic capacitors at the following two locations:

( ) C112.
( ) C113.

Install 4700 Ω (yel-viol-red) resistors at the following three locations:

( ) R119.
( ) R121.
( ) R122.

( ) FB103: 1.7 µH RF choke.

( ) C121: 22 pF (220 or 22K) axial-lead ceramic capacitor.

( ) R106: 4700 Ω (yel-viol-red) resistor.

( ) C161: .1 µF (104) axial-lead ceramic capacitor.

( ) R127: 1000 Ω (brn-blk-red) resistor.

( ) R126: 10 kΩ (brn-blk-org) resistor.

( ) R125: 2200 Ω (red-red-red) resistor.

( ) D108: 1N4149 (#56-56) diode.

( ) Solder the leads to the foil and cut off the excess lead lengths.

Section 4

Install 22 pF (220 or 22K) axial-lead ceramic capacitors at the following three locations:

( ) C141.
( ) C138.
( ) C139.

( ) D116: 1N6263/SD101A (#56-655) diode.

Install .1 µF (104) axial-lead ceramic capacitors at the following four locations:

( ) C173.
( ) C169.
( ) C163.
( ) C164.

( ) R120: 10 kΩ (brn-blk-org) resistor.

( ) R131: 1000 Ω (brn-blk-red) resistor.

( ) R140: 4700 Ω (yel-viol-red) resistor.

Install 22 pF (220 or 22K) axial-lead ceramic capacitors at the following seven locations:

( ) C137.
( ) C136.
( ) C135.
( ) C134.
( ) C133.
( ) C123.
( ) C122.

Install 4700 Ω (yel-viol-red) resistors at the following two locations:

( ) R117.
( ) R118.

( ) C116: 22 pF (220) axial-lead ceramic capacitor.

( ) R105: 10 kΩ (brn-blk-org) resistor.

( ) FB104: 1.7 µH RF choke.

Install .1 µF (104) axial-lead ceramic capacitors at the following two locations:

( ) C172.
( ) C168.

( ) Solder the leads to the foil and cut off the excess lead lengths.

Section 5

Install 22 pF (220 or 22K) axial-lead ceramic capacitors at the following three locations:

( ) C129.
( ) C131.
( ) C132.

Install 4700 Ω (yel-viol-red) resistors at the following eight locations:

( ) R108.
( ) R116.
( ) R109.
( ) R115.
( ) R111.
( ) R114.
( ) R113.
( ) R112.

Install 10 kΩ (brn-blk-org) resistors at the following three locations:

( ) R104.
( ) R103.
( ) R107.

( ) D101: 1N4149 (#56-56) diode.

( ) R101: 10 kΩ (brn-blk-org) resistor.

Install 22 pF (220 or 22K) axial-lead ceramic capacitors at the following three locations:

( ) C128.
( ) C127.
( ) C126.

( ) R110: 10 kΩ (brn-blk-org) resistor.

( ) D115: 1N6263/SD101A (#56-655) diode.

Install .1 µF (104) axial-lead ceramic capacitors at the following two locations:

( ) C171.
( ) C167.

( ) R148: 4700 Ω (yel-viol-red) resistor.

( ) Solder the leads to the foil and cut off the excess lead lengths.

Section 6

Install 22 pF (220 or 22K) axial-lead ceramic capacitors at the following four locations:

( ) C124.
( ) C125.
( ) C119.
( ) C118.

Install 1.7 µH RF chokes at the following two locations:

( ) FB101.
( ) FB102.

( ) R102: 10 kΩ (brn-blk-org) resistor.

( ) C143: .1 µF (104) axial-lead ceramic capacitor.

( ) D117: 1N4744 (#56-25) zener diode.

Install 1N4002 (#57-65) diodes at the following four locations:

( ) D113.
( ) D112.
( ) D107.
( ) D106.

Install .1 µF (104) axial-lead ceramic capacitors at the following two locations:

( ) C181.
( ) C147.

( ) C146: .001 µF (102) axial-lead ceramic capacitor.

NOTE: Do not install a part at C146 at this time.

( ) R124: 22 kΩ (red-red-org) resistor.

( ) R123: 1000 Ω (brn-blk-red) resistor.

Install 1N5401 (#57-42) diodes at the following four locations:

( ) D105.
( ) D102.
( ) D104.
( ) D103.

( ) C140: .1 µF (104) axial-lead ceramic capacitor.

Install 10 kΩ (brn-blk-org) resistors at the following three locations:

( ) R133.
( ) R134.
( ) R149.

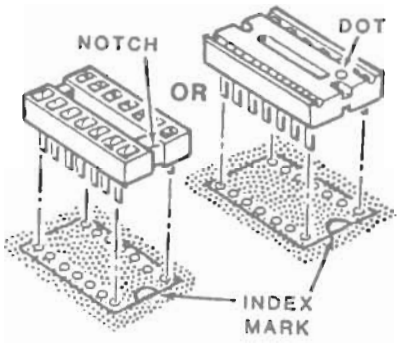
( ) R132: 680 Ω, 1/2-watt (blu-gry-brn) resistor.

( ) Solder the leads to the foil and cut off the excess lead lengths.

Refer to Pictorial 1-2 for the following steps.

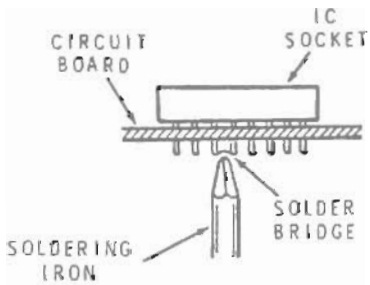
Section 1

NOTE: Before you install an IC socket, make sure the pins are straight. If there is any kind of identification mark (notch, dot, arrowhead, etc,) at or near one end of the socket, place this marked end toward the index mark on the circuit board. Then start the pins into the circuit board holes.



Hold the socket in place while you turn the board over and lay it on top of the socket on your work surface. The board will hold the socket in place. At first, solder only two pins at diagonally opposite corners of the socket. When the solder cools, check to make sure the socket is tight against the circuit board. If not, reheat the pins while you press against the socket to reseat it. Then solder the remaining pins to the foil.

NOTE: A solder bridge may occur when you make solder connections at closely spaced foils. Therefore, after each solder step, carefully inspect the foil for solder bridges and remove any that have formed. To remove a solder bridge, hold the circuit board foil-side-down as shown, and hold the soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip to clear the bridge.



Install 14-pin IC sockets at the following six locations:

( ) U101.
( ) U102.
( ) U103.
( ) U104.
( ) U105.
( ) U106.

Section 2

Install 40-pin IC sockets at the following three locations:

( ) U107.
( ) U108.
( ) U109.

( ) 28-pin IC socket at U110.

Install 20-pin IC sockets at the following three locations:

( ) U123.
( ) U122.
( ) U121.

( ) 14-pin IC socket at U120.

( ) 16-pin IC socket at U119.

( ) 14-pin IC socket at U118.

( ) 8-pin IC socket at U125.

Section 3

( ) 16-pin IC socket at U116.

( ) 40-pin IC socket at U112.

Install 28-pin IC sockets at the following three locations:

( ) U115.
( ) U117.
( ) U111.

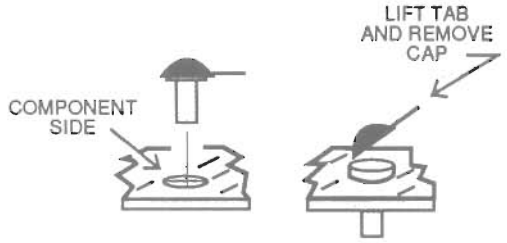
Install 14-pin IC sockets at the following two locations:

( ) U113.
( ) U114.

Refer to Pictorial 1-3 for the following steps.

Section 1

When you install wire connectors in the following steps, insert the pins into the circuit board holes with the square outlines. Press each pin into the hole as far as the plastic cap, then turn the board over and solder the pin to the foil. You can use masking tape to hold the pins in place. Be careful not to use too much heat. Once the solder cools, remove and discard the cap from the connector.



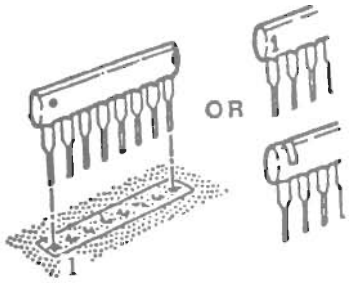
Install wire connectors at the following twelve locations:

( ) Hole 7.
( ) Hole 6.
( ) Hole 14.
( ) Hole 13.
( ) Hole 21.
( ) Hole 20.
( ) Hole 28.
( ) Hole 27.
( ) Hole 35.
( ) Hole 34.
( ) Hole 42.
( ) Hole 41.

Section 2

You will install the following components out of sequence.

When you install the resistor pack in the following step, position the end with the dot, bar, or number "1" toward the "1" printed on the circuit board. Solder the pins to the foil after you install the resistor pack.

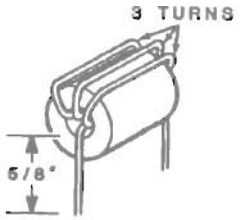


( ) RP103: 4700 Ω (472) resistor pack.

( ) Locate the magnet wire and cut four 4-1/2" pieces. Discard the remaining wire.

( ) Insert one end of the wire into a ferrite bead until the end protrudes 5/8".

( ) Wrap three turns of wire through each of the four ferrite beads as shown. Then cut the lead ends so they are even.

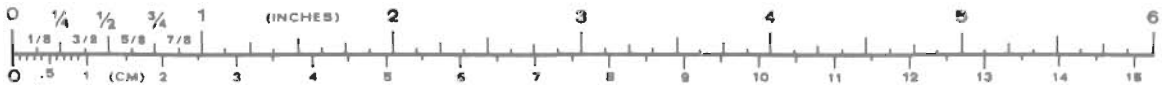


( ) Use a piece of sandpaper or a knife to remove 1/2" of the lacquer coating from the wire ends of the ferrite beads. Make sure the wire ends are free of the coating; otherwise they will not solder properly.

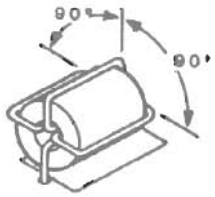
Install the ferrite beads at the following four locations:

( ) L104.
( ) L105.
( ) L106.
( ) L107.

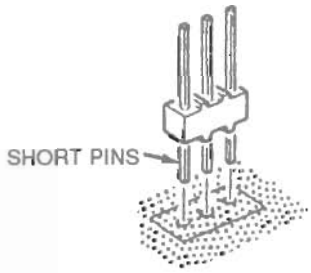
( ) Solder the leads to the foil and cut off the excess lead lengths.



( ) Spread the three turns on each of the four ferrite beads approximately 90° apart as shown.



Insert the shorter pin ends of each 3-pin plug into the circuit board holes at the indicated location. Make sure the pins are perpendicular and that the body is flat against the board and solder the pins to the foil.



Install 3-pin plugs at the following eleven locations and solder each one to the foil:

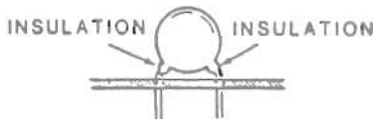
( ) $\overline{A.FD}$.
( ) $\overline{INIT}$.
( ) $\overline{SLCT}$ $\overline{IN}$.
( ) $\overline{A.FD}$
( ) $\overline{ERROR}$.
( ) $\overline{INIT}$.
( ) $\overline{SLCT}$ $\overline{IN}$.
( ) PE.
( ) SLCT.
( ) P105.
( ) P103.

Section 3

Install 3-pin plugs at the following five locations and solder each one to the foil:

( ) P106.
( ) P101.
( ) P100.
( ) P102.
( ) P104.

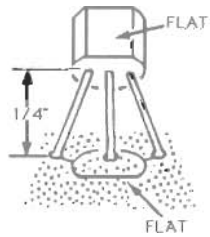
NOTE: When you mount ceramic capacitors in the following steps, do not push the leads all the way through the circuit board holes. The leads have a coating of insulation that may keep you from making a good solder connection.



( ) C115: 220 pF (221) ceramic capacitor.

( ) C117: 220 pF (221) ceramic capacitor.

NOTE: Whenever you install a transistor, as in the following step, position it so the flat side is over the flat of the outline on the circuit board, as shown. Then insert the leads into their circuit board holes and position the bottom of the case 1/4" above the board. Bend the transistor leads out slightly on the foil side of the board to hold it in place. Solder the leads to the foil and cut off the excess lead lengths.



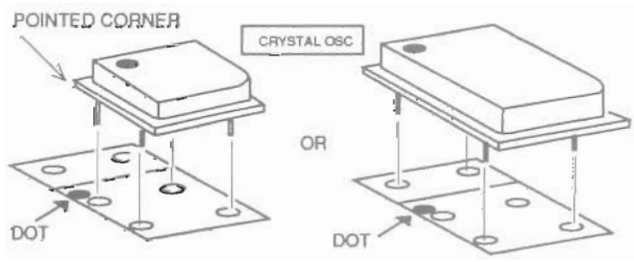
( ) Q105: MPSA20 (#417-801) transistor.

( ) Solder the leads to the foil and cut off the excess lead lengths.

Section 4

NOTE: You will install the components in this section out of sequence.

( ) Install the 4.9152 MHz crystal oscillator (#150-507) at Y101 so that the dot or the pointed corner on the case is toward the dot shown on the circuit board. Be sure to use the holes shown in the illustration. Solder the oscillator to the foil and cut off any excess pin lengths.



( ) Wire connector at hole TP. Solder the pin to the circuit board after you install it.

( ) P116: 3-pin plug. Solder the pins to the foil.

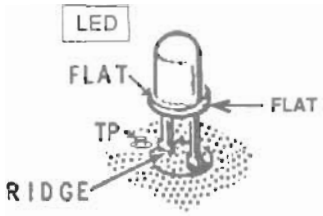
( ) P117: 4-pin plug. Position the plug with the **flange toward the double line** shown on the circuit board, then solder the pins to the foil.

( ) Q103: MPSA20 (#417-801) transistor.

( ) Q104: 2N3906 (#417-814) transistor.

( ) U126: **78L05** (#442-627) IC. NOTE: This IC looks and mounts the same as the previous transistor.

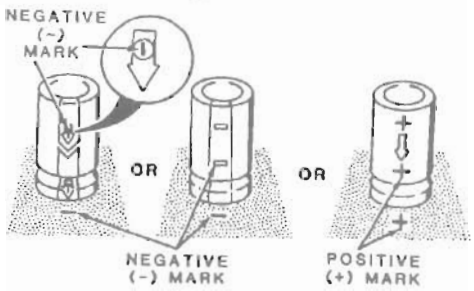
( ) D114: Position the case flat of the LED away from wire connector TP as shown. Then insert the LED leads into the circuit board holes as far as the ridge and solder the leads to the foil. Cut off the excess lead lengths.



Refer to Pictorial 1-4 for the following steps.

In this Pictorial, you will install components in the following order: all of the electrolyitic capacitors, the power socket, the battery holders, and finally the remaining semiconductors (transistors & ICs). You will be working across the board from left to right.

NOTE: Before you install an electrolytic capacitor, look at it and identify the leads. One lead will have either a negative (-) mark or a positive (+) mark near it on the side of the capacitor. (The marking for a negative lead may look like an oblong bar, sometimes with a circle around it, inside an arrow.). Be sure to install the the negative lead in the negative-marked hole, and the positive lead in the positive-marked hole.



Install electrolytic capacitors at the following locations:

( ) C152: 1 µF electrolytic capacitor.

( ) C151: 2.2 µF electrolytic capacitor.

( ) C114: 10 µF electrolytic capacitor.

( ) C148: 100 µF electrolytic capacitor.

( ) C144: 1 µF electrolytic capacitor.

( ) C149: 100 µF electrolytic capacitor.

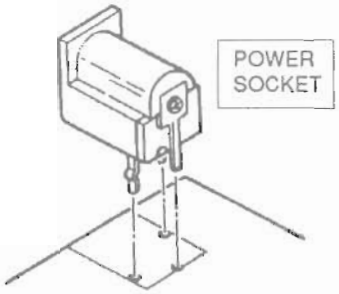
( ) C150: 100 µF electrolytic capacitor.

( ) C160: 100 µF electrolytic capacitor.

( ) C142: 2200 µF electrolytic capacitor.

( ) Solder the leads to the foil and cut off the excess lead lengths.

( ) Install the power socket at S101 as shown. Solder the pins to the foil and cut off the excess pin lengths.



( ) Cut the leads of a .1 µF axial-lead ceramic capacitor to 1/2".

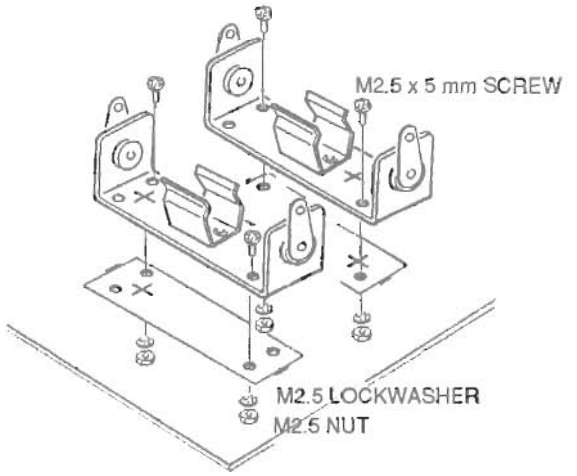
( ) Turn the circuit board over so the foil side faces up.

( ) Refer to inset drawing #1 on Pictorial 1-4 and form the leads of the prepared .1 µF axial-lead ceramic capacitor to fit the spacing of the indicated foil pads of S101. Solder the formed capacitor leads to the foil pads of the circuit board, adding as much extra solder as necessary to make good connections. After the connections cool, cut off any excess lead lengths.

( ) Turn the circuit board over and reposition it as shown in Pictorial 1-4.

NOTE: Use the nut starter that was supplied with your kit to hold and start the nuts on the screws.

( ) Install the battery holders at the two indicated circuit board locations. Position the holders with the positive (+) polarity mark stamped on the inside toward the (+) marks shown on the circuit board. Mount the holders to the circuit board at either opposite corner mounting holes with M2.5 x 5 mm screws, M2.5 lockwashers, and M2.5 nuts as shown. NOTE You may have to thread the screws through the battery holder mounting holes.



Install IC UA**7805** (#442-54) at the indicated location as shown using the following numbered steps:

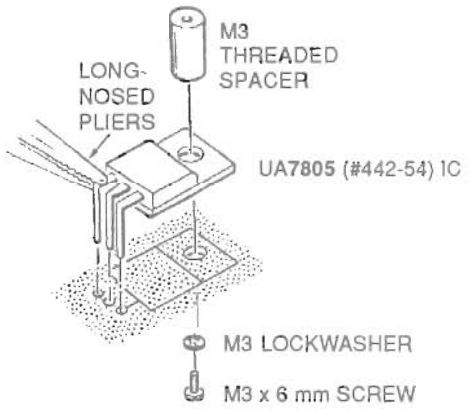
( ) 1. Place the IC against the circuit board at U124 so the mounting holes align.

( ) 2. Note the location where the leads cross the circuit board mounting holes and mark them with a pencil.

( ) 3. Bend the leads straight down at the pencil marks using a pair of long-nosed pliers to fit the hole spacing.

( ) 4. Mount the UA**7805** (#442-54) IC to the circuit board at U124 (shown at the top of the right column) with an M3 x 6 mm screw, an M3 lockwasher, and an M3 threaded spacer. NOTE: The spacer may have a hex shape at one end. You can position it either way.

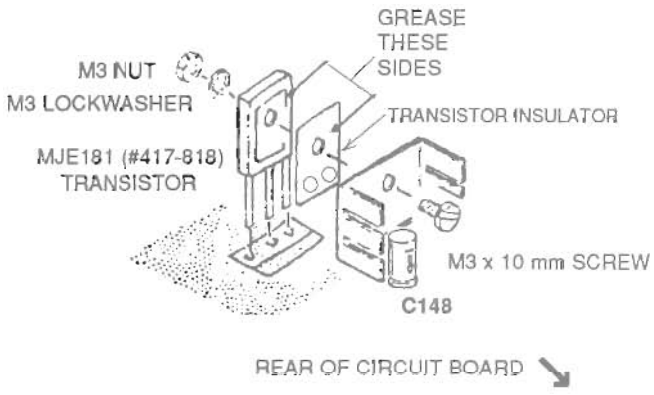
( ) 5. Solder the IC leads to the foil and cut off the excess lead lengths.



Install transistor MJE181 (#417-818) on the circuit board at Q101 as shown below using the following numbered steps:

( ) 1. Refer to inset drawing #2 and cut a small opening in the silicone grease container.

( ) 2. Position a heat sink with the mounting hole and flanges as shown. Do not get any of the grease on your clothing or furniture, otherwise, professional cleaning may be required. Also, if you get any of the grease on your hands, wash them after you finish using it.



( ) 3. Spread a small amount of silicone grease on one side of a transistor insulator. Then press the coated side against the heat sink with the flanges as shown so the mounting holes align. If there are extra holes in your insulator, disregard them.

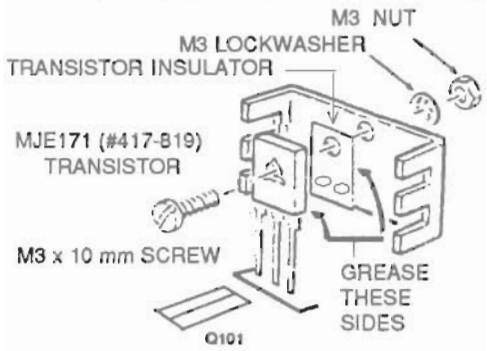
( ) 4. Spread a small amount of silicon grease on the bare metal side of transistor MJE181 (#417-818). Then mount the transistor to the heat sink and insulator with an M3 x 10 mm screw, an M3 lockwasher, and an M3 nut.

( ) Q101: Insert the transistor assembly leads into the circuit board holes at Q101 so the base of the heat sink is just above any components. If the insulator extends past the bottom of the heat sink, position the assembly so the bottom of the insulator just touches the board and solder the leads to the foil. The heat sink will surround C148. Cut off the excess lead lengths. Keep the transistor perpendicular to the board.

Install transistor MJE171 (#417-819) on the circuit board at Q102 as shown below using the following numbered steps:

( ) 1. Position a heat sink with the mounting hole and flanges as shown.

( ) 2. Spread a small amount of silicone grease on one side of a transistor insulator. Then press the



coated side against the heat sink with the flanges as shown so the mounting holes align.

( ) 3. Spread a small amount of silicone grease on the bare metal side of transistor MJE171 (#417-819). Then mount the transistor to the heat sink and insulator with an M3 x 10 mm screw, an M3 lockwasher, and na M3 nut.

( ) Q102: Position the heat sink flanges around the transistor assembly at Q101 and insert the transistor assembly leads into the circuit board holes at Q102 so the base of the heat sink is just above any components. If the insulator extends past the bottom of the heat sink, position the assembly so the bottom of the insulator just touches the board and solder the leads to the foil. Cut off the excess lead lengths. Keep the transistor perpendicular to the board.

( ) Discard the remaining silicone grease.

CIRCUIT BOARD WIRING

Refer to Pictorial 1-5 for the following steps.

NOTE: When you are instructed to prepare a wire, as in the following step, and if the wires are not separate, separate the specified wire color from the 6" 8-wire cable. Use a pair of diagonal cutters to begin to separate the wires (see the inset drawing). Cut the wire to the indicated length and remove 1/4" of insulation from each end. Twist the fine wire strands tightly together and apply a small amount of solder to hold the fine strands together.

( ) Prepare the following wires:

1-1/8" brown
1-1/8" red
1-1/4" gray
1-1/2" orange
Two 1-1/2" yellow
1-1/2" green

NOTE: Whenever you are instructed to connect wires to the circuit board holes, insert each wire into the circuit board hole as directed in the step and solder it to the foil. Then cut off the excess wire length.

Refer to Detail 1-5A for the following steps.

( ) Connect and solder one end of the 1-1/8" brown wire to the negative terminal of battery holder 1 and the other end to circuit board hole "-".

( ) Connect and solder one end of the 1-1/8" red wire to the positive terminal of battery holder 2 and the other end to circuit board hole "+".

( ) Connect and solder one end of the 1-1/4" gray wire to the negative terminal of battery holder 2 and the other end of the wire to the positive terminal of battery holder 1.

( ) On the remaining prepared wires, cut the 1/4" bare wire ends on one end only to 1/8".

( ) Refer to Detail 1-5B and crimp and solder a spring connector on the 1/8" end of each of the four remaining prepared wires.

Refer to Detail 1-5B and insert the spring connectors on the end of each prepared wire into the large holes of the four-hole socket as follows. Position the socket with the slots facing up and the spring connectors with the locking tabs up as shown. Press each connector into its indicated hole until it locks into place.

( ) Either yellow wire into hole 4.

( ) Other yellow wire into hole 3.

( ) Green wire into hole 2.

( ) Orange wire into hole 1.

You will connect the other end of these wires later. Set the assembly aside and discard the remaining 8-wire cable.

Connect the free wires on the end of a 6-wire cable w/ connector to the following circuit board holes.

( ) Black wire to hole 5.

( ) Red wire to hole 3.

( ) Brown wire to hole 1.

( ) Yellow wire to hole 4.

( ) Green wire to hole 2.

( ) Push the end of the orange wire into wire socket 6. NOTE: Do not solder the wire to the connector.

Connect the free wires on the end of a second 6-wire cable w/connector to the following circuit board holes.

( ) Black wire to hole 12.

( ) Red wire to hole 10.

( ) Brown wire to hole 8.

( ) Yellow wire to hole 11.

( ) Green wire to hole 9.

( ) Push the end of the orange wire into wire socket 13. Do not solder the wire to the connector.

Connect the free wires on the end of a third 6-wire cable w/connector to the following circuit board holes.

( ) Black wire to hole 19.

( ) Red wire to hole 17.

( ) Brown wire to hole 15.

( ) Yellow wire to hole 18.

( ) Green wire to hole 16.

( ) Push the end of the orange wire into wire socket 20. Do not solder the wire to the connector.

Connect the free wires on the end of a fourth 6-wire cable w/connector to the following circuit board holes.

( ) Black wire to hole 26.

( ) Red wire to hole 24.

( ) Brown wire to hole 22.

( ) Yellow wire to hole 25.

( ) Green wire to hole 23.

( ) Push the end of the orange wire into wire socket 27. Do not solder the wire to the connector.

Connect the free wires on the end of a fifth 6-wire cable w/connector to the following circuit board holes.

( ) Black wire to hole 33.

( ) Red wire to hole 31.

( ) Brown wire to hole 29.

( ) Yellow wire to hole 32.

( ) Green wire to hole 30.

( ) Push the end of the orange wire into wire socket 34. Do not solder the wire to the connector.

Connect the free wires on the end of the remaining 6-wire cable w/connector to the following circuit board holes.

( ) Black wire to hole 40.

( ) Red wire to hole 38.

( ) Brown wire to hole 36.

( ) Yellow wire to hole 39.

( ) Green wire to hole 37.

( ) Push the end of the orange wire into wire socket 41. Do not solder the wire to the connector.

NOTE: Each 25-wire cable w/connector is broken into two bundles. One bundle has a **single black wire** in it and and will be referred to as "**bundle #1.**" The other bundle has **eight black wires** and will be referred to as "**bundle #2.**" Make sure you refer to the correct bundle (1 or 2) in the following steps.

Connect the wires coming from "bundle #1" of a 25-wire cable w/connector to the front row of circuit board holes as follows.

( ) Brown wire to hole 68.

( ) Red wire to hole 69.

( ) Orange wire to hole 70.

( ) Yellow wire to hole 71.

( ) Green wire to hole 72.

( ) Blue wire to hole 73.

( ) Violet wire to hole 74.

( ) Gray wire to hole 75.

( ) White wire to hole 76.

( ) Black wire to hole 77.

Separate the following three wires coming from "bundle #2" and cut off the first section of each wire as far as the cable tie. **Do not pull the wires out** of the cable tie. You will not use these wires:

( ) Red wire.
( ) Orange wire.
( ) Green wire.

( ) Connect and solder the brown wire coming from "bundle #2" to **front row** hole 78.

Similarly connect the remaining wires coming from "bundle #2" to the back row of circuit board holes as follows:

( ) Yellow wire to hole 79.

( ) Blue wire to hole 80.

( ) Violet wire to hole 81.

NOTE: Connect the remaining black wires to the following eight circuit board holes:

( ) Hole 82.
( ) Hole 83.
( ) Hole 84.
( ) Hole 85.
( ) Hole 86.
( ) Hole 87.
( ) Hole 88.
( ) Hole 89.

On the second 25-wire cable w/connector, connect the wires coming from "bundle #1" to the front row of circuit board holes as follows:

( ) Brown wire to hole 43.

( ) Red wire to hole 44.

( ) Orange wire to hole 45.

( ) Yellow wire to hole 46.

( ) Green wire to hole 47.

( ) Blue wire to hole 48.

( ) Violet wire to hole 49.

( ) Gray wire to hole 50.

( ) White wire to hole 51.

( ) Black wire to hole 52.

Connect the wires coming from "bundle #2" to the front row of circuit board holes as follows:

( ) Brown wire to hole 53.

( ) Red wire to hole 54.

( ) Orange wire to hole 55.

Connect the wires coming from "bundle #2" to the back row of circuit board holes as follows:

( ) Yellow wire to hole 56.

( ) Green wire to hole 57.

( ) Blue wire to hole 58.

( ) Violet wire to hole 59.

NOTE: Connect the remaining black wires to the following eight circuit board holes:

( ) Hole 60.
( ) Hole 61.
( ) Hole 62.
( ) Hole 63.
( ) Hole 64.
( ) Hole 65.
( ) Hole 66.
( ) Hole 67.

You will mount the "D" connectors later.

( ) Turn the circuit board over so the foil side faces up.

( ) Cut a 2-1/4" piece of blue wire from the leftover ribbon cable. Remove 1/16" of insulation from one end of the wire and 3/8" of insulation from the other end.

( ) Twist the fine wire strands tightly together and apply a small amount of solder to hold the strands in place.

Refer to the large inset in Pictorial 1-5 for the next two steps.

( ) Solder the 3/8" prepared end of the 2-1/4" blue wire between the foil pads at pins 13 and 1 of IC U120. Make sure you use enough solder to make a good connection and be careful not to create a solder bridge.

( ) Solder the 1/16" prepared end of the 2-1/4" blue wire to the foil pad at pin 6 of IC U113.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following possible problems:

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns. NOTE: Refer to the "X-Ray Views" if you are uncertain and want to see the correct foil patterns.

( ) Protruding leads which could touch together or short to the chassis when the circuit board is mounted later.

Refer to the illustrations where the parts were installed as you make the following visual checks:

( ) Transistors for the proper type and installation.

( ) Diodes for the proper type and positioning of the banded end.

( ) LED for the proper positioning of the case flat.

( ) Electrolytic capacitors for the correct position of the positive (+) or negative (-) markings.

IC INSTALLATION

CAUTION: Integrated circuits (ICs) are complex electrical devices that perform many complicated operations in a circuit. Read all of the following information before you install the ICs.

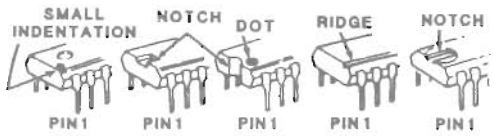
Some of the ICs used in this kit may be MOS (metal-oxide semiconductor) devices; these ICs are shipped in a foam pad or tube to protect them. These are rugged and reliable devices. However, if you do not handle them properly when you remove them from the protective foam pad or tube and install them, they can be damaged by static electricity. Other ICs may be of a type that are not susceptible to static electricity. Nevertheless, treat all ICs as if they were MOS, and this will help insure that no ICs will be damaged.

If the pins on the IC are bent out at an angle, as shown below, they will not line up with the holes in the IC socket. Do not try to install the IC without first bending the pins as described below or you may damage them or the socket, and cause an intermittent contact.

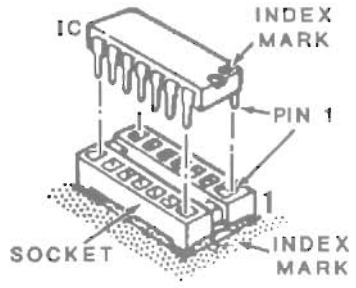
Remove the IC from its protective foam pad or tube, but **do not let go of it until it is installed in its socket.** Hold the IC in one hand and place your other hand on your work surface before you touch the IC to your work surface. This will equalize the static electricity between the work surface and the IC.

Very carefully roll the IC toward the pins to bend the lower pins into line. Then turn the IC over and bend the pins on the other side in the same manner.

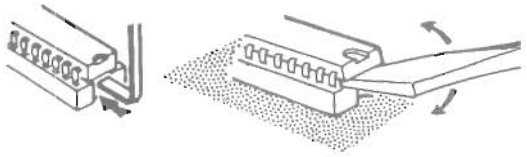
Compare the IC to the drawing shown below. Then determine which end of the IC is the pin 1 end.



Hold the IC in one hand and the circuit board in the other. Then position the pin 1 end of the IC over the index mark on the circuit board and start the pins into the socket. Make sure that all of the pins are started; then push the IC down firmly. NOTE: An IC pin can become bent under the IC and it will look as though it is correctly installed in the socket.



If it is ever necessary to remove an IC from its socket, use an IC lifter (if one was supplied with your kit) or a small-bladed screwdriver as shown. Push it between the IC and the socket and carefully lift the IC free. If any IC pins become bent, carefully straighten them.



Refer to Pictorial 1-6 for the following steps.

Section 1

Install ICs at the following locations.

( ) U101: MC**1489** or **75189** IC (#443-795).

( ) U102: MC**1488** or **75188** IC (#443-794).

( ) U103: MC**1489** or **75189** IC (#443-795).

( ) U104: MC**1488** or **75188** IC (#443-794).

( ) U105: MC**1489** or **75189** IC (#443-795).

( ) U106: MC**1488** or **75188** IC (#443-794).

( ) U120: **74HC74** IC (#443-1309).

( ) U119: **74HC123** IC (#443-1383).

( ) U118: **74HC32** IC (#443-1175).

( ) U125: NE555 IC (#442-53).

Section 4

( ) U116: **74HC138** IC (#443-1311).

( ) U112: **Z84C0006** IC (#443-1703).

( ) U115: **6264/5864** IC (#443-1553).

( ) U117: **Programmed EPROM** IC (#444-852).

( ) U111: **84C3006** IC (#443-1704).

( ) U113: **74HC04** IC (#443-1308).

( ) U114: **74HC32** IC (#443-1175).

( ) Recheck each IC for the proper type and installation.

This completes the circuit board assembly. Set it aside until it is called for later.

CHASSIS

PARTS LIST

Remove the remaining parts from the carton and check each part against the following list. The key numbers correspond to the numbers on the "Chassis Parts Pictorial." Return any part that is in an individual envelope back into the envelope after you have identified it until that part is called for in a step. Do not throw away any packing material until you account for all the parts.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual.

A replacement part may look slightly different than the original part, or may have different printing on it. In any case, the performance of the replacement part will meet or exceed the requirements of the original part. For example: A 15-volt capacitor (10 µF, 15 V) may be replaced with a 25-volt capacitor 10 µF, 25 V).

HARDWARE

NOTE: Hardware is shown full size in the Parts Pictorial so you can place any screw, nut, etc., you are uncertain about over the illustration. The hardware may be packed in more than one envelope. Open all of the hardware envelopes before you check the screws, nuts, lockwashers, etc. against the Parts List.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A1	810-9	12	M3 x 6 mm screw	
A2	811-6	8	M3 nut	
A3	812-15	24	M3 lockwasher	
A4	252-2	16	4-40 nut	
A5	255-757	16	Hex spacer	

METAL PARTS

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
B1	90-1403-1	1	Cabinet top	
B2	200-1580-1	1	Chassis	
B3	203-2388-1	1	Rear panel	
B4	203-2389-1	1	Front panel	
B5	210-144	1	Bezel	

MISCELLANEOUS

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
C1	60-679	1	Rocker switch w/LED	SW101
C2	150-267	1	Power cube	
C3	261-49	4	Foot	
	448-549	1	5-1/4" software diskette	
	448-550	1	3-1/2" software diskette	
	134-2167	1	Serial interface cable	

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 2-1 for the following steps.

( ) Position the chassis as shown.

( ) Mount the rear panel to the chassis with two M3 x 6 mm screws. Slide the panel back away from the center of the chassis as far as it will go before you tighten the screws.

( ) Position the front panel into the bezel. Then insert the eight front panel studs into the chassis front holes and secure the assembly with eight M3 lockwashers and M3 nuts.

( ) SW101: Position the rocker switch w/LED so the LED is to the right and press the switch into the front panel cutout until it snaps into place.

Locate the 4-hole socket w/wires that you assembled and set aside earlier. Then refer to the inset drawing and connect the free end of each wire to the lugs of switch SW101 as follows. Solder each connection after you make it.

( ) Yellow wire from hole 4 to lug 1.

( ) Yellow wire from hole 3 to lug 2.

( ) Green wire from hole 2 to lug 3.

( ) Orange wire from hole 1 to lug A.

You will connect the socket later.

Refer to Pictorial 2-2 for the following steps.

( ) Position the cables coming from the circuit board out of the way and loosely mount the board to the chassis studs with four M3 x 6 mm screws. When all of the screws are installed, tighten them securely. NOTE: If the power socket is not even with the inside of the rear panel, loosen the panel screws and position it so it is even; then tighten the screws.

( ) Connect the 4-hole socket coming from SW101 over plug P117. The plug is polarized to fit only one way.

Mount the following six 9-hole connectors coming from the cable assemblies with the longest row of pins along the top as shown. Use two hex spacers, two M3 lockwashers, and two 4-40 nuts at each connector. Center each connector in its chassis cutout before you tighten the hardware.

( ) Port 1 (from circuit board holes 8 through 13).
( ) Port 0 (from circuit board holes 1 through 6).
( ) Port 3 (from circuit board holes 22 through 27).
( ) Port 2 (from circuit board holes 15 through 20).
( ) Port 5 (from circuit board holes 36 through 41).
( ) Port 4 (from circuit board holes 29 through 34)

Mount the following two 25-hole connectors coming from the cable assemblies with the longest row of holes along the top as shown. Use two hex spacers, two M3 lockwashers, and two 4-40 nuts at each connector. Do not overtighten the hardware. Center each connector in its chassis cutout before you tighten the hardware.

( ) Port 6 (from circuit board holes 43 through 67).

( ) Port 7 (from circuit board holes 68 through 89).

( ) Route the cables neatly against the back edge of the board.

( ) Refer to Detail 2-2A and install the AA batteries into their battery holders with the (+) and (-) terminals as shown. NOTE: The batteries will last as long as their normal shelf life. We recommend that you replace them once each year.

( ) Refer to Detail 2-2B and position the chassis upside down on your work surface.

( ) Remove the backing paper from the four feet and press them at the corners of the chassis at the locations shown.

( ) Remove the backing from the FCC label and press it on the chassis bottom at the indicated location.

( ) Reposition the chassis in its normal position with the front panel facing you.

This completes the assembly of your Octoport.

INITIAL TESTS

The following tests will verify that your Octoport is operating properly. Two sets of tests are provided, one for use with a PC-compatible computer, the other for use with a terminal or a computer running a terminal emulation program. Perform the set of tests that is appropriate for your installation. Besides confirming proper operation, this section will help you to familiarize yourself with your Octoport's functions.

In some of the following steps you will be instructed to install jumper sockets over the various 3-pin plugs on the circuit board. When you install a socket, make sure it is over the center pin and the indicated outer pin. The pin designations are printed on the circuit board.

TESTING WITH A COMPUTER

Refer to Pictorial 3-1 for the following steps.

1. Make sure the Octoport is turned off.

2. If it has not already been done, install jumper sockets over the following circuit board plugs:

   P100 - P106: "O" end.
   P107: "LO" end.
   P108 - P115: "HI" end.
   P116: "RESET" end.

3. Move the jumper socket on P116 to the "NORM" end. The unit has now been reset to default conditions.

4. Plug the end of the power cube cable into the Octoport power connector.

5. Connect the power cube to an AC outlet.

6. Connect the supplied serial interface cable between port P0 on the Octoport and serial port COM1 or COM2 on the computer, and turn the computer on.

7. Press the Octoport power switch to "1." The LED should light.

8. Install the software disk supplied with your Octoport into your computer's drive A and run the TEM.COM program by typing **A: <ENTER>** and then **TEM <ENTER>**. (If you connected the Octoport to port COM2, type **TEM/2 <ENTER>** .)

9. Press the **ENTER** key on the computer twice. The **CMD?** prompt should appear. NOTE: If you accidentally press a key other than ENTER, the Octoport will not be able to determine the baud rate, and you will have to turn it off and back on and repeat this step. If the prompt still does not appear, refer to the "In Case of Diffculty" section of this manual.

10. Press **S <ENTER>** , and you should see the status display. Notice that port P6 is shown as an output. Also notice that only port 0 is presently in "Command" mode, and that no ports are linked to each other.

11. Move the cable from port P0 to port P1.

12. Press function key **F9**. After about a second the **CMD?** prompt should appear.

13. Repeat step 12 for each of the remaining serial ports (2-5). The **CMD?** prompt should appear at each port.

14. Move the cable back to port P0. You have now tested all six of the serial ports. By pressing the **F9** key, each serial port was placed in Command mode. Press **S <ENTER>** to verify this.

If you have a Centronics-compatible printer, you may check parallel output ports P6 and P7 by continuing with step 15. Otherwise, proceed to step 21.

15. Using an appropriate cable, connect your printer to port P6. Type **L P6 <ENTER>**. This links your computer to port P6. Press **S <ENTER>** to verify this.

16. Make sure your printer is turned on and is on line. Press the **ESC** key. This takes port P0 out of Command mode so that the characters you type will not be interpreted as commands by the Octoport, but will pass directly to the printer. Type a string of text and press **<ENTER>**. The string should be printed. This prints one line only with no line feed.

17. Return port P0 to command mode by pressing **F9**. The **CMD?** prompt will appear.

18. Type **U <ENTER>**. This Unlinks port P0 from port P6.

19. Connect your printer to port **P7** and type **L P7 <ENTER>** to link to port P7. Repeat step 16 to test port P7.

20. Press **F9** to return to Command mode, then type **U <ENTER>** to Unlink from port P7.

21. If you plan to use port P6 as an input from your computer's parallel port, or wish to confirm that it is functional as an input, continue with step 22. Otherwise, proceed to step 30.

NOTE: You will need an appropriate 25-wire, straight through cable (such as the Heath HCA-84) to connect between your computer's parallel output port and port P6 on the Octoport.

22. Turn your Octoport off.

23. Move the seven jumper sockets at P100 through P106 to the "I" side of the plugs.

24. Connect a parallel interface cable between port P6 and the parallel port on the computer.

25. Turn the Octoport on.

26. Type **S <ENTER>**. You will see that port P6 is now listed as an input.

27. Type **L P6 <ENTER>** to link to port P6, then press **ESC** to exit Command mode.

28. Exit the TEM program and enter DOS by pressing function key **F10** and then **Y**. Make sure that the computer is configured so that the PRINT command will send output data to the parallel port. (Refer to your computer manual if necessary.) Print a small text file.

29. Type **TEM <ENTER>** (or **TEM/2 <ENTER>** if you are using COM2). You should see the file being printed on your screen. (Your Octoport is converting the parallel data from your computer to serial and returning it to the serial port for the TEM program to display.) Wait until the end of the file has been reached.

30. Turn your Octoport off for about 15 seconds, then back on. The **CMD?** prompt should appear immediately. This verifies that your Octoport's battery backup circuitry is working properly.

31. Type **Z <ENTER>** and then **Y** to reset the Octoport.

32. Turn your Octoport off and proceed to "Installation."

TESTING WITH A TERMINAL

Refer to Pictorial 3-1 for the following steps.

1. Make sure the Octoport is turned off.

2. If it has not already been done, install jumper sockets over the following circuit board plugs:

P100 - P106:	"O" end.
P107:	"LO" end.
P108 - P115:	"HI" end.
P116:	"RESET" end.

3. Move the jumper socket on P116 to the "NORM" end. The unit has now been reset to default conditions.

4. Plug the end of the power cube cable into the Octoport power connector.

5. Connect the power cube to an AC outlet.

6. Connect the supplied serial interface cable between port P0 on the Octoport and the (DTE) serial port on the terminal, and turn the terminal on.

7. Press the Octoport power switch to "1." The LED should light.

8. Press the **ENTER** key on the terminal several times until the **CMD?** prompt appears. NOTE: If you accidentally press a key other than ENTER, or if the **CMD?** prompt does not appear after pressing **ENTER** eight times, turn the Octoport off and return to step 7. If it still does not appear, refer to the "In Case of Difficulty" section of this manual.

9. Press **S <ENTER>** , and you should see the status display. Notice that port P6 is shown as an output. Also notice that only port 0 is presently in 'Command' mode, and that no ports are linked to each other.

10. Move the interface cable from port P0 to port P1.

11. If your terminal has a BREAK key, hold it down until the **CMD?** prompt appears. (On some terminals you may have to press the BREAK key three times.) If your terminal does not have a BREAK key, press the "+" key three times. The **CMD?** prompt should appear after one second. (Make sure that you wait at least one second before pressing the "+" key the first time.)

12. Repeat step 11 for each of the remaining serial ports (2-5). The **CMD?** prompt should appear at each port.

13. Move the cable back to port P0. You have now tested all six of the serial ports. By pressing the **BREAK** key or "+" key three times, each serial port was placed in Command mode. Press **S <ENTER>** to verify this.

If you want to test the parallel ports, you will need a Centronics-compatible printer. Continue with step 14 to make these tests or proceed to step 20.

14. Using an appropriate cable, connect your printer to port P6. Type **L P6 <ENTER>**. This links your terminal to port P6. Press **S <ENTER>** to verify this.

15. Make sure your printer is turned on and is online. Press the **ESC** key. This takes port P0 out of Command mode so that the characters you type will not be interpreted as commands by the Octoport but will pass directly to the printer. Type a string of text and press **<ENTER>**. The string should be printed with no line feed.

16. Return port P0 to command mode as you did in step 11. The **CMD?** prompt will appear.

17. Type **U <ENTER>**. This Unlinks port P0 from port P6.

18. Connect your printer to port P7 and type **L P7 <ENTER>** to link to port P7. Repeat step 15 to test port P7.

19. Return Port P0 to command mode as you did in step 11.

20. Turn your Octoport off for about 15 seconds, then back on. The **CMD?** prompt should appear immediately. This verifies that your Octoport's battery backup circuitry is working properly. Type **Z <ENTER>** and then **Y** to reset the Octoport.

21. Turn your Octoport off and proceed to "Installation."

INSTALLATION

Refer to Pictorial 3-1 and use the following procedure to install the Octoport in your system.

( ) Determine what device you want to connect to each port. Remember that Port P0 is the master port, and so generally must be accessible by a terminal or a computer capable of acting as a terminal.

( ) Determine the handshaking requirements of each serial device. You will need to know what handshaking outputs are provided and which handshaking inputs are required. (Refer to the individual operation manuals for each device for this information.)

In general, you can apply the following information to your equipment:

1. Data Communications Equipment (DCE) devices, such as most printers and plotters, will use the Clear-to-Send (CTS) output to indicate when they are capable of receiving information on the transmit Data (TD) circuit. The busy condition is usually indicated by a negative level. In the case of a printer, this line will go into a busy state when the printer is taken off line, or when its internal buffer becomes nearly full.

2. Data Terminal Equipment (DTE) devices such as video terminals, computers running terminal emulation software, and electro-mechanical terminals, normally signal that they are ready to send and/or receive data (on circuits TD and RD, respectively), using the Data Terminal Ready (DTR) output. The ready condition is normally indicated by a positive level on this line.

3. Other control (handshaking) lines may be provided, such as Request-to-Send (RTS) and Data Set Ready (DSR). Request-to-Send is an input to DCE devices; DSR is an input to DTE devices. These lines may often be hard-wired to their ON state, which is normally positive. The wire sockets provided in the Octoport allow you to accomplish this easily.

NOTE: You should be aware that there are a number of different interpretations and implementations of the RS-232 standard in use. The RTS and DSR lines mentioned in step 3 may need to take the place of DTR and/or CTS in some instances. You should refer to individual operation manuals to determine if a device is configured as DTE or DCE, whether the RS-232 standard and signal naming conventions have been followed, and the pin numbers used by each signal.

4. Obtain or assemble a cable to connect each of the devices to the chosen Octoport connector. The Octoport connector pinout is the same as the 9-pin connector on an AT-compatable computer. Refer to the Appendix for wiring information for specific computers. If you assemble your own cables, make sure that both cable and connectors are shielded types to ensure that they comply with FCC requirements for radio frequency interference. Serial port cables should generally not exceed 50 feet in length. If you require longer serial cable runs of up to 4000 feet, we recommend that you use the Heath **HCA-1032-1** Line Extender.

Serial ports P0 through P5 may be considered to be DTE and are normally wired as follows:

PIN	DIRECTION	FUNCTION	COMMENT
1	-	-	Not used
2	To Octoport	Receive data	
3	From Octoport	Transmit data	
4	From Octoport	-	Wired high (ON)
5	-	Ground	
6	-	-	Not used
7	From Octoport	Inable (RTS)	Enables input
8	To Octoport	Outable (CTS)	Enables output
9	-	-	Not used

NOTE: To aid in interfacing to non-standard serial devices, or equipment whose manuals are not available, a test point (TP) and an LED (D114) are included on the Octoport circuit board to determine handshaking output levels without a meter. RS-232 voltage levels will cause the LED to turn red on positive signals and green on negative signals.

If the peripheral you are connecting requires hardware handshaking to avoid the loss of characters, its handshake output must be connected to pin 8 of the serial connector.

To use D114 to determine the polarity that is required to to output the Octoport's data to the peripheral, perform steps 1 through 4:

( ) 1. Insert one end of a convenient length of wire into wire socket TP on the Octoport circuit board.

( ) 2. Touch the other end of the wire to pin 8 of the serial connector to which the peripheral is attached.

( ) 3. Alternately switch the peripheral on-line and off-line. If the LED changes color each time, pin 8 is wired correctly. If this does not happen, it means that pin 8 from the serial port is connected to the wrong line of the peripheral.

The Outable polarity* defaults to positive when you first turn the Octoport on and whenever it is reset. You will have to determine the Outable setting for your peripheral to operate properly. You will do this in the next step.

* Input level that allows the Octoport to output data. Refer to the description or Outable command on Page 5-3.

( ) 4. If the LED is red when the peripheral is off-line and green when it is on-line, set the Outable polarity for this port (refer to the "Operation" for making the setting) to negative (see Table 1). If the LED colors are reversed, set the Outable polarity to positive.

Table 1

LINE SWITCH	D114 COLOR	OUTABLE POLARITY SETTING
Off-line	Red	Negative
On-line	Green	
On-line	Red	Positive
Off-line	Green	

( ) Connect the Octoport to your computer or terminal by connecting port P0 to the serial port on your computer using the supplied serial cable.

( ) Determine whether you wish to use P6 as an input or an output.

( ) Configure the jumpers in the Octoport. Seven of the jumper sockets determine whether port P6 is an input or an output. Position the jumper sockets on the "I" side for input or on the "O" side for output of jumper sockets P100 - P106. All seven jumper sockets must be positioned to either I or O.

( ) If you configured port P6 as an input, you may connect the parallel output of a computer to port P6 of the Octoport using a "straight-through" cable, such as the Heath HCA-84.

( ) If you configured port P6 as an output, connect Centronics-compatible peripherals to ports P6 and/or P7. Use the standard cable that was supplied with the peripherals.

The positions for the remaining jumper sockets are determined by the peripheral connected to port P6 and port P7. There are three jumper plugs provided for output options on ports P6 and P7, and three for input options on port P6. Only the input or the output jumpers need to be set for port P6, depending on how you configured it.

Tables 2 and 3 list the functions of each jumper and how it should normally be set. Refer to your printer's manual, if necessary, and install the jumper sockets as listed in the appropriate Table. Store any unused jumper sockets over a single jumper plug pin to prevent losing them.

Table 2

OUTPUT JUMPERS FOR P6 AND P7					
Output Port Jumper P6		P7	Signal	From	Function
P109	$\overline{\text{A.FD}}$ HI	P113	Auto-feed	CPU	Causes automatic line feed after printing is finished.
P111	$\overline{\text{INIT}}$ HI	P114	Initialize	CPU	Resets printer and clears its input buffer.
P112	$\overline{\text{SLCT IN}}$ HI	P115	Select	Printer	Indicates printer is selected.

Table 3

INPUT JUMPERS FOR P6			
Input Port Jumper	Signal	From	Function
PE LO(P107)	Paper	Printer	Indicates printer is out of paper.
SLCT HI (P108)	Select	CPU	Selects (enables) printer.
$\overline{\text{ERROR}}$ HI (P110)	Error	Printer	Indicates: No paper, off-line, other error.

NOTE: If you should ever need to perform a "hard reset" of the Octoport, thereby clearing RAM and starting over, you may do so by moving the jumper on P116 from "Normal" to "Reset" briefly, and then back to "Normal." Proceed as though the unit had been reset with the "ZAP" command (see Page 5-5).

( ) Refer to Pictorial 3-2 and scrape or sand off any paint spray from around the inside of the four bottom mounting flange holes on the cabinet top. This will insure a good ground between the chassis and the cabinet top for RF shielding.

( ) Refer to Pictorial 3-2 and install the cabinet top on the chassis assembly. Loosely install M3 x 6 mm screws at the two rear locations, then loosely install the four bottom screws. When all of the screws are installed, tighten the rear screws first and then the bottom screws.

This completes the "Installation."

OPERATION

COMMANDS

SPECIFYING COMMANDS

There are 19 commands available that you can use to perform various operations. Each command specification begins with a unique letter, which is sufficient to identify the command. You only need to enter enough characters to make the command, port name, or parameter explicit.

NOTE: The term "Enter" refers to that key on a computer keyboard. If you use a terminal, use the "Return" key.

Serial port P0 is the master port. It is the only port that can issue certain global commands and LINK two remote ports, such as a modem to a printer.

When you first turn the Octoport on, and after being reset (either internally or using the ZAP command), the Octoport will have to determine the baud rate of the terminal or computer that is connected to port P0 so that you can enter additional configuration information. To allow the Octoport to make this determination, press the ENTER key on your computer, or the Return key on your terminal keyboard several times.

1. If you are using a computer, run TEM first. Refer to "Octoport PC Utilities" on Page 5-5.

2. Turn the Octoport on and press ENTER repeatedly until the **CMD?** prompt appears. The Octoport initially assumes a baud rate of 9600. If the terminal or computer baud rate is 9600, you will need to press ENTER twice. Lower baud rates will require you to press ENTER several more times.

NOTE: If the **CMD?** prompt does not appear after pressing ENTER eight times, the handshaking level on the OUTABL input may be low, which inhibits (inactivates) the output. To overcome this condition, type eight ENTERs, and then:

O and a space,
P and a space,
N and a space,
ENTER.

You should now see the **CMD?** prompt.

There are three commands that provide useful information. These are as follows:

Assistance — Displays general information about each of the Octoport's 19 commands.

Help — Displays the syntax for each command.

Status — Displays all of the configuration settings and linkages that are in effect at the time you enter this command.

COMMANDS

NOTES:

1. You can issue all commands in upper and/or lower case. However, they will all be converted to upper case while in the Command mode.

2. To exit the Command mode, press the ESC or "^" key. If the port to which you are connected is not linked to another port, exiting the Command mode will make it available to others.

3. Angle brackets (< >) are used in the following paragraphs to denote parameters.

4. A bar (|) between parameters means "or".

5. In the following text, characters and parameters shown within brackets ([ ]) are optional.

A[ssistance]

This command displays general information on each of the 19 commands. To see this information, type A and press ENTER.

B[aud] <port name><baudrate>

This command sets the Octoport's baud rate for a specified port so that it matches the baud rate of the equipment connected to that port. If the port is not available (for example, if it is linked or in the Command mode) at the time you issue the command, the command is ignored and the error message "**Port not available**" is displayed.

As an example, if you wish to set the baud rate of a port named "MY_PORT" to 2400, you may type "BAUD MY_PORT 2400," or simply B M 2.

NOTES:

1. If you use the abbreviated form in the previous example, the lowest-numbered port whose name starts with an M will be selected by the Octoport.

2. To set the baud rate to 150, enter at least the first two digits (15), or else the Octoport will set the baudrate to 1200.

C[ommand] <char>

You must enter the Command mode before you can enter any of the other operating commands (Port 0 is in Command mode upon power-up). There are two ways to do this. The first is to create a series of three Breaks. A Break is a spacing condition that lasts for a minimum of one character duration (the equivalent of a NULL character (00) with no stop bit). This method is always enabled.

The second way to enter the Command mode is to pause for at least one second, enter a sequence of three like-characters (e.g. +++), followed by another one-second pause. The pauses ensure that if the three like-character sequence is part of a data file, the Octoport will not accidentally enter the Command mode, which would disable the port and stop the data flow.

When you reset the Octoport with the ZAP command, the command character defaults to a "+." To specify a different command character, you must enter the two hex digits that define the ASCII character. For example, if you want an ampersand (@) character, type C space 40 (see "ASCII-To-Hex Conversion Table" on Page A-4). Do not use the following characters in your Command character entry:

11 = DC1
13 = DC3
1B = ESC

The Octoport uses these characters for other purposes.

If you want to use only the BREAK sequence to enter the Command mode, specify a null (00) for the character. This command will only be accepted from Port 0.

E[cho] E[nabled] | D[isabled]

If you are using a terminal or terminal emulator to communicate with another terminal, it is likely that the characters you type will not show (or echo) on your display. If you wish to see what you are typing, you can enable the echo function, which applies only to the requesting port.

To enable Echo, type E and a space, E and press ENTER. To disable Echo, type E and a space, D and press ENTER.

H[elp]

This command prints a list of all commands, showing their proper syntax. To obtain the command list, type H and press ENTER.

I[nable] <port name> P[ositive] I N[egative]

The Inable (INput enABLE) signal is an output that is used for handshaking. It signals the equipment connected to the port that the Octoport is ready to accept input. The input polarity you select should enable the external equipment to send more data.

To set the Inable polarity, type **I** and a space, **<port name>** and a space, **P, or N,** and **ENTER.**

K[eep]

If there is a particular configuration that you use often, you can use this command to save everything except linkage status and Memo contents. To return to the saved configuration, use the Restore command. This command is only accepted from port P0.

To save the current configuration, type **K** and press ENTER.

L[ink] <port name> [<port name>]

The Link command connects two ports together. A requesting port (other than port P0) can Link itself to another port by specifying the port name to which it wishes to link. Port P0 can link itself to another port and also link two remote ports. However, when you link two remote ports, you must specify both remote port names.

If a port tries to link to a port which is in the Command mode, a "**Port not available**" message is returned. If the requesting port attempts to link to a port already linked, but not in the Command mode, the message "**Will link when port becomes available**" is returned. Unless you cancel the Link request using the Unlink command, the link will be made automatically when the other port becomes available.

Example: To link ports P0 and P1 together, type **L** and a space, **P0** and a space, and **P1** and press ENTER.

M[emo] [<port name>] [<text>]

If you wish to leave a memo for any serial port, use this command, followed by the destination port's name and the text of the memo. This text may be only a single line (up to about 80 characters), and will be saved in upper case. If you wish to retrieve a memo, type the command, followed by an optional port name. If you do not specify a port name, the memo for the requesting port will be returned. If you wish to erase a memo, enter a period (.) for <text>.

EXAMPLES:

To leave the message "test" in P1's mailbox, type **M** and a space, **P1** and a space, **TEST** and press ENTER.

To erase **P1's** memo, type **M** and a space, **P1** and a space, a period (.), and press ENTER.

N[ame] <old port name><new port name>

When you first turn on or reset the Octoport, the port names will default to P0 through P7. Use this command to change any of the port names. The new name you choose can be up to eight characters long. Spaces are not allowed between characters and non-printing characters are invalid. You can only change names from Port 0.

EXAMPLE: To change P0 to Main, type **N** and a space, **P0** and a space, **Main** and press ENTER.

O[utable] <port name> P[ositive] I N[egative]

The Outable (OUTput enABLE) command is an input signal that is used for handshaking. The equipment that is connected to a serial port uses it to signal the Octoport that it is ready to accept data. The polarity you select should match the "ready" output polarity from the external equipment.

To change the polarity, type **O** and a space, **P** or **N** and press ENTER.

P[arity] <port name> N[one] I E[ven] I O[dd]

The Octoport does not check the parity of characters input to its serial ports. However, some equipment may require odd or even parity from the Octoport. Use this command to set the appropriate output parity from the Octoport. In most cases you will leave the parity set to None.

To change parity, type P and a space, <port name> and a space, N or E or O and press ENTER.

Q[uiet] E[nabled] I D[isabled]

When you connect a computer to a port, you may wish to disable the output of prompts and error messages when the port is in the Command mode. By enabling this function, you will prevent output when you are in the Command mode. However, any errors you make will still output a bell character (ASCII 07), and the Assistance, Help, and Status commands will still output normally. This function only applies to the requesting port.

To change the status of the Quiet command, type Q and a space, E or D and press ENTER.

R[estore]

The Restore command allows you to return the Octoport to the configuration you last saved (using the Keep command). Any current linkages will be lost when you use Restore. You will be asked to verify this command before it is executed. This command is only available to port P0.

To use Restore, type R and press ENTER.

S[tatus]

This command prints out a table showing you the current configuration status of each port. The LINKED column of the table shows the port number of the linked-to port, or a dash (-) if the port is not linked. If a port issues a Link request that will be completed as soon as the destination port becomes available, the destination port number will appear in parentheses until the linkage is actually made.

The Timeout value is also displayed, along with a list of the port numbers that are affected by the Timeout function. The jumper-configuration status (input or output) of port P6 and the hex value of the character you selected to enter the Command mode are also displayed. (If you chose a printable command character, the actual sequence of three characters will also be shown in parentheses.)

To view the Status, type S and press ENTER.

T[IMEOUT] <minutes> [<port name list>]

The timeout feature allows the Octoport to automatically Unlink a pair of ports when either of them is inactive for a specific length of time (from 1 to 9 minutes). This timeout value might typically be set to 1 minute in an office where several workers share a common printer. Then, one minute after one worker's printout has completed, another's will begin.

Entering a time value of 0 will disable this feature. (It is also disabled upon resetting with the ZAP command.) To enable the timeout for selected ports, follow the non-zero time value with a list of the names of those ports. If no port names are specified, this feature will be enabled for all ports.

The timeout value and the numbers of the ports which will unlink automatically after that period of inactivity are displayed at the bottom of the Status screen.

Example: To set a timeout value of two minutes, and enable it for ports P5 and P7, type T and a space, 2 and a space, P5 and a space, P7, and press ENTER.

U[nlink] [port name>]

This command unlinks two ports. If you use port P0 to unlink two remote ports, you only have to specify one of the remote port names. If you wish to unlink your own port, no name entry is required. If you entered a request to link to a currently busy port, using this command prior to auto-linking will cancel the LINK request.

To Unlink, type U and a space, <port name> and press ENTER.

X[ON]<port name> E[nabled] I D[isabled]

If software handshaking is required, you can enable it with this command. When XON is enabled for a particular port, the Octoport sends an XOFF(DC3,^S) character when its associated 256-byte input buffer becomes 3/4 full. The Octoport will also send an XON (DC1, ^Q) character when its buffer empties to 1/4 full. Also, XON and XOFF characters received by that port from any external equipment respectively enable and disable the output from that port.

To change the status of XON, type **X** and a space, **E** or **D** and press ENTER.

When you transfer binary files between ports, you should disable the software handshaking. This prevents any XON and XOFF characters contained in the file from being interpreted as handshaking characters. Hardware handshaking, as defined by the Inable and Outable commands, is always active.

Z[AP]

The Zap command restores the Octoport to the same conditions as when you first turned it on, or as if you used the internal reset jumper to erase RAM. The Octoport will request verification from you before it proceeds. Remember to press the ENTER key several times to establish the baud rate as described at the start of the Operation section. This command is only available to port P0.

To initiate ZAP, type **Z** and press ENTER. Then type **Y** and press ENTER several times until you get the **CMD?** prompt.

OCTOPORT PC UTILITIES

THE TEM.COM PC UTILITY

The TEM.COM (Terminal EMulator) program was written especially for use with your Octoport, and provides a convenient means of taking full advantage of your Octoport's features.

You can run the TEM program as a transient program, or make it memory-resident so that you can access it from within an application program.

TEM provides hardware handshaking to prevent the Octoport's internal data buffers from overflowing during high-speed transfers or transfers from one baud rate to a lower one.

NOTES:

1. When transferring binary files (programs, etc.), you must disable XON/XOFF on the Octoport, as these characters may be contained in binary files and must not be interpreted as flow-control characters.

2. All Octoport ports that are connected to PCs running TEM must be configured for Positive Inable and Outable signal polarities. (Refer to the "Operation section".) TEM only supports hardware handshaking.

3. TEM uses the Data Terminal Ready (DTR) and Request To Send (RTS) outputs to enable data input from the Octoport, and monitors the Clear To Send (CTS) and Data Set Ready (DSR) inputs to determine when it can output data to the Octoport. The Octoport's hardware handshaking is always active.

To invoke TEM as a transient program, type **TEM <ENTER>**), at the DOS prompt. There are two optional software "switches" that you can use to specify the desired baud rate and serial port.

To specify the use of port COM2, follow the command with **/2**.

To specify a different baud rate, follow the command with a slash (/) followed by at least the first two digits of the desired baud rate, for example **/24** for 2400 baud.

You may use either or both switches, in either order, with or without spaces between them. If the port is not specified, it will default to COM1. If the baud rate is not specified, it will default to 9600.

Examples:

TEM/12 <ENTER> selects 1200 baud on port COM1.
TEM /2 <ENTER> selects 9600 baud on port COM2.
TEM /24/2 <ENTER> selects 2400 baud on port COM2.

NOTE: Although TEM supports baud rates of 19200 and 38400, the highest baud rate you can use with the Octoport is 9600.

If you forget the proper syntax for invoking TEM, type TEM/ <ENTER>, and the display will show a message with the proper usage.

MAKING TEM MEMORY RESIDENT

To install TEM as a memory-resident (pop-up) program, add a /! switch to the command. A message will will indicate that the program was successfully installed, and will provide some reminders as to its usage.

Once installed, you can invoke TEM with a special combination of keys, referred to as the "hotkey". The default hotkey is **CTRL-right SHIFT**, that is, you must hold down the CTRL key while pressing the right SHIFT key. You may choose among several other hotkeys by immediately following the /! symbol with a letter. Type TEM/ for a list of the optional hotkeys and the letters that specify them. For example, /!S will specify CTRL-SPACE as the hotkey. As TEM installs itself, it will display the hotkey you selected.

When you press the hotkey, TEM will respond with a three-note sequence of rising pitch. This indicates that it is waiting for one of several special keys. If you press a key other than one of these special keys, TEM will abort and will be indicated by a three-note sequence of descending pitch.

If you want TEM's terminal window to appear on the screen and the video display adapter is in a text mode, press the SPACE bar. TEM can only display itself in text modes. If you do this while the display is in graphics mode, you will hear a two-note sequence of descending pitch.

By using the flag /@ in the command line when you are in the transient or memory-resident mode, you can cause TEM to automatically place the Octoport port to which you are connected in Command mode when you enter TEM and exit Command mode when you exit TEM. TEM will not alter the Command mode status of the port unless you use this flag.

SETUP FILES

If you press one of the ten function keys (F1 through F10) right after you press the hotkeys, TEM will look for a special setup file named **SETUPn.OCT** in a directory named **\TEM**, which you must create off of your root directory. (Refer to your DOS manual, if necessary.) The "n" is a digit corresponding to the function key number (where 0 represents F10). For example, if you press F5, the file \TEM\SETUP5.OCT will be sent to the Octoport.

An additional "switch" in the command line allows you to specify the drive where the \TEM directory is located. For example, \C will cause TEM to look for setup files on drive C. If this switch is not used, TEM sill assume the \TEM directory is on the currently logged drive.

When the application program regains control, you will hear a two-note sequence of descending pitch. If it is preceded by a low pitch tone, the setup file was not found.

The setup files function like DOS batch files. Usually, setup files contain commands in the format you would use at the CMD? prompt from TEM's terminal emulator window. Each command must be on a separate line with a carriage return following the last command. You can abbreviate the commands as documented in the "Operation" section and displayed with the Octoport's Help command*.

Because the port must be in Command mode before you can enter commands, the TEM program automatically places the port in Command mode prior to sending the contents of a setup file.

You may wish to reset the Octoport to place it in a known state before issuing other commands. For example, if you changed a port name since creating a setup file that addressed that port, any command sent to the old port name could be ignored. To reset the Octoport from a setup file, add the tilde character (~). This character will be intercepted by the TEM program when the file is read and will not be sent to the Octoport. Instead, TEM will send the Zap command followed by a Y (for Yes) to reset the Octoport, and the appropriate

---

* This ensures that the setup file will be as short as possible. Since hardware handshaking is not used in Command mode, setup files much larger than 256 bytes may overflow an internal buffer. (You can check the size of the file by using the DOS directory command DIR.)

number of carriage returns to allow the Octoport to determine the proper baud rate. You can use the ~ character alone on the first line of the setup file, or it may precede the first command.

NOTE: Remember that the Zap command, and several other commands, may only be issued to port 0. Also remember that a setup file that resets the Octoport must re-establish any desired settings that are different from the defaults.

There may be times when you need to change the baud rate of the Octoport port to which you are connected. For example, if you connect to a 300-baud modem and do not use XMODEM, or similar protocol, you will have to set the port to which the modem is linked to 300 baud to avoid buffer overflow. If you change the baud rate of the port to which your computer is connected, you must also change the computer's baud rate.

If you run TEM as a transient program, you could exit TEM, and run it again, specifying the new baudrate. But if TEM is installed in memory, its baudrate was specified when it was installed.

A baud rate command **B[AUD] <port name> <baud>** in a setup file normally only changes the baud rate of the Octoport port specified in the command. If you precede the baud value with **@**, it will tell TEM that the port whose baud rate is being altered is the one you are connected to. You must enter at least the first two digits of the new baudrate, and there must be no spaces between it and the @ symbol. For example: **B ME @24**. TEM will reconfigure the Octoport to the new baud rate and then reconfigure the computer's serial port to match. NOTE: This function will not work from the **TEM CMD?** prompt.

NOTE: If you install TEM from your AUTOEXEC.BAT file, be sure, before turning your system off, that the Octoport's serial port to which your computer is connected, is configured for the same baud rate that TEM was installed for.

As an example of how setup files may be used, let's assume that your computer (configured for 9600 baud), is connected to port 0, a 300-baud modem is connected to port 1, a 4800-baud dot matrix printer is connected to port 2, and a laser printer is connected to port 7. This particular dot matrix printer has a busy handshake line that goes high when its buffer is near full, and low to accept more text.

You could have a setup file, named **\TEM\SETUP0.OCT**, that configures the Octoport appropriately for these devices. It might look like this:

```
~              <— Reset the Octoport
B P0 @96       <— Set port 0 and TEM for 9600 baud
Q E            <— Disable Echo of commands
N P0 ME        <— ReName port P0 to ME
N P1 MODEM     <— ReName port P1 to MODEM
N P2 DOT       <— ReName port P2 to DOT
N P7 LASER     <— ReName port P7 to LASER
B MO 30        <— Specify modem's baud rate
B D 48         <— Specify dot matrix printer's baud rate
O D N          <— Specify dot matrix printer's handshaking
Q D            <— Disable Quiet mode
```

Now, by just pressing the hotkey followed by the **F10** key, the Octoport will be properly configured.

NOTE: The Quiet Enable and Disable commands can be ommitted since the TEM program ignores any responses from the Octoport.

To easily select the modem or either printer from within a word processor, spreadsheet, or other application (or even from DOS), create four more setup files in the **\TEM** directory, named:

\TEM\SETUP1.OCT
\TEM\SETUP2.OCT
\TEM\SETUP3.OCT
\TEM\SETUP4.OCT

\TEM\SETUP1.OCT:

```
U              <— Unlink (in case you were linked to another
                  port)
T 0            <— Disable timeout
B ME @30       <— Set Octoport and TEM ports to 300 baud
L MO           <— Link to the modem
^              <— Exit Command mode
```

\TEM\SETUP2.OCT:

```
U              <— Unlink (in case you were linked to another
                  port)
T 1 DOT        <— Set the timeout to one minute for this printer
L DOT          <— Link to the dot matrix printer
^              <— Exit Command mode
```

\TEM\SETUP3.OCT:

```
U          <— Unlink
T 1 LAS    <— Set timeout
L LAS      <— Link to laser printer
^          <— Exit Command mode
```

\TEM\SETUP4.OCT:

```
B ME @96  <— Return our port and TEM to 9600 baud
```

NOTE: A timeout of other than 0 (no timeout) is usually not required unless the printers or other peripherals are being shared. You can tailor your setup files to suit your needs.

When you want to print a document from within your application with TEM installed in memory, simply press the hotkey and press **F2** to link to the dot matrix printer, or press **F3** to link to the laser printer, wait for the two-note sequence that indicates that the setup file was sent, and then use the application program's normal print function. Connect to a modem using the hotkey and **F1** key. Finally, use the hotkey and the **F4** key to re-configure port 0 and TEM to 9600 baud after you are done with the modem.

This example illustrates what you can do with setup files. You can create your setup files with a text editor, such as EDLIN, that produces straight ASCII files. You can also use the DOS COPY command, using the format **COPY CON \TEM\SETUPn.OCT**. (Refer to your DOS manual for information on the use of the COPY command for creating files in this manner.)

The **COPY CON** method has an advantage in this application over many editors, including EDLIN, in that it will not automatically add a CRLF (carriage return/line feed) to the end of the setup file. After you enter the ^ character to exit from Command mode, any characters remaining in the setup file are sent to the linked port. If ^ is followed by a CRLF and you are linked to a printer, the printer will advance the paper one line before printing, which is usually not desired.

By appending a form-feed character at the end of the setup file, you can cause the paper to advance to the next page prior to printing, to separate print jobs. (After you enter ^, hold the **CTRL** key down and press L and then Z. Then release the CTRL key and press **<ENTER>**.)

Remember that if the last line in a setup file is a command, it must be followed by CRLF. If it is the ^ symbol, it should usually be the last character in the file.

THE TERMINAL EMULATOR WINDOW

When TEM is run as a transient program or is popped up using the hotkey and SPACE bar, the terminal emulator window will initially present a cleared screen, except for two lines at the bottom. The upper line contains prompts and error messages. The lower line displays the functions assigned to the seven computer function keys used by the program.

NOTE: If you installed TEM without the /@ flag and have popped it up before, any text displayed when the window was last exited will be redisplayed, and the cursor will move back to where it was at that time. If you installed TEM with the /@ flag, the screen will clear each time TEM is popped up.

At this point, you may communicate with the Octoport as if you were using a terminal. If you are linked directly to another terminal, or to another computer running TEM, you can press the **F5** key to "echo" each character you type so that you can see what you are typing. F5 toggles echo on and off. You can enable echo either in the TEM program or on the Octoport. Make sure that you do not enable echo on both the Octoport and TEM or you will see double characters.

If you want to send a disk file, press the **F1** key. You will be prompted for a filename, which may include path information. As soon as you press **<ENTER>**, the file will be sent. A message will remind you that you can abort the transfer of the file by pressing the ESC key.

To receive a file to disk, press the **F2** key. You will be prompted for a filename. If the file already exists, you will be asked if you want to overwrite it. When you open the the file , a 60-second timeout period is established. If no data is received within this period, the file is automatically closed. As soon as data transfer begins, the timeout period is changed to 5 seconds. Any 5-second pause within the data will be considered the end of the file, and the file will close. If you want to close the file prematurely, press the **F4** key.

During a file transfer, data is not normally displayed on the screen. If you wish to view the file's progress, press the **F3** key to enable the View function. The **F3** key toggles View on and off. However, files will transfer more quickly with it off.

NOTE: Binary files normally display miscellaneous characters, and may cause the computer's "bell" to ring frequently, so you will not normally want to turn View on when you transfer binary files.

The **F9** key returns the Octoport to Command mode by generating a sequence of three Breaks.

The **F10** key exits TEM. If you run TEM as a transient program, you will first be asked for confirmation. If you have installed TEM as a memory-resident utility, pressing F10 will exit TEM immediately.

USING OTHER TERMINAL EMULATORS

When you transfer a text file using the Octoport, you can use any terminal emulation program capable of XON/XOFF handshaking. Simply enable XON/XOFF handshaking on the Octoport ports you wish to use. This is done with the XON command and is described in the "Operation" section of this manual.

You may also use a terminal emulator that uses "XMODEM" protocol to ensure error-free transfer of binary or text files. XMODEM and similar protocols send data in "packets", one at a time. After each packet is sent with accompanying error detection bytes, the receiving end determines whether it received the packet correctly. If so, it sends back a positive acknowledgment, and the transmitting end sends the next packet. If an error is detected, the receiver returns a negative acknowledgment and the corrupted packet is re-transmitted. As long as the packets are smaller than the Octoport's 256-bytes per port buffer size, additional handshaking is not required to avoid buffer overflow. This method is best for transferring files over modems because hardware handshaking is not necessary.

CONFIGURING YOUR COMPUTER'S SERIAL PORT

For Octoport compatibility, you must configure all of the computer serial ports to which the Octoport is connected, for "compatibility" mode. This corresponds to both DTR and RTS lines being positive for data transfer. The baud rate must match the Octoport's port baud rate. Normally, you will choose 9600 baud for the fastest response. Your computer's port should also normally be set for no parity, one stop bit, and 8-bit words.

The Octoport's port defaults to positive INABLE and OUTABLE handshaking levels, which is correct for use with the compatibility mode.

If you are using a Heath or Zenith Data Systems computer, you can use the CONFIGUR.COM program to select and set up the serial port. Your application program (word processor, spreadsheet, etc.) should be configured to output directly to the selected COM port.

If you are using another system, you will have to use the MODE command that is furnished with MS-DOS. Refer to your DOS manual for instructions.

THE CMD.COM UTILITY

Although the TEM is the most convenient way to configure and use the Octoport, the accompanying disk also contains a utility program that is useful if you wish to configure the Octoport from a batch file.

CMD.COM is a program that sends a series of three Breaks to the appropriate serial port to ensure that the Octoport is in Command mode and ready to accept configuration commands.

A Break is a spacing condition on the data line that lasts at least one character length. Some terminals have a special BREAK key on their keyboard that produces this condition. The TEM program uses the F9 key to generate three Breaks.

If you wish to configure the Octoport without using the TEM program, you can create a file that contains the list of commands that you would normally enter from the keyboard at the CMD? prompt in TEM. Use a batch file to copy this command file to the Octoport.

For example, assume you made a batch file and named it **C.BAT** which contains the following information .

```
ECHO OFF
MODE COM1:9600,N,8,1
CMD
COPY %1.CFG COM1
ECHO ON
```

The Mode command used ensures that the serial port is configured properly. Note that the Mode command cannot select handshaking polarities. IBM systems require positive levels on the CTS and DSR inputs to enable outputs and provide positive levels on the RTS and DTR outputs to enable input. This is compatible with the default configuration of the Octoport. On most Zenith computers, use the CONFIGUR.COM utility furnished with DOS to select the "compatibility" mode, with the Octoport's default positive Inable and Outable signal polarities.

The CMD command ensures that the Octoport is in the Command mode and is ready for the COPY command which follows it. NOTE: CMD.COM defaults to port COM1. To use it with port COM2, use **CMD/2**. (Type **CMD/** for usage information.)

To execute the file, type **C filename** where filename is the file that contains the configuration commands. The COPY command needs a **.CFG** extension after this filename and the file must be in the current directory.

For example, assume that you have made a file that you named **LINKP.CFG**. It contains the following commands:

Q E	<—	Enables the quiet mode.
E D	<—	Disables echo.
T 1 PRINTER	<—	Sets a timeout of 1 minute for the printer link.
L PRINTER	<—	Links the printer at the port named PRINTER.
Q D	<—	Disables the quiet mode.
^	<—	Exits the Command mode.

To send this file to the Octoport, type **C LINKP**.

For more information on using batch files, consult your MS-DOS manual.

APPLICATION PROGRAMS

The baudrate of each Octoport port must match the baudrate of the device that is connected to that port. Data cannot transfer between your computer and the Octoport unless the baudrate of the data sent to your computer's serial port matches the baudrate setting of the Octoport port to which it is connected.

If you print a file to the serial port from the DOS command line, the baudrate and handshaking used are determined by the configuration you set using the DOS MODE command (or the CONFIGUR command on Heath/Zenith Data Systems computers).

TEM saves the DOS configuration, reconfigures the serial port for the baudrate you specified in TEM's command line, (or defaults to 9600 baud), then restores the DOS configuration when you exit TEM.

Application programs, such as word processors and spreadsheets, might use either method. If an application configures the serial port itself, you will have to refer to its manual for information on how to set it for the proper baudrate and handshaking. If it uses the DOS configuration, you will only have to ensure that the DOS configuration is correct.

Application programs that do not use the DOS configuration will allow you to select betweeen one or more serial and parallel ports. You must configure these programs to utilize the serial port to which the Octoport is connected.

Using TEM With Microsoft Windows®

Microsoft Windows is not compatible with memory-resident programs. To use TEM in the Windows environment, you must create a .PIF file which specifies TEM's requirements of the system. Once you create the .PIF file, you can select the TEM.PIF file to gain access to TEM. When you run TEM in this manner, it operates as a transient program, just as it would if you ran it from the DOS prompt.

Refer to your Windows documentation for information on creating .PIF files. Set the TEM.PIF file up as follows:

Program Name:	TEM.COM
Program Title:	TEM
Program Parameters:	(Port and baudrate switches)
Initial Directory:	(Directory where TEM.COM is located)
Memory Requirements:	32K
Directly Modifies:	Screen
Program Switch:	Text
Screen Exchange:	Text
Close Window on Exit:	Yes

Printing Files With Microsoft Windows

To print files through the Octoport when you use Windows, use the Windows Control Panel to select parallel port LPT1, and use MODE.COM (or CONFIGUR.COM on Heath/Zenith Data Systems computers) to map the parallel output to the serial COM port to which your Octoport is connected.

IN CASE OF DIFFICULTY

GENERAL

This part of the Manual will help you locate and correct difficulties which might occur in your Octoport. This information is divided into the "Visual Checks," "Precautions for Bench Testing," "Shipping," and a "Troubleshooting Chart." Use the Visual Checks to locate any difficulties that occur right after the unit is assembled.

The "Troubleshooting Chart" calls out specific problems that may occur and lists one or more conditions or components that could cause each problem. A "Circuit Board X-Ray View" is also provided on Page 14 of the Illustration Booklet to help you locate the circuit components, and compare foil patterns in case you suspect that a solder bridge exists between the foils.

NOTE: Be sure you read the "Precautions for Bench Testing" before you use a voltmeter or do any power-on testing on this Octoport.

In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

VISUAL CHECKS

1. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, you can eliminate many difficulties by carefully inspecting each connection to make sure it is soldered as described in the "Soldering" instructions for the first part on Page 1-5. Reheat any doubtful connections.

2. Check the circuit board to be sure there are no solder bridges between adjacent connections. Check the "Circuit Board X-Ray View" for any questions you may have concerning the foil pattern.

3. Check capacitor values carefully. Be sure the proper value part is installed at each capacitor location and that the positive (+) or negative (-) marks are oriented correctly.

4. Be sure the correct diode is installed at each diode location, and that the banded end is positioned correctly.

5. Recheck the wiring. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.

6. Check all component leads connected to the circuit board. Make sure that none of the leads make contact with other connections or components.

PRECAUTIONS FOR BENCH TESTING

1. Be careful when you test solid-state circuits. Although semiconductor devices have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than other circuit components.

2. Be sure you do not short any terminals to ground when you make voltage measurements. If the probe should slip, for example, and short out a voltage source, you could damage one or more components.

3. Do not remove components while the unit is plugged in.

TROUBLESHOOTING CHART

The following Troubleshooting Chart lists specific difficulties that could occur in your Octoport. Several possible causes may be listed for each difficulty. Refer to the "Circuit Board X-Ray View" and the "Schematic Diagram" to locate and identify the parts listed in this chart.

If a particular part is mentioned (R101 for example) as a possible cause, check that part and other components connected to it to see that they are installed and/or wired correctly. Also check for solder bridges and poor connections in the surrounding area. It is also possible, on rare occasions, for a part to be faulty and require replacement.

SYMPTOM	POSSIBLE CAUSE
Can not get initial CMD? prompt.	1. Wrong handshake polarity. Reset with internal jumper, press RETURN several times, then type O P N (Outable, P0, Negative), then RETURN again. 2. Baud rate of terminal or computer not set to one of the baud rates supported by the Octoport. 3. Cable between computer or Octoport wired incorrectly.
Configuration information lost when unit is turned off	1. Weak batteries. 2. Diode D111.
Characters lost when transferring or printing files.	1. Incorrect handshaking selected. 2. Incorrect cable wiring.

CIRCUIT DESCRIPTION

IC U112 is a CMOS Z80 CPU (central processing unit) which controls all of the Octoport functions. Its program instructions, as well as the ASCII prompt strings, are contained in EPROM IC U117. IC U115 is an 8KB CMOS RAM which is used for data buffering, as scratchpad, and to retain the configuration information and memo's for each port when the power is turned off.

Y101 provides the basic clock signal used by the CPU and the Counter/Timer Circuit (CTC) ICs U110 and U111. IC U113B and U113C, along with resistor R101 and capacitor C114, generate a Reset pulse to initialize the CPU, CTCs, and Serial Input/Output (SIO) ICs U107, U108, and U109. Diode D101 helps C114 discharge quickly when the Octoport is turned off, so that the Octoport will reset properly if it is turned off and on quickly.

Each SIO contains two complete serial ports. Voltage translation to and from the RS-232 standard is provided by ICs U101 through U106. The CTCs are used as programmable baud rate clocks so that each of the six serial ports may be configured for different baud rates.

The serial port ICs are configured by software for the desired handshaking polarities, parity, etc., and to generate an interrupt when there is a character available in the input register or when the output register is empty. These interrupts are daisy-chained so that multiple interrupts may be serviced according to a priority scheme, where the lower-numbered serial ports have the highest priority.

IC U116 is used as an I/O address decoder for the three SIOs, the two CTCs, and the two parallel port latches.

The two parallel ports operate on a polled basis. Their status is monitored via inputs on the SIOs that are not normally used in asyncronous mode. The level on jumper plug P103 is connected to IC U107, pin 11, so that the CPU can determine whether to use Port 6 as an input or an output. Data that is to be output on Port 7 is latched to the output of IC U123 by the CPU. The falling edge of the $\overline{WR}$ signal, in conjunction with a LOW on $\overline{CE6}$, causes IC U118C, pin 8, to go low, and results in a high on the enable pin (11) of U123. When the $\overline{WR}$ signal returns high, monostable IC U119B is triggered and produces a negative $\overline{STB}$ (strobe) pulse to the printer. This same pulse sets IC U120B. Until the printer sends an ACK (acknowledge) pulse to clock a low to the output of U120B and the printer's Busy line is low, pin 11 of U118D will be high, indicating that the printer is not ready for another character yet. When Port 6 is jumpered as an output, it operates similarly to Port 7.

When port 6 is jumpered as input, the falling edge of the $\overline{STB}$ pulse is inverted by IC U113E and latches data from the port into IC U122. This edge also clocks a high to the busy output. When the CPU reads the latch, the falling edge of the $\overline{RD}$ (read data) signal, concurrent with a low on $\overline{CE7}$, causes pin 3 of IC U118A to go low. When the $\overline{RD}$ signal returns high, monostable IC U119A generates an $\overline{ACK}$ pulse, which is also used to set U120A, taking the Busy line low.

Diodes D115 and D116 ensure that voltages present in equipment connected to a parallel port will not feed the Octoport's Vcc line if the equipment is left on when the Octoport is turned off. Otherwise, the Octoport might not reset properly.

IC U125 is connected as an astable oscillator which drives a voltage multiplier through transistors Q101 and Q102. This circuit provides the negative voltage required by the RS-232 driver ICs. Zener diode D117 ensures that this voltage does not exceed 15 volts.

Transistor Q105 and IC U114C/D form a Schmitt trigger to produce a fast, clean 60 Hz square wave, which is connected to the non-maskable interrupt ($\overline{NMI}$) input of the CPU. This signal times the Timeout interval and the 1-second delay required when using a 3-character sequence to enter the Command mode.

Transistors Q103, Q104, IC U126, and their associated components, protect the contents of the CMOS RAM when power is turned off. As Vdd falls, capacitor C151 discharges through diode D108 and causes transistor Q103 to turn off. The values of voltage divider resistors R126/R127 were chosen so that this will occur before IC U124 or IC U126 go out of regulation. This causes transistor Q104 to turn off, and resistor R129 takes CS2 on IC U115 low, after which the B+ voltage may fall as low as 2 volts without losing the contents of RAM.

This lower backup voltage is furnished by two 1.5-Volt AA batteries. While power is on, diode D111 is back-biased, preventing the batteries from discharging through IC U126. Diode D109 compensates for the voltage drop across diode D110. Upon power-up, B+ must be allowed to return to +5 volts before the CS2 pin can return high. This is ensured by the time it takes capacitor C151 to charge through resistor R125 to the point that transistor Q103 can begin to turn on.

The 9 volt AC input from the wall cube is full-wave rectified by diodes D102 through D105, and filtered by capacitor C142. The resulting +12 volts supplies the RS-232 driver ICs and is regulated by IC U124 to +5 volts for the rest of the circuitry.

MEMORY MAP

Device	Address	Function
U117	0000H - 1FFFH	ROM
U115	4000 - 5FFFH	RAM
	2000H - 3FFFH	(may be used for future enhancements)

I/O MAP

Device	Address	Function
U107	0 - 3	SIO0
U108	4 - 7	SI01
U109	8 - 0BH	SI02
U110	0CH - 0FH	CTC0
U111	10H - 13H	CTC1
U123	14H	Port 7 latch
U121/122	18H	Port 6 latches

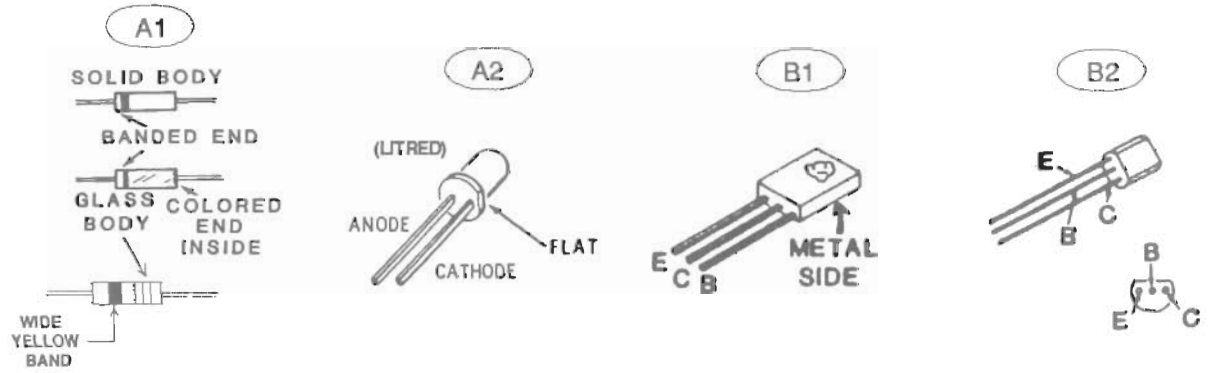
SEMICONDUCTOR IDENTIFICATION

DIODES

COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	KEY NUMBER
D101	56-56	1N4149	A1
D102 — D105	57-42	1N5401	A1
D106	57-65	1N4002	A1
D107	57-65	1N4002	A1
D108	56-56	1N4149	A1
D109	56-56	1N4149	A1
D110	56-56	1N4149	A1
D111	56-655	1N6263/SD101A	A1
D112	57-65	1N4002	A1
D113	57-65	1N4002	A1
D114	412-644	LST71	A2
D115	56-655	1N6263SD101A	A1
D116	56-655	1N6263/SD101A	A1
D117	56-25	1N4744 zener	A1

TRANSISTORS

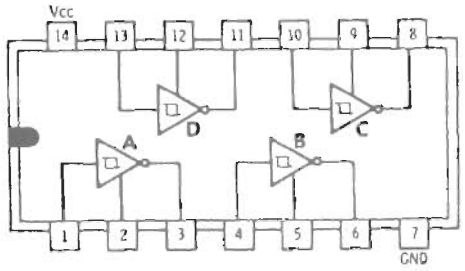
COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	KEY NUMBER
Q101	417-818	MJE-181	B1
Q102	417-819	MJE-171	B1
Q103	417-801	MPSA20	B2
Q104	417-874	2N3906	B2
Q105	417-801	MPSA20	B2



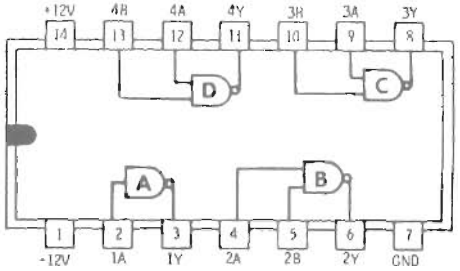
INTEGRATED CIRCUITS (ICs)

COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	KEY NUMBER
U101	443-795	MC1489 or 75189	C1
U102	443-794	MC1488 or 75188	C2
U103	443-795	MC1489 or 75189	C1
U104	443-794	MC1488 or 75188	C2
U105	443-795	MC1489 or 75189	C1
U106	443-794	MC1488 or 75188	C2
U107	443-1705	84C4206	C3
U108	443-1705	84C4206	C3
U109	443-1705	84C4206	C3
U110	443-1704	84C3006	C4
U111	443-1704	84C3006	C4
U112	443-1703	84C0006	C5
U113	443-1308	74HC04	C6
U114	443-1175	74HC32	C7
U115	443-1553	6264/5864	C8
U116	443-1311	74HC138	C9

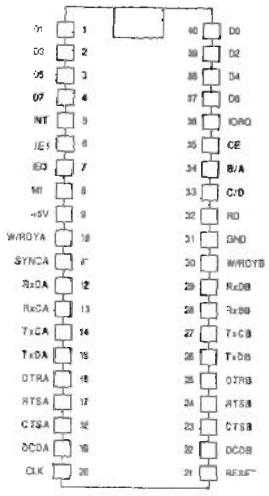
C1



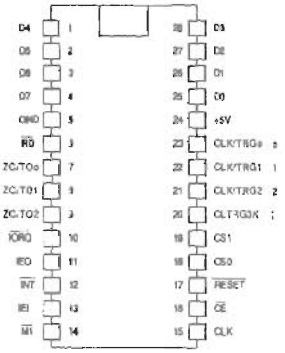
C2



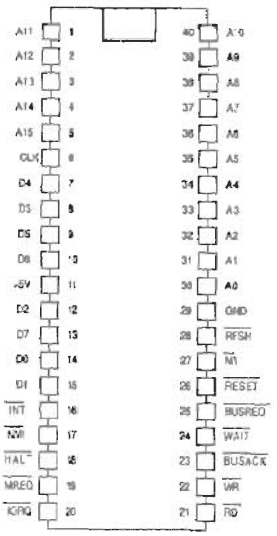
C3



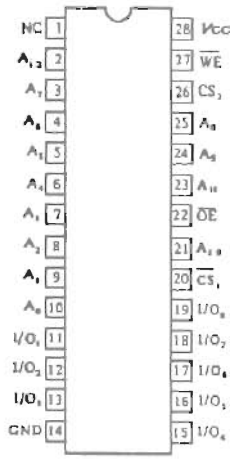
C4



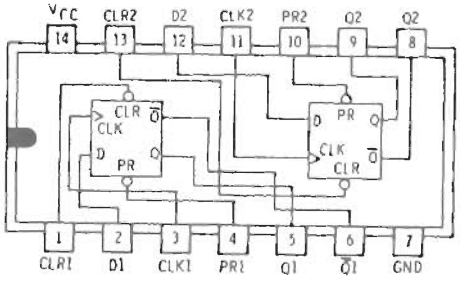
C5



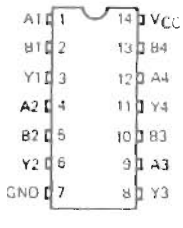
C8



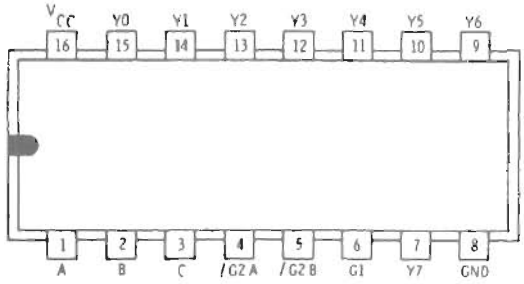
C6



C7



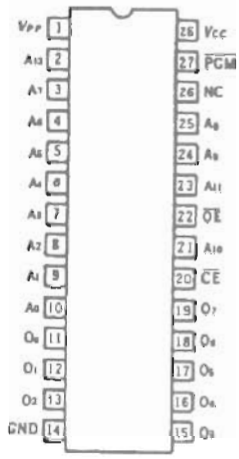
C9



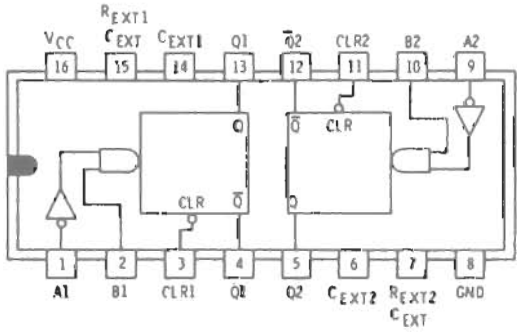
INTEGRATED CIRCUITS (ICs)

COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	KEY NUMBER
U117	444-852	Programmed EPROM	C10
U118	443-1175	74HC32	C7
U119	443-1383	74HC123	C11
U120	443-1309	74HC74	C12
U121	443-1331	74HC373	C13
U122	443-1382	74HC374	C14
U123	443-1331	74HC373	C13
U124	442-54	UA7805	C15
U125	442-53	NE555	C16
U126	442-627	78L05	C17

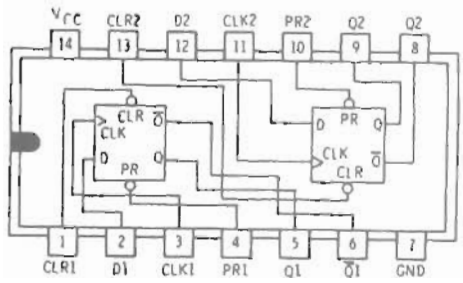
C10



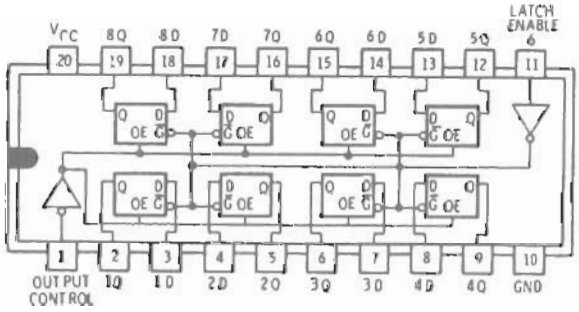
C11



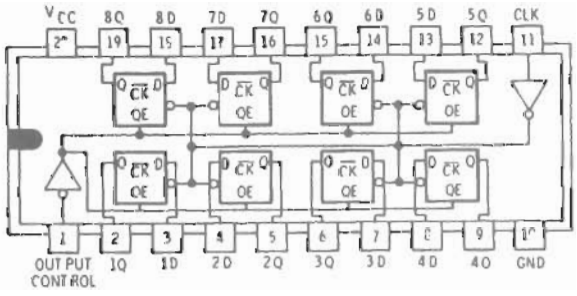
C12



C13



C14



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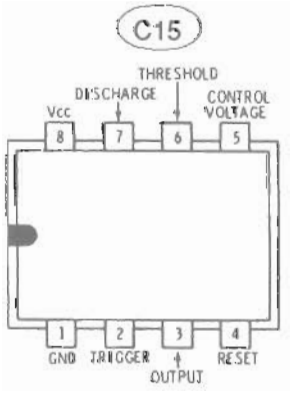
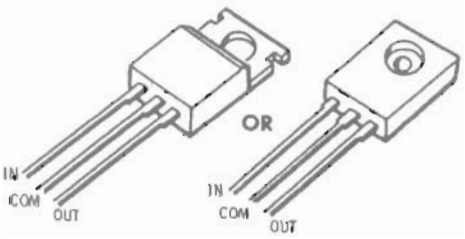
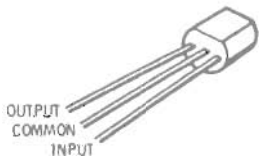


C16



C17



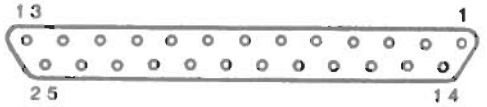
APPENDIX

Parallel Port Pin Configuration

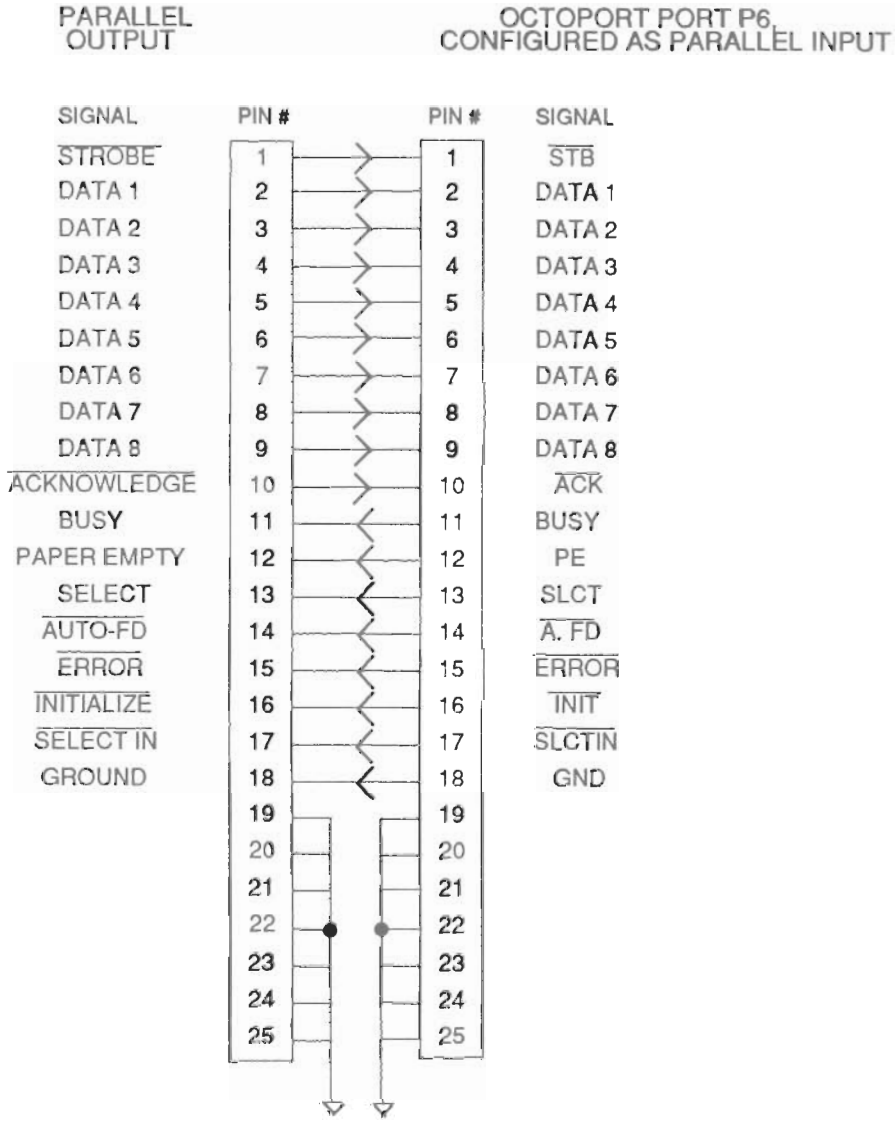
INPUT PORT		
PIN #	SIGNAL	SIGNAL FLOW
1	$\overline{\text{Strobe}}$	Input
2	Data 1	Input
3	Data 2	Input
4	Data 3	Input
5	Data 4	Input
6	Data 5	Input
7	Data 6	Input
8	Data 7	Input
9	Data 8	Input
10	$\overline{\text{Acknowledge}}$	Output
11	Busy	Output
12	Paper End	Output
13	Select	Output
14	$\overline{\text{NC}}$	—
15	$\overline{\text{Error}}$	Output
16	NC	—
17	NC	—
18	Ground	—
19	Ground	—
20	Ground	—
21	Ground	—
22	Ground	—
23	Ground	—
24	Ground	—
25	Ground	—

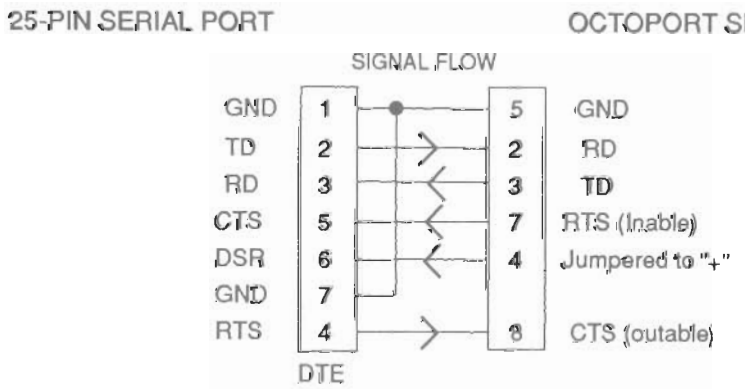
OUTPUT PORT		
PIN #	SIGNAL	SIGNAL FLOW
1	$\overline{\text{Strobe}}$	Output
2	Data 1	Output
3	Data 2	Output
4	Data 3	Output
5	Data 4	Output
6	Data 5	Output
7	Data 6	Output
8	Data 7	Output
9	Data 8	Output
10	$\overline{\text{Acknowledge}}$	Input
11	Busy	Input
12	NC	—
13	NC	—
14	Auto Form Feed	Output
15	$\overline{\text{NC}}$	—
16	$\overline{\text{Initialize}}$	Output
17	Select In	Output
18	Ground	—
19	Ground	—
20	Ground	—
21	Ground	—
22	Ground	—
23	Ground	—
24	Ground	—
25	Ground	—

25-PIN "D" CONNECTOR

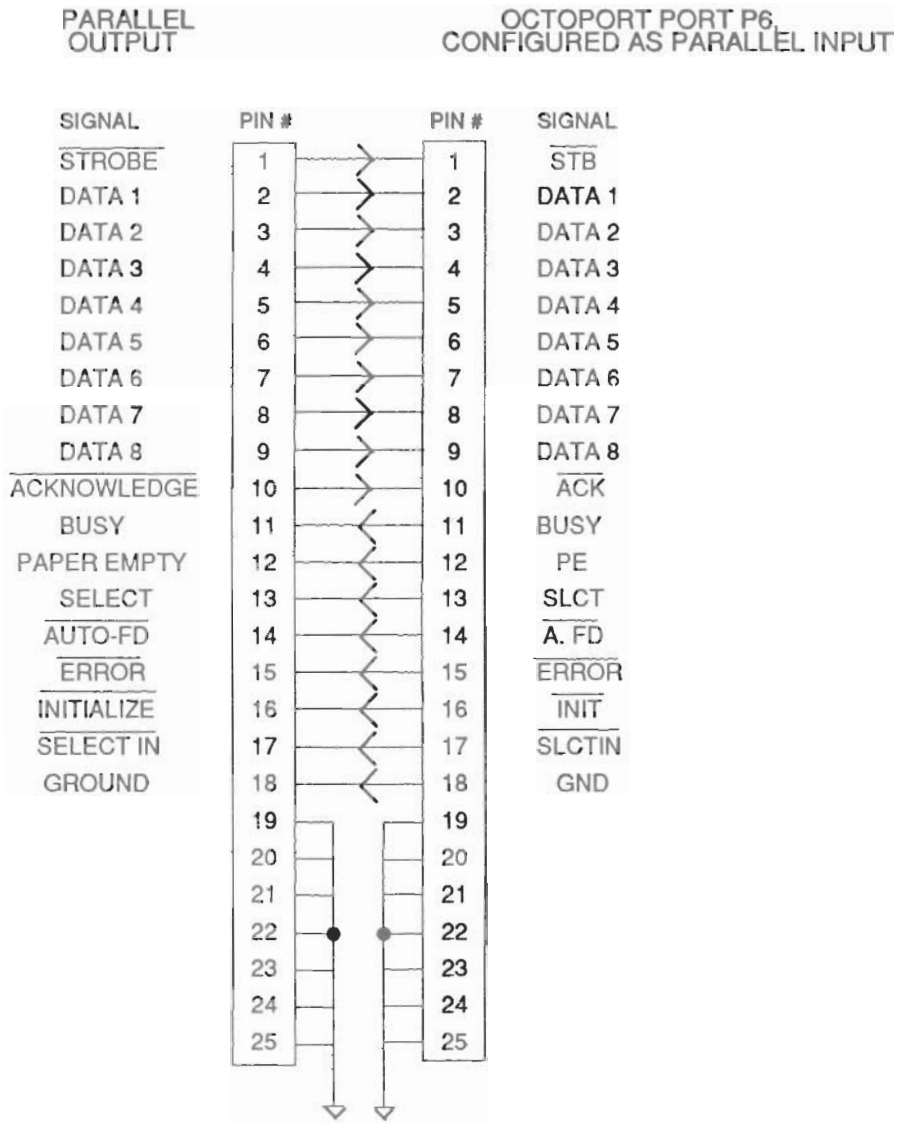


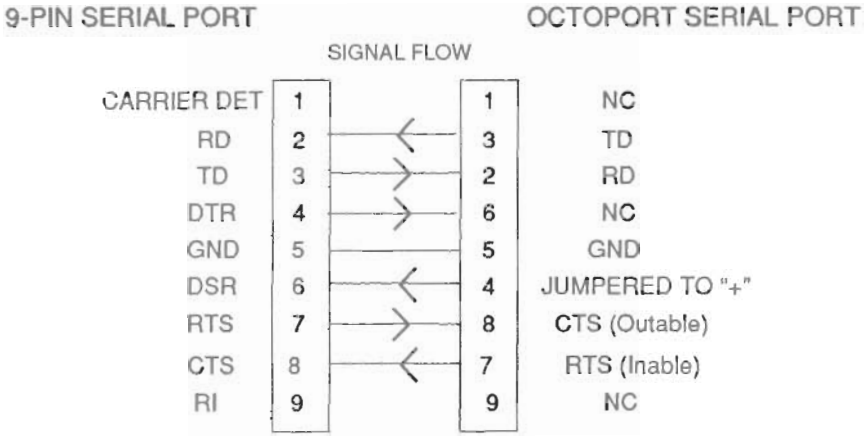
IBM PC Computers, or Heath/Zenith Computers Model 130, 140, 150, & 160





IBM AT Computers, or Heath/Zenith 200 Series Computers





ASCII-TO-HEX CONVERSION TABLE

ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX
NUL	00	SPACE	20	@	40	`	60
SOH	01	!	21	A	41	a	61
STX	02	"	22	B	42	b	62
ETX	03	#	23	C	43	c	63
EOT	04	$	24	D	44	d	64
ENQ	05	%	25	E	45	e	65
ACK	06	&	26	F	46	f	66
BEL	07	'	27	G	47	g	67
BS	08	(	28	H	48	h	68
HT	09	)	29	I	49	i	69
VF	0A	*	2A	J	4A	j	6A
VT	0B	+	2B	K	4B	k	6B
FF	0C	,	2C	L	4C	l	6C
CR	0D	-	2D	M	4D	m	6D
SO	0E	.	2E	N	4E	n	6E
SI	1F	/	2F	O	4F	o	6F
DLE	10	0	30	P	50	p	70
DC1	11	1	31	Q	51	q	71
DC2	12	2	32	R	52	r	72
DC3	13	3	33	S	53	s	73
DC4	14	4	34	T	54	t	74
NAK	15	5	35	U	55	u	75
SYN	16	6	36	V	56	v	76
ETB	17	7	37	W	57	w	77
CAN	18	8	38	X	58	x	78
EM	19	9	39	Y	59	y	79
SUB	1A	:	3A	Z	5A	z	7A
ESC	1B	;	3B	[	5B	{	7B
FS	1C	<	3C	\	5C	|	7C
GS	1D	=	3D	]	5D	}	7D
RS	1E	>	3E	^	5E	~	7E
US	1F	?	3F	_	3F	DEL	7F

GLOSSARY

The following terms used throughout the manual are defined as follows.

BAUD RATE — The speed at which data is transferred over a serial path, often expressed in bits-per-second.

BREAK — When no data is being sent on a serial interface, the polarity of the data line(s) is negative. This is defined as a "marking" condition. If a line goes positive, it is said to be in a "spacing" condition. A Break occurs if the line stays in the spacing condition for a period of time greater or equal to the duration of one character at the established baud rate.

BUFFER — A group of memory locations where data may be sequentially stored, and later retrieved. The buffers in the Octoport are FIFO (first-in, first-out).

ECHO — A feature that allows characters typed at a keyboard to be copied to the screen of the computer or terminal, so you can see what you are typing.

HANDSHAKING — A protocol, either in software or hardware, that allows two devices to determine when the other is ready to transmit and/or receive data.

PARALLEL — An interface system in which characters are transferred eight bits (one character) at a time. It uses multiple conductors, one conductor per bit plus handshaking lines.

PARITY — An error checking method that "sets" or 'clears' the most-significant bit of an ASCII character to make the total number of "set" bits in the character either even or odd. Parity must be off (NONE) when transferring binary files.

RS-232 — An EIA (Electronic Industries Association) standard defining the electrical and physical characteristics of the serial interface.

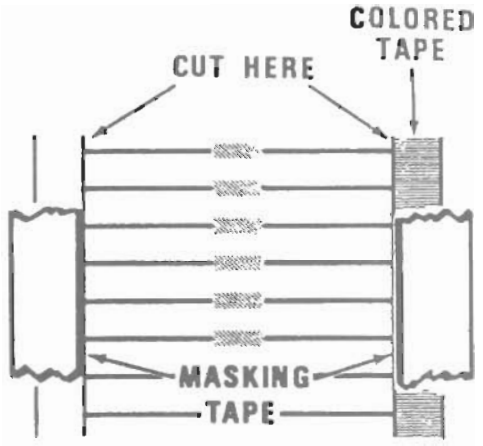
SERIAL — An interface system in which characters are transferred a bit at a time, using a single conductor and common return. The beginning and end of each character are identified by adding a "start" (spacing) bit and a "stop" (marking) bit.

TAPED COMPONENTS CHART

Read and Follow These Instructions
Before You Install The First Component.

Use masking tape, as shown in the Taping Detail, to secure the component strips over the component drawings. Make sure that each component matches the color bands or part number next to its illustration. Cut the tapes, as necessary, so that you can properly align the components in each section. Do not remove any components from the strip until they are called for in the assembly instructions.

NOTE: Never attempt to pull the components from the tape unless you are instructed to do so in a step; gum residue from the tape could cause an intermittent solder connection. Use diagonal cutters to remove each part as it is called for in the assembly instructions. Cut the leads at the inside edge of the tape as shown.

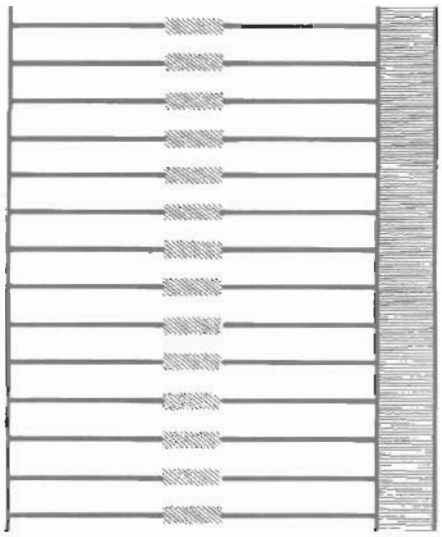


Taping Detail

CIRCUIT BOARD

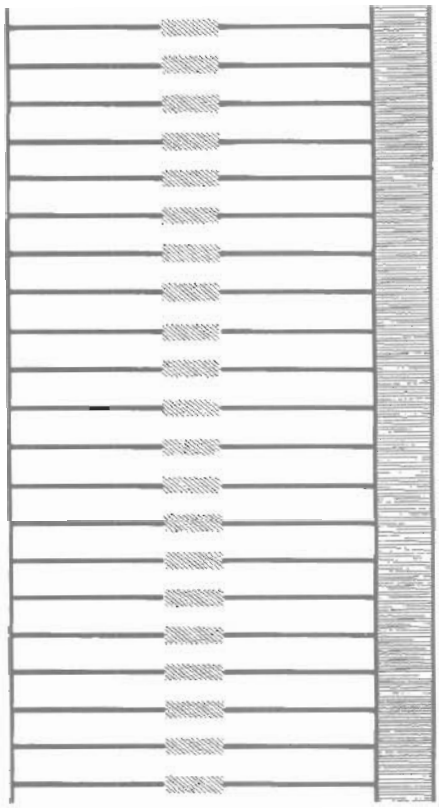
Section 1

330 pF (331) axial-lead capacitor
330 pF (331) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
1000 Ω (brn-blk-red) resistor
1000 Ω (brn-blk-red) resistor
1000 Ω (brn-blk-red) resistor
1000 Ω (brn-blk-red) resistor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
10 kΩ (brn-blk-org) resistor



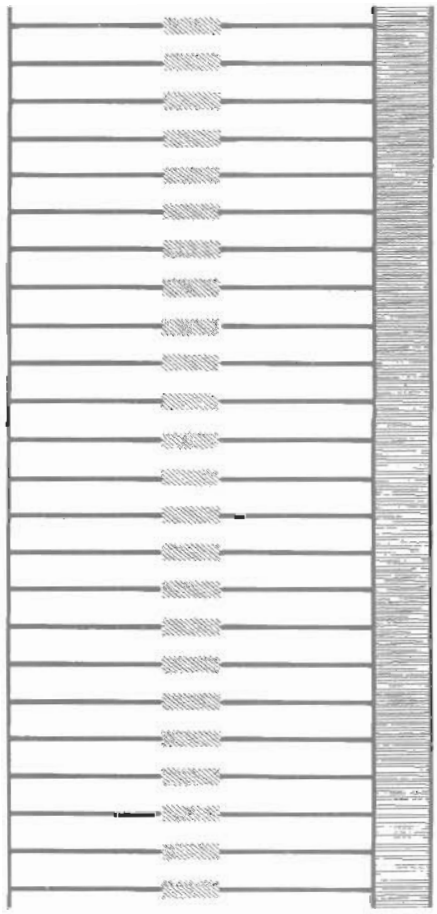
Section 2

330 pF (331) axial-lead ceramic capacitor
330 pF (331) axial-lead ceramic capacitor
330 pF (331) axial-lead ceramic capacitor
330 pF (331) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
1N6263/SD101A (#56-665) diode
1N4149 (#56-56) diode
1000 Ω (brn-blk-red) resistor
1000 Ω (brn-blk-red) resistor
1000 Ω (brn-blk-red) resistor
1000 Ω (brn-blk-red) resistor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
10 kΩ (brn-blk-org) resistor
10 kΩ (brn-blk-org) resistor
10 kΩ (brn-blk-org) resistor
1N4149 (#56-56) diode



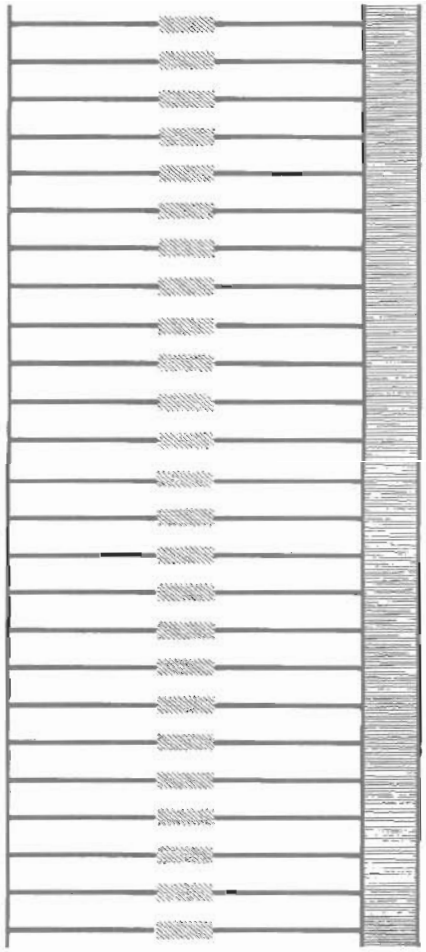
Section 3

330 pF (331) axial-lead ceramic capacitor
330 pF (331) axial-lead ceramic capacitor
330 pF (331) axial-lead ceramic capacitor
330 pF (331) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
1000 Ω (brn-blk-red) resistor
1000 Ω (brn-blk-red) resistor
1000 Ω (brn-blk-red) resistor
1000 Ω (brn-blk-red) resistor
330 pF (331) axial-lead ceramic capacitor
330 pF (331) axial-lead ceramic capacitor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor
1.7 µH RF choke
22 pF (220 or 22K) axial-lead ceramic capacitor
4700 Ω (yel-viol-red) resistor
.1 µF (104) axial-lead ceramic capacitor
1000 Ω (brn-blk-red) resistor
10 kΩ (brn-blk-org) resistor
2200 Ω (red-red-red) resistor
1N4149 (#56-56) diode



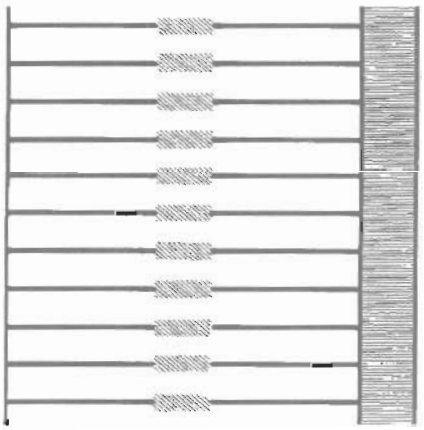
Section 4

22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
1N6263 or SD101A (#56-655) diode
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
10 kΩ (brn-blk-org) resistor
1000 Ω (brn-blk-red) resistor
4700 Ω (yel-viol-red) resistor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor
22 pF (220 or 22K) axial-lead ceramic capacitor
10 kΩ (brn-blk-org) resistor
1.7 µH RF choke
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor



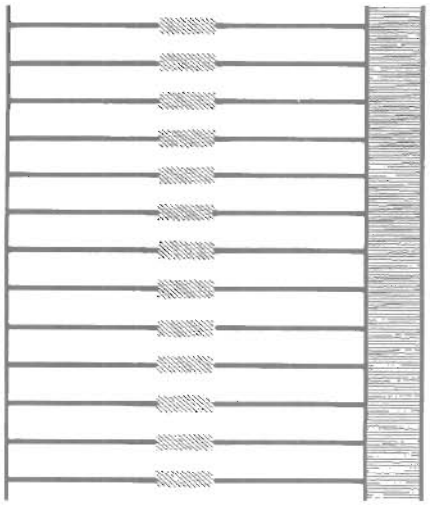
Section 5

22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor
4700 Ω (yel-viol-red) resistor



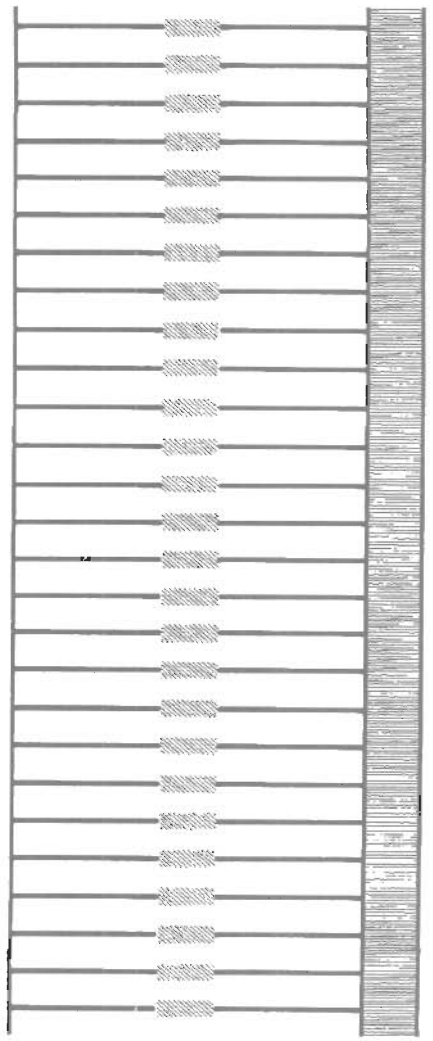
Section 5 (Cont'd)

10 kΩ (brn-blk-org) resistor
10 kΩ (brn-blk-org) resistor
10 kΩ (brn-blk-org) resistor
1N4149 (#56-56) diode
10 kΩ (brn-blk-org) resistor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
10 kΩ (brn-blk-org) resistor
1N6263/SD101A (#56-655) diode
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
4700 Ω (yel-viol-red) resistor



Section 6

22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
22 pF (220 or 22K) axial-lead ceramic capacitor
1.7 µH RF choke
1.7 µH RF choke
10 kΩ (brn-blk-org) resistor
.1 µF (104) axial-lead ceramic capacitor
1N4744 (#56-25) zener diode
1N4002 (#57-65) diode
1N4002 (#57-65) diode
1N4002 (#57-65) diode
1N4002 (#57-65) diode
.1 µF (104) axial-lead ceramic capacitor
.1 µF (104) axial-lead ceramic capacitor
.001 µF (102) axial-lead ceramic capacitor
22 kΩ (red-red-org) resistor
1000 Ω (brn-blk-red) resistor
1N5401 (#57-42) diode
1N5401 (#57-42) diode
1N5401 (#57-42) diode
1N5401 (#57-42) diode
.1 µF (104) axial-lead ceramic capacitor
10 kΩ (brn-blk-org) resistor
10 kΩ (brn-blk-org) resistor
10 kΩ (brn-blk-org) resistor
680 Ω, 1/2-watt (blu-gry-brn) resistor



CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath/Zenith Computers and Electronics centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH/ZENITH COMPUTER AND ELECTRONICS CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath/Zenith Computer and Electronics centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath/Zenith Computer and Electronics center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? – Operation? — Call or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heath/Zenith Computer and Electronics center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heath/Zenith Computers and Electronics center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

Heath Company
Benton Harbor, Michigan