HEATH COMPANY • BENTON HARBOR, MICHIGAN 49022
TLX 72-9421

IMPORTANT NOTICE

Dear Customer:

We are in the process of changing the standardization of screws from slotted head to phillips head. The new screws will also be black or stainless steel instead of zinc.

If some of the screws in your kit do not match the description in the Manual, use the screws that match the size, thread and length of the description as shown in the following example.

EXAMPLE

Thank you,

HEATH COMPANY

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Heathkit® Manual

for the

RS-232C TO BSR X-10 INTERFACE

Model GD-1530

595-2932-01

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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WARNING

This equipment has been verified to comply with the limits for a Class B computing device, pursuant to Subpart J of part 15 of FCC Rules.

This equipment generates and uses radio frequency energy for its operation and if not installed and used properly, that is, in strict accordance with the instruction manual, may cause interference to radio and television reception. It has been type tested and found to comply with the RF emission limits for a Class B computing device which is intended to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

— Move the equipment away from the receiver being interfered with.

— Relocate the equipment with respect to the receiver.

— Reorient the receiving antenna.

If additional help is needed, consult the dealer or ask for assistance from the manufacturer. Customer service information may be found on the inside back cover of this manual or on an insert sheet supplied with this equipment. The user may also find the following booklet helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20401. — Stock No. 004-000-00345-4.

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INTRODUCTION

The Heathkit Model GD-1530 is a computer Interface device which allows you to operate your BSR X-10 modules from a computer having an RS-232C output.

With the RS232/BSR Interface, you can write a program on your computer to control various appliances, lights, and other devices controlled by modules in your BSR X-10 Control System.

Your computer system must be equipped with an RS-232C Serial Interface Port (no protocol required or available) capable of a baud rate between 110 baud and 2400 baud to work correctly with the GD-1530 Interface.

Programming syntax and simple program examples are provided in the Appendix at the back of this Manual. You may develop more sophisticated programs for your own applications, or you may find programs available in various user's groups.

WARNING

Federal Communications Commission requirements prescribe verification of computing devices in Part 15 Subpart J of the rules and regulations. This computing device will meet these requirements when constructed in strict accordance with the instructions in this manual, using only components and materials supplied with the kit or the exact equivalent thereof.

ASSEMBLY NOTES

TOOLS

You will need these tools to assemble your kit.

SOLDERING IRON

OR

PENCIL SOLDERING IRON (25 WATTS)

OTHER HELPFUL TOOLS

*TO REMOVE SOLDER FROM CIRCUIT CONNECTIONS.

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 using 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 a part or a group of parts only when you are instructed to do so.

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6. Each circuit part in an electronic kit has its own component number (R2, C4, 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 WARNING: Avoid eye injury when you cut off excessive lead lengths. Hold the leads so they cannot fly toward your eyes.

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 right type of soldering iron. A 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 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 or 50:50 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 has been used.

PARTS

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 and four or five color bands, where each color represents a number. These colors (except for the last band, which indicates a resistor's "tolerance") will be given in the steps in their proper order. Therefore, the following color code is given for information only. NOTE: Occasionally, a "precision" or "power" resistor may have the value stamped on it.

Band 1 1st Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Band 2 2nd Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Band 3 (if used) 3rd Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Multiplier	
Color	Multiplier
Black	1
Brown	10
Red	100
Orange	1,000
Yellow	10,000
Green	100,000
Blue	1,000,000
Silver	0.01
Gold	0.1

Resistance Tolerance	
Color	Tolerance
Silver	±10%
Gold	± 5%
Brown	± 1%

Capacitors will be called out by their capacitance value in μF (microfarads) or pF (picofarads) and type: ceramic, Mylar*, electrolytic, etc. Some capacitors may have their value printed in the following manner:

EXAMPLES:

151K = 15 × 10 = 150 pF
759 = 75 ×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).

MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	±0.1 pF	B	
1	10	±0.25 pF	C	
2	100	±0.5 pF	D	
3	1000	±1.0 pF	F	±1%
4	10,000	±2.0 pF	G	±2%
5	100,000		H	±3%
			J	±5%
8	0.01		K	±10%
9	0.1		M	±20%

*DuPont Registered Trademark

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PARTS LIST

Unpack the parts and check each part against the following list. The key numbers correspond to the numbers on the Parts Pictorial (Illustration Booklet, Page 1). Any part that is packaged in an individual envelope with a part number on it should be placed back in the envelope after you identify it until it is called for in a step. Do not discard any packing materials until all the parts are accounted for.

Some parts are marked with a "171-" or "172-" packaging number. These numbers are used for packaging purposes only and do not appear in the "Manual Parts List."

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with the kit. If one is not available, see "Replacement Parts" inside the rear cover. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
RESISTORS				
All resistors are 1/4-watt, 5% (fourth band gold) unless stated otherwise.				
A1	6-150-12	1	15 Ω (brn-grn-blk)	R13
A2	6-220	1	22 Ω, 1/2-watt (red-red-blk)	R1
A1	6-331-12	1	330 Ω (org-org-brn)	R11
A1	6-821-12	1	820 Ω (gry-red-brn)	R14
A1	6-102-12	1	1000 Ω (brn-blk-red)	R3
A1	6-182-12	1	1800 Ω (brn-gry-red)	R7
A1	6-222-12	1	2200 Ω (red-red-red)	R10
A1	6-392-12	2	3900 Ω (org-wht-red)	R5, R8
A1	6-512-12	2	5100 Ω (grn-brn-red)	R4, R12
A1	6-103-12	1	10 kΩ (brn-blk-org)	R6
A1	6-153-12	1	15 kΩ (brn-grn-org)	R15
A1	6-334-12	1	330 kΩ (org-org-yel)	R2
CAPACITORS				
Mica				
B1	20-173	2	20 pF	C8, C9
B2	20-122	1	1000 pF	C11
Ceramic				
B3	21-164	1	1500 pF (.0015 μF)	C14
B4	21-72*	1	.005 μF	C16
B5	21-192	4	.1 μF (104 M)	C4, C10, C12, C15

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
Capacitors (Cont'd)				
Electrolytic				
B6	25-900	1	1 μF	C7
B7	25-872	1	220 μF	C5
B7	25-875	2	1000 μF	C2, C6
Polypropolene				
B8	27-60	1	.22 μF	C13
B9	27-90	1	2.2 μF	C1
Mylar				
B10	27-10	1	.047 μF	C3
DIODES				
C1	56-26	1	1N191 (brn-wht-brn)	D5
C1	57-65	6	1N4002	D1, D2, D3, D4, D7, D8
C1	56-84	2	1N4148	D6, D9
C1	56-605	1	1N4746	D11

* Safety critical component. Replace only with the exact Heath Company replacement part.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

TRANSISTOR — INTEGRATED CIRCUITS (IC's)

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

1. Part number.
2. Type number. (On integrated circuits this refers only to the numbers and letters listed. Any additional letters or numbers on an IC are not significant.)
3. Part number and type number.
4. Part number with a type number other than the one listed.

D1	417-811	1	MPSL01 transistor	Q2
D1	417-875	1	2N3904 transistor	Q1

NOTE: "Protected" IC's can be damaged by static electricity. DO NOT remove them from their foam pad until you are instructed to do so in a step.

D2	442-54	1	UA7805 IC	U5
D3	442-741	1	2209 IC	U3
D3	443-603	1	4011 IC	U2
D3	444-205	1	8748 IC	U1
D3	443-1109	1	HCPL2531 IC	U4

OTHER CIRCUIT COMPONENTS

E1	10-311	1	5000 Ω (5k) control	R9
E2	45-604	1	100 μH (101K) choke	L1
E3	52-192	1	Module transformer	T2
E4	54-1020	1	Power transformer	T1
E5	404-647	1	6 MHz crystal	Y1
E6	412-640	1	LST5053 light-emitting diode (LED)	V1
E7	421-49*	1	.125 (1/8) ampere regular fuse	F1

HARDWARE

#4 Hardware

F1	252-2	2	4-40 nut
F2	254-9	3	#4 lockwasher
F3	255-757	2	4-40 hex stud

* Safety critical part. Replace with only the same rated part.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

#6 Hardware

F4	250-1280	2	6-32 × 3/8" phillip's head screw
F5	250-1434	4	#6 × 3/8" self-tapping screw
F6	250-1322	1	#6 × 5/8" self-tapping screw
F7	252-3	2	6-32 nut
F8	254-1	1	#6 lockwasher
F9	259-1	2	#6 solder lug

CLIPS - CONNECTORS - SOCKETS

G1	260-65	2	Fuse clip	
G2	432-134	7	Wire connector (1-extra)	
G3	432-866	3	Spring connector (1-extra)	
G4	432-1033	4	Male connector (2-extra)	
G5	432-1030	1	2-hole socket shell	
G6	432-1032	1	25-hole socket	J1
G7	434-230	2	8-pin IC socket	
G8	434-298	1	14-pin IC socket	
G9	434-253	1	40-pin IC socket	

LINE CORD - WIRE

89-23	1	Line cord
340-8	8"	Bare wire
344-125	15"	Black wire
344-134	15"	White wire

MISCELLANEOUS

H1	75-710	4	Circuit board spacer (See ** below)
H2	75-753	1	Line cord strain relief
H3	90-1291-1	1	Cabinet top
H4	90-1292-1	1	Cabinet bottom
H5	215-677	1	Transistor heat sink
H6	260-89	1	LED grommet
H7	260-90	1	LED retainer ring
H8	261-43	4	Rubber foot
H9	352-13	1	Silicone grease
	85-2755-1	1	Circuit board
	490-185	1	Solder-wick***
			Solder
	390-1255	1	Caution label
	390-1872	1	FCC label
		1	Blue and white label
	597-260	1	Parts Order Form
			Assembly Manual (See Page 1 for Part Number.)
			Illustration Booklet (See Page 1 for Part Number.)

** Soak these spacers in water until they are called for in a step.

*** Registered Trademark, Solder Removal Co.

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STEP-BY-STEP ASSEMBLY

CIRCUIT BOARD ASSEMBLY

START

Position the circuit board as shown.

NOTE: Only a portion of the circuit board is shown in the following Pictorial. The small "Identification Drawing" at the top of the page shows the area of the circuit board to be assembled.

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

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD. See Detail 1-1A.

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.

( ) 1N191 diode (brn-wht-brn, #56-26). Hold the diode with pliers as shown and bend the leads straight down.

( ) D5: Position the end with the band as shown. Push the leads through the holes at the proper location on the circuit board.

The steps performed in this Pictorial are in this area of the circuit board.

Detail 1-1A

PICTORIAL 1-1

CONTINUE

( ) Position the diode against the circuit board. Then bend the leads outward slightly to hold the diode in place.

( ) Turn the circuit board over, and solder the diode 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. Then 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.

( ) 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 connection. Compare it to the illustrations on Page 10. After you have checked the solder connections, proceed with the assembly on Page 11. Use the same soldering procedure for each connection.

A GOOD SOLDER CONNECTION

When you heat the lead and the circuit board foil at the same time, the solder will flow evenly onto the lead and the foil. The solder will make a good electrical connection between the lead and the foil.

POOR SOLDER CONNECTIONS

When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

When the foil is not heated sufficiently the solder will blob on the circuit board as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

SOLDER BRIDGES

A solder bridge between two adjacent foils is shown in photograph **A**. Photograph **B** shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is: always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil.

Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will remove the solder bridge. NOTE: The foil side of most circuit boards has a coating on it called "solder resist." This is a protective insulation to help prevent solder bridges.

A

SOLDER BRIDGE

B

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START

( ) D1: 1N4002 diode (#57-65).

( ) D2: 1N4002 diode (#57-65).

( ) D3: 1N4002 diode (#57-65).

( ) D4: 1N4002 diode (#57-65).

( ) D6: 1N4148 diode (#56-84).

Be sure you installed diode D5 in Pictorial 1-1.

( ) D7: 1N4002 diode (#57-65).

( ) D11: 1N4746 diode (#56-605).

( ) D8: 1N4002 diode (#57-65).

( ) D9: 1N4148 diode (#56-84).

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

PICTORIAL 1-2

START

( ) R2: 330 kΩ (org-org-yel).

( ) R13: 15 Ω (brn-grn-blk).

( ) R15: 15 kΩ (brn-grn-**org**).

( ) R14: 820 Ω (gry-red-brn).

( ) R12: 5100 Ω (grn-brn-red).

( ) R10: 2200 Ω (red-red-red).

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

( ) R8: 3900 Ω (org-wht-red).

( ) R7: 1800 Ω (brn-gry-red).

( ) R5: 3900 Ω (org-wht-red).

( ) R4: 5100 Ω (grn-brn-red).

( ) R6: 10 kΩ (brn-blk-**org**).

( ) R3: 1000 Ω (brn-blk-**red**).

( ) R11: 330 Ω (org-org-brn).

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

The remaining resistor will be installed later.

PICTORIAL 1-3

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START

NOTE: When you install an IC socket, be sure the index mark is still visible after the socket is installed. Then solder the pins to the foil.

( ) 8-pin IC socket at location U4.

( ) 14-pin IC socket at location U2.

( ) 40-pin IC socket at location U1.

( ) 8-pin IC socket at location U3.

( ) R1: 22 Ω, 1/2-watt (red-red-blk).

( ) L1: 100 μH (101K) choke (#45-604).

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

NOTE: Install wire connectors in the following steps as shown. Solder each connector to the foil as you install it.

( ) 6-wire connectors.

PICTORIAL 1-4

START

(✓) F1: Install a fuse clip on each end of the .125 (1/8) ampere fuse. Insert the clips in the circuit board and solder them as quickly as possible to the foil.

( ) U5: UA7805 IC (#442-54). Hold the IC leads with long-nose pliers and bend the leads as shown. Refer to Detail 1-5A and open the silicone grease. Apply a thin layer of silicone grease to the indicated side of the IC. Mount the IC and the heat sink to the board with a 6-32 × 3/8″ screw, #6 lockwasher, and 6-32 nut. Then solder the leads to the foil and cut off the excess lead lengths.

(✓) Q1: 2N3904 transistor (#417-875). **See Detail 1-5B.**

(✓) Q2: MPSL01 transistor (#417-811).

WARNING: The silicone grease you will use in the following step(s) helps transfer heat from the transistor to the heat sink. The grease is not caustic, but make sure you do not get it into your eyes, ears, nose, mouth, or clothing. Always wash your hands after you use the grease. Keep this and all chemicals out of the reach of children.

Detail 1-5A

NOTE: When you install a transistor in each of the following steps, align its flat with the flat on the board. Insert the leads into their correct holes. Position the transistor 1/4″ above the board. Then solder the leads to the foil and cut off the excess lead lengths.

Detail 1-5B

PICTORIAL 1-5

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START

(✓) C4: .1 µF (104M) ceramic.

( ) C14: 1500 pF (.0015 µF) ceramic. See Detail 1-6A.

( ) T2: Module transformer (#52-192). Align the notch in the transformer with the notch outline on the circuit board. Insert the pins into the board holes and solder them to the foil.

(✓) C15: .1 µF (104M)ceramic.

(✓) C12: .1 µF (104M)ceramic.

(✓) C10: .1 µF (104M)ceramic.

(✓) C9: 20 pF mica.

(✓) C8: 20 pF mica.

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

(✓) Y1: 6 MHz crystal (#404-647). Insert the crystal leads into their circuit board holes, solder them to the foil, and cut off their excess lead lengths. Bend a 2″ bare wire at its center, fit it over the crystal, and insert its ends into the circuit board holes. Then, quickly, to avoid melting the solder seal, solder the bare wire to the top of the crystal and the board foils and cut off the excess wire ends.

NOTE: When you install ceramic capacitors, do not push the insulated portions of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.

Detail 1-6A

PICTORIAL 1-6

START

( ) C3: .047 µF Mylar.

NOTE: When you install an electrolytic capacitor, be sure to match the positive (+) mark on the capacitor with the positive (+) mark on the circuit board, or match the negative (−) mark on the capacitor with the negative mark on the circuit board.

( ) C2: 1000 µF electrolytic.

( ) C1: 2.2 µF polypropolene.

( ) C13: .22 µF polypropolene.

( ) C6: 1000 µF electrolytic.

( ) C5: 220 µF electrolytic.

( ) C11: 1000 pF mica.

( ) C7: 1 µF electrolytic.

( ) Solder the leads to the foil and cut off the excess lead lengths. The remaining capacitor will be installed later.

( ) R9: 5000 Ω (5k) control (#10-311). Bend the pins slightly if necessary, and insert them in the board holes. Push the control tight against the board. Then solder the pins to the foil.

PICTORIAL 1-7

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Detail 2-1A

Refer to Pictorial 2-1 (Illustration Booklet, Page 2) for the following steps.

When a wire is called for, cut the specified color wire to the indicated length and remove 1/4″ of insulation from each end. Then tightly twist the fine wire strands and melt a small amount of solder to the exposed wire end to hold the fine wire strands together.

( ) Prepare the ends of a 3-1/2″ black wire and a 3-1/2″ white wire.

( ) Refer to Detail 2-1A and cut one exposed end of the 3-1/2″ black wire to 1/8″. Then solder this wire end to a male connector.

( ) In the same manner, install a male connector to one end of the 3-1/2″ white wire.

( ) Push the male connector on the end of the black wire into hole 7 of the 25-hole socket until it clicks into place. Use a pointed object to push the connector. The hole numbers are molded into the socket.

( ) In the same manner, push the male connector on the white wire into hole 3 of the 25-hole socket.

Set the 25-hole socket aside temporarily.

( ) Prepare the ends of a 10-1/2″ black wire and a 10-1/2″ white wire.

( ) Refer to Detail 2-1B and cut one exposed end of the 10-1/2″ black wire to 1/8″. Then solder this wire end to a spring connector.

( ) In the same manner, install a spring connector to one end of the 10-1/2″ white wire.

Detail 2-1B

Detail 2-1C

( ) Refer to Detail 2-1C and position the 2-hole socket shell with the slots up and push the spring connector on the black wire into the left hole until the locking tab snaps into place.

( ) In the same manner, push the spring connector on the white wire into the right hole in the 2-hole socket shell. Its free end will be connected later.

Solder the free ends of the wires of the 25-hole socket to the circuit board as follows:

( ) White wire to the "+" marked hole.

( ) Black wire to the "−" marked hole.

Solder the free ends of the wires of the 2-hole socket to the circuit board as follows:

( ) Black wire to hole B.

( ) White wire to hole C.

( ) T1: Install the power transformer at location T1 on the circuit board. It will only fit one way. With the transformer tight against the board, bend over the transformer mounting tabs against the foil side of the board. Then solder the transformer pins to the foil.

CAUTION: When you install a protected IC (one with a foam pad on its pins), be sure it does not get damaged by static electricity. Once you remove the foam pad from the IC, DO NOT let go of the IC. Install the IC as follows. Read the following six instructions before you pick up the IC.

1. Pick up the IC and touch the foam with both hands.

Detail 2-1D

2. Hold the IC with one hand and remove the foam pad with the other hand.

3. Continue to hold the IC with one hand and straighten any bent pins with the other hand.

4. Pick up the circuit board in the other hand.

5. Align the pin 1 end of the IC with the index mark on the circuit board. See Detail 2-1D.

6. Then push the IC pins into the IC socket. Once in the socket, the IC is protected.

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( ) U1: 8748 IC (#444-205) at location U1.

( ) U2: 4011 IC (#443-603) at location U2.

( ) U3: 2209 IC (#442-741) at location U3.

( ) U4: HCPL 2531 IC (#443-1109) at location U4.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

( ) Unsolder connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Transistors and IC's for the proper type and installation.

( ) Electrolytic capacitors for the correct position of the positive (+) end.

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

Set the circuit board aside temporarily.

CABINET ASSEMBLY

Refer to Pictorial 3-1 (Illustration Booklet, Page 3) for the following steps.

( ) Refer to the inset drawing on Pictorial 3-1 and remove the protective backing from a rubber foot. Then press the foot firmly into place at one corner on the bottom of the cabinet bottom.

( ) In the same manner, install the remaining three rubber feet on the cabinet bottom.

( ) Remove the protective backing from the blue and white label. Press (do not rub) this label into place on the bottom of the cabinet bottom. Always mention the Model and Serial numbers on this label in any communications you have with the Heath Company about this kit.

( ) In the same manner, install the FCC label on the bottom of the cabinet bottom.

( ) Remove the four circuit board spacers from the water and dry them. Push the short end of one spacer into hole A inside the cabinet bottom until it clicks into place.

( ) In the same manner, install the remaining circuit board spacers into holes B, C, and D in the cabinet bottom.

Detail 3-1A

( ) Refer to Detail 3-1A and prepare the end of the line cord as follows:

1. Separate the three wires to 10-1/2″ from the free end.
2. Remove 1/4″ of insulation from the ends of the ribbed and the smooth wires.
3. Cut the center wire to 2″ from the separation location and remove 3/8″ of insulation.
4. Peel the thin black insulation from the center (green) wire and cut off the insulation at the separation.
5. Twist together the fine wire strands at the end of each wire and melt a small amount of solder on the exposed wire ends.

( ) Refer to Detail 3-1B and pass the line cord through hole G in the cabinet bottom. Be sure you position the ribbed wire as shown.

( ) Then feed the line cord through the three holes in the line cord strain relief following the number sequence until the green wire extends 2″ from the strain relief as shown in Detail 3-1B. Hold the free end of the line cord and pull the extra back through the strain relief.

( ) Refer to Detail 3-1B and secure the line cord strain relief at location G in the cabinet bottom with a #6 × 5/8″ self-tapping screw.

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Detail 3-1B

( ) V1: Refer to Detail 3-1C and install the LST5053 light-emitting diode (#412-640) at location V1 in the cabinet bottom as follows:

1. Insert the LED grommet in the hole at V1 from the outside of the cabinet bottom.
2. Position the flat (short lead) side of the LED as shown and push it into the LED grommet. DO NOT turn the LED from this position.
3. Push the LED retainer ring all the way onto the LED grommet. DO NOT shorten the leads of the LED.

( ) Scrape (with a knife) or sand off the paint at holes E and F from the inside of the cabinet bottom.

Detail 3-1C

Detail 3-1D

Detail 3-1E

( ) Refer to Detail 3-1D and install a #6 solder lug at hole F with a 6-32 × 1/4" screw and a 6-32 nut.

( ) Solder the green line cord wire to the solder lug at location F. Make a mechanically secure connection.

( ) Position the free line cord wires around the outside of the circuit board spacers at locations C and A.

( ) Lay the circuit board in the cabinet bottom. Now solder the ribbed line cord wire into hole AC(−) and the smooth line cord wire into hole AC(+) in the circuit board.

( ) Secure the 25-hole socket at location J1 in the cabinet bottom with a 4-40 hex stud, a #6 solder lug, a #4 lockwasher, and a 4-40 nut at hole E. Use a 4-40 hex stud, two #4 lockwashers, and a 4-40 nut at the other socket hole. Be sure you position the socket so the black and white wires are located as shown.

( ) C16: Solder one lead of a .005 μF ceramic capacitor into hole A of the circuit board, and solder the other lead to the solder lug at location E on the cabinet bottom. Position the leads away from the chassis.

( ) Push the circuit board down onto the circuit board spacers until they snap into place in the circuit board holes.

( ) Be sure the long and short leads of the LED at location V1 are positioned as shown in Pictorial 3-1. Position the slots in the 2-hole socket up and push the socket all the way onto the leads of the LED. Then bend the LED leads around and against the sides of the 2-hole socket. These leads must not touch each other. The leads will hold the socket in place on the LED leads.

( ) Locate the "Caution" label and write ".125 (1/8) AMP. Regular Fuse" on it. Remove the protective backing and press the label into place at the indicated location inside the cabinet bottom.

This completes the wiring of the kit. Proceed to the "Initial Test" section on the next Page.

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INITIAL TEST

If you do not obtain the specified results as you make the following tests, proceed to the "In Case of Difficulty" section of the Manual and correct the problem before you proceed.

If you have or can obtain a volt-ohmmeter (VOM), perform the following resistance and voltage checks. If you do not have a meter, make another good visual check of all the wiring to be sure all the parts are installed correctly, that all connections are soldered, and that there are no short circuits (solder bridges between the circuit board foils or leads of different components touching each other). Then proceed to the "Calibration" section of the Manual (Page 24).

RESISTANCE CHECKS

NOTE: The polarity of ohmmeters differ. Therefore, if you do not obtain the correct response in a test, reverse the leads (connect the negative lead where the positive lead was etc.) and try again. If you obtain the correct reading now, everything is all right.

Furthermore, different meters use different voltages to test resistance. This may affect resistance readings when diodes are involved. Your reading in some of the next steps may be much greater than the minimum value listed; this is perfectly acceptable.

Refer to Pictorial 4-1 (Illustration Booklet, Page 4) for the following steps.

( ) Set the ohmmeter to its R × 1M range.

( ) Connect the meter's negative (−) test lead to the round prong of the Interface line cord plug.

( ) Touch the positive (+) meter test lead first to one flat prong of the line cord plug, and then to the other flat prong of the line cord plug. In both instances, the indicator on the meter should rise (may move slowly, due to the charging of a capacitor) from a low value to some value near or greater than 1 MΩ.

( ) Set the ohmmeter to its R × 100 range.

( ) Touch one meter lead to either flat prong of the line cord plug and touch the other meter lead to the other flat prong. The meter should indicate approximately 200 ohms.

( ) Connect the negative (−) meter lead to the lead of capacitor C16 coming from hole A in the circuit board. Do not move this lead unless you are instructed to do so in a step.

( ) Leave the meter set to its R × 100 range.

In each of the following steps, touch the positive (+) meter lead to the indicated location; then compare your meter indication to the meter reading called for in the step. NOTE: In some checks, the meter indicator will rise slowly (a capacitor is charging) before it reaches the specified indication.

( ) Positive (+) lead of capacitor C2. The meter should indicate greater than 5000 ohms.

( ) Positive (+) lead of capacitor C5. The meter should indicate greater than 700 ohms.

( ) Positive (+) lead of capacitor C6. The meter should indicate greater than 600 ohms.

This completes the "Resistance Checks."

VOLTAGE CHECKS

CAUTION: When you make voltage measurements or connect other test equipment to the circuit board in the Interface, you must operate the Interface from an isolation transformer. Otherwise, you may damage circuit components in the Interface.

WARNING: When the line cord of the Interface is connected to an AC voltage source (AC outlet or isolation transformer), AC line voltage is present at a number of locations on the circuit board. Avoid these areas, shown in Pictorial 4-1, so you do not get an electrical shock.

Refer to Pictorial 4-1 as you perform the following voltage checks.

( ) Connect the negative (−) voltmeter lead (and leave it connected) to the lead of capacitor C16 that comes from hole A in the circuit board.

AC Voltage Checks

( ) Set the voltmeter to a range that is above 120 VAC.

( ) Plug the line cord into a 120 VAC outlet. NOTE: The Transmit LED (V1) will not light at this time.

In each of the following steps, touch the positive (+) meter lead to the indicated location; then compare your meter indication to the meter reading called out in the steps.

( ) The bare end of the smooth AC line cord wire coming from the AC(+) hole on the circuit board. The meter should indicate the AC line voltage (approximately 120 VAC).

( ) The indicated fuse (F1) clip (nearest diode D3). The meter should indicate the AC line voltage (approximately 120 VAC).

DC Voltage Checks

( ) Set the voltmeter to a range that is 20 VDC or higher.

In each of the following steps, touch the positive (+) voltmeter lead to the indicated location; then compare your meter indication to the meter reading called out in the steps.

( ) Positive (+) lead of capacitor C2. The meter should indicate approximately 13 VDC.

( ) Positive (+) lead of capacitor C5. The meter should indicate approximately 5 VDC.

( ) Positive (+) lead of capacitor C6. The meter should indicate approximately 17 VDC.

( ) Pin 1 of U5. The meter should indicate approximately 13 VDC.

( ) Pin 3 of U5. The meter should indicate approximately 5 VDC.

( ) Pin 40 of U1. The meter should indicate approximately 5 VDC.

( ) Pin 13 of U2. The meter should indicate approximately 5 VDC.

( ) Pin 1 of U3. The meter should indicate approximately 6.5 VDC.

( ) Pin 5 of U3. The meter should indicate approximately 2.2 VDC.

( ) Pin 7 of U4. The meter should indicate approximately 5 VDC.

( ) Pin 8 of U4. The meter should indicate approximately 5 VDC.

( ) Collector lead of Q2. The meter should indicate approximately 17 VDC.

This completes the "Voltage Checks." Unplug the Interface from the AC outlet and disconnect the meter leads.

CALIBRATION

Refer to Pictorial 4-1 (Illustration Booklet, Page 4) for the following steps.

( ) Set control R9 to the position shown in the Pictorial (pointing between 10:00 and 11:00 O'clock.

( ) Refer to the following chart and install jumper wires into the wire connectors at locations W1, W2, or W3 on the circuit board to obtain the correct baud rate to match your computer system. Use 1-1/4" bare wires and bend them as shown on Pictorial 4-1.

BAUD RATE	WIRE JUMPER AT: W1	W2	W3
110	YES	YES	YES
150	NO	YES	YES
300	YES	NO	YES
600	NO	NO	YES
1200	YES	YES	NO
2400	NO	YES	NO

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NOTES:

1. The interface alignment adjustments are quite broad and the unit may not require the following alignment procedure except in the more demanding applications.

2. The following instructions are divided into two sections, "Alignment Verification Without Instruments" and "Alignment With Instruments." If you do not have an isolation transformer, oscilloscope, and frequency counter, perform the "Alignment Verification Without Instruments." If you do have these instruments, skip the "Alignment Verification Without Instruments" and perform the "Alignment With Instruments."

3. This Manual is only for the Interface, and cannot anticipate the programming and operation specifics of your computer system. We must rely on your ability to operate your system for the specific programming and output expertise.

ALIGNMENT VERIFICATION WITHOUT INSTRUMENTS

( ) Connect the RS-232 accessory cable between connector J1 on the Interface and your computer or terminal.

( ) Connect the line plug of the Interface to an AC outlet.

( ) Set the driver to the same baud rate you selected on Page 24.

( ) Generate and run the following MBASIC® language program that corresponds to your operating system. The program assumes that you are using an alternate terminal device driver (AT.DVD) that has been loaded prior to loading MBASIC.

For HDOS®

```
1Ø  OPEN "O",1,"AT:"
2Ø  PRINT #1,"A1"
3Ø  CLOSE #1
4Ø  FOR I=1 TO 1ØØØ:NEXT I:REM PAUSE BETWEEN COMMAND WORDS
5Ø  OPEN "O",1,"AT:"
6Ø  PRINT #1,"AON"
7Ø  CLOSE #1
8Ø  END
```

For CP/M® (see footnote)

```
1Ø  LPRINTΔ"A1"
2Ø  FOR X=1ΔTOΔ1ØØØ:NEXT X
3Ø  LPRINTΔ"AON"
4Ø  END
```

( ) The LED at V1 on the Interface should light briefly (about 1/2 second) to indicate that the unit has transmitted the "turn on" code to module one, house code "A." If the LED does not light, verify that your computer is providing the proper signal to the Interface, then use the "In Case Of Difficulty" section to troubleshoot the Interface. If you cannot find any obvious problems, you will need to troubleshoot the system using test instruments.

This completes "Calibration." Proceed to the "Final Assembly" section of the Manual.

FOOTNOTE: The special sign (Δ) is used in the CP/M program to signify that a space is required wherever the Δ is found.

ALIGNMENT WITH INSTRUMENTS

( ) Connect the frequency counter signal lead to pin 8 of IC U2, and the ground lead to the lead of capacitor C16 coming from hole A in the circuit board.

( ) Plug the line plug of the Interface into the isolation transformer. Then connect the isolation transformer to an AC outlet.

( ) Turn on the test equipment.

( ) Adjust control R9 on the circuit board for a frequency of 120 kHz.

( ) Turn off the isolation transformer and frequency counter, and disconnect them from the Interface.

( ) Connect the oscilloscope signal lead to the indicated lead of capacitor C13 on the circuit board. Be sure you do not short the capacitor lead to the board foil with the oscilloscope lead. Connect the oscilloscope ground lead to the lead of capacitor C16 that comes from circuit board hole A.

( ) Connect an RS-232 accessory cable between connector J1 on the Interface and your computer or terminal.

( ) Connect the line cord of the Interface to an AC outlet.

( ) Generate and run an MBASIC program like the following:

For HDOS

```
10  OPEN "O",#1,"AT:"
20  PRINT #1 "A1"
30  CLOSE #1
40  FOR X=1 TO 1000:NEXT X
50  GOTO 10
```

For CP/M (see footnote)

```
10  LPRINTΔ"A1"
20  FOR X=1 TO 1000:NEXT X
30  GOTO 10
```

The LED at V1 on the Interface should flash to indicate that the unit is transmitting.

( ) Adjust transformer T2 to give the maximum output indication on the oscilloscope while the LED is lit.

( ) Disconnect the oscilloscope and the Interface. This completes the "Calibration."

FOOTNOTE: The special sign (Δ) is used in the CP/M program to signify that a space is required wherever the Δ is found.

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FINAL ASSEMBLY

Refer to Pictorial 5-1 for the following steps.

( ) Position the cabinet top onto the cabinet bottom. When their holes are aligned, their rear edges should be even with each other.

( ) Secure the cabinet top to the cabinet bottom with four #6 × 3/8" self-tapping screws.

This completes the assembly of the kit.

PICTORIAL 5-1

OPERATION

( ) Program your BSR X-10 modules.

( ) Connect an RS-232C accessory cable (not supplied) from the DTE connector on your Interface to the DCE connector on your computer or terminal.

( ) Plug the line cord of the Interface into an AC outlet.

( ) Write your desired program to control your BSR X-10 System. See the sample programs in the Appendix on Page 37.

This completes the "Operation" section of the Manual.

IN CASE OF DIFFICULTY

CAUTION: When the line cord is connected to an AC outlet, AC voltage will be present at several places on the chassis. Do not contact this voltage or you will receive an electrical shock.

This section gives you some suggestions for locating and resolving difficulties.

The first part, "Visual Checks," deals with problems that exist when you have just completed the assembly of your kit. This information primarily covers soldering and assembly problems.

The second part consists of a "Troubleshooting Chart," which gives difficulties and likely causes.

NOTE: 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. Recheck the wiring. Trace each lead in color pencil on the Pictorial as it is checked. 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.

2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by a careful inspection of connections to make sure they are soldered as described in the "Soldering" section of the "Assembly Notes." Reheat any doubtful connections. Be sure all the wires are soldered at places where several wires are connected.

3. Be sure the transistors and the integrated circuit are in the proper locations (correct part number and type number). Be sure that each transistor lead is in the right hole and has a good solder connection. Check the integrated circuit for proper positioning and for good contact at each pin connection.

4. Check capacitor values carefully. Be sure the proper part is wired into the circuit at each capacitor location. Check each electrolytic capacitor to be sure the lead near the positive (+) marking is at the correct position.

5. Check each resistor value carefully.

6. Be sure the correct diode is installed and that the banded end is positioned correctly.

7. Check all component leads connected to the circuit board.

8. Make sure bare wires do not touch the chassis or other lugs and make sure all wires are properly soldered.

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Troubleshooting Chart

This chart lists the condition and possible causes of several malfunctions. If a particular part is mentioned (capacitor C6 for example) as a possible cause, check that part to see if it was installed correctly. Also check it and the parts connected to it for poor connections. It is also possible, on rare occasions, for a part to be faulty and require replacement.

PROBLEM	POSSIBLE CAUSE
A. Very low or "0" resistance indication between the round prong and either flat prong of the line cord plug.	1. Circuit board foil shorted to the cabinet. 2. Lead from capacitor C16 to circuit board hole A also touching cabinet. 3. Smooth or ribbed wire touching green wire of line cord. 4. Transformer T1.
B. Very high or infinite resistance indication between flat prongs of line cord plug.	1. Bad solder connection at circuit board hole AC(+) or AC(−). 2. Fuse F1 open. 3. Poor solder connections at transformer T1 pins. 4. Transformer T1.
C. Very low (below about 200) or "0" resistance indication between flat prongs of line cord plug.	1. Short circuit between AC(+) and AC(−) circuit board foils. 2. Transformer T1.
D. Resistance at positive (+) lead of capacitor C2 considerably lower than infinity.	1. Capacitor C2. 2. Diodes D1-D4. 3. IC's U3 and U5.
E. Resistance at positive (+) lead of capacitor C5 considerably lower or higher than 900 Ω.	1. Capacitor C5. 2. Diode D6. 3. IC U5. 4. All components connected to the 5 volt circuit board foils. See the Schematic Diagram in the Illustration Booklet, Page 5.
F. Resistance at positive (+) lead of capacitor C6 considerably lower or higher than 800 Ω.	1. Capacitor C6. 2. Diode D11. 3. Transformer T2 (pins 1 and 2). 4. Transistor Q2.
G. No AC line voltage (120 VAC) at the AC(+) hole in the circuit board.	1. No line voltage at the AC outlet where the Interface is connected. 2. Poor solder connection at AC(+) or AC(−) circuit board holes.
H. No AC line voltage (120 VAC) at the fuse (F1) clip nearest diode D3.	1. Fuse F1 blown (check D1-D6 and U5 for cause). 2. Diodes D1-D6. 3. IC U5.

(Cont'd)

Troubleshooting Chart (Cont'd)

PROBLEM	POSSIBLE CAUSE
I. Voltage at positive (+) lead of capacitor C2 below 15 VDC.	1. See D.
J. Voltage at positive (+) lead of capacitor C5 not 5 VDC.	1. See E.
K. Voltage at the positive (+) lead of capacitor C6 lower than 17 VDC.	1. See F.
L. Pin 40 of U2 not 5 VDC.	1. See E.
M. Pin 13 of U2 not 5 VDC.	1. See E.
N. Pin 1 of U3 not 6.5 VDC.	1. See D. 2. R7.
O. Pin 5 of U3 not 2.2 VDC.	1. See E. 2. R4 or R5.
P. Pin 7 of U4 not 5 VDC.	1. See E.
Q. Pin 8 of U4 not 5 VDC.	1. See E.
R. Pin 1 of U5 not 15 VDC.	1. See D.
S. Pin 3 of U5 not 5 VDC.	1. See E.
T. Collector lead of Q2 not 17 VDC.	1. See F.
U. LED V1 does not light.	1. V1 (wrong polarity or damaged). 2. No RS232 input at J1, pins 3 & 7. (Verify by connecting a printer where the Interface is.) 3. Computer baud rate wrong. 4. Data input not reaching U1, pin 1.
V. LED V1 lights, but modules do not respond.	1. Module plugged into different house circuit from Interface; plug module into same outlet to test. 2. Command programming wrong; you must send two "words." The first word addresses the module, the second tells it what to do.
W. LED V1 turns on at right time, but does not turn off.	1. D5. 2. U1. 3. U2.

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SPECIFICATIONS

Line Carrier Frequency	120 kHz.
Baud Rates	110, 150, 300, 600, 1200, and 2400.
Input Interconnect	DCE connector for connection with RS-232C cable (not supplied).
Input Format	RS232 asynchronous signal, no parity, 1 stop bit, ASCII coded format.
Output	Standard BSR X-10 compatible line carrier output.
Output Connection	AC line receptacle.
Power Requirements	120 VAC, 60 Hz; 3 watts.
Dimensions	3″ high × 6-3/8″ wide × 6-3/8″ deep. (7.6 × 16.2 × 16.2 cm).
Weight	1 pound, 11 ounces (0.77 kg).

The Heath Company reserves the right to discontinue products and change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

The Heathkit RS232/BSR Interface is an intelligent command unit that is connected between your computer and your BSR X-10 Modules. As you run your program on your computer, its RS-232C serial interface output is coupled to the input of the GD-1530 Interface, where these ASCII signals are converted to BSR X-10 format carrier current signals. These signals are then transmitted through the AC line to the BSR X-10 system modules.

POWER SUPPLY

Transformer T1 in the Interface steps the standard AC line voltage down to approximately 10 volts. Diodes D1 through D4 form a full-wave bridge rectifier that converts this AC voltage to about 13 volts DC. Capacitor C2 provides additional filtering to reduce ripple. C3 functions as a high frequency bypass. This results in a fairly clean 13 VDC source for IC's U5 and U3.

U5 is a 5-volt regulator device that provides a steady 5 VDC source voltage for IC's U1 through U4. Added filtering is provided by capacitors C4, C5, C10, and C15.

The circuit consisting of C1, R1, L1, D7, and D8 taps off some of the voltage from the AC line, through fuse F1 and converts it to DC. This voltage is regulated by zener diode D11 and filtered by C6 to provide an 17 VDC supply voltage for the operation of output stages Q1 and Q2.

DATA INPUT

The computer signal in serial RS-232C format is fed to the Interface through socket J1, R11, and D9 to the input of U4. U4 is an optical isolator that couples the signal from the computer to the Interface, but isolates the units from each other. The electrical data signal from the computer causes the LED connected between pins 1 and 2 of U4 to flash on and off. A diode photo detector, also in U4, sees these light flashes and converts them back to electrical signals. These signals are amplified by the transistor in U4 and fed to the input (pin 1) of central processor U1.

CENTRAL PROCESSOR

When the power cord is plugged in, capacitor C7 initially holds the RESET line (U1 pin 4) low to reset U1. Then C7 builds up a charge, removing the reset signal and allowing U1 to react to incoming commands.

Crystal Y1, along with capacitors C8 and C9, stabilize the 6 MHz clock in U1. Jumper wires at W1 through W3 determine the operating baud rate of 110, 150, 300, 600, 1200, or 2400.

U2A, along with D5 and D6, detects the zero crossings of the input (line) voltage and notifies U1 (pin 24) at each zero. U1 can then send the commands (pin 27) to the modules while the "line is clear."

The serial input pulses at pin 1 of U1 are converted to the BSR X-10 format and appear at output pin 27. U2B, an AND gate buffer, turns on and off at this output rate. The resulting pulsed output at pin 4 is fed directly to pin 9 of U2C.

Integrated circuit U3 and its associated circuitry form a 120 kHz oscillator. The exact frequency is determined by the setting of control R9. The oscillator output signal at pin 7 of U3 is connected directly to pin 8 of U2C.

The 120 kHz oscillator output signal at pin 10 of U2C is pulsed on and off at the BSR X-10 coded rate from U2B. This pulsed 120 kHz signal at the output (pin 10) of U2C is coupled through R12 to Q1 and then to Q2. These transistors amplify this signal and feed it to the primary winding of transformer T2.

OUTPUT

Modulation transformer T2 isolates transistors Q1 and Q2 from the AC line, but couples the coded pulsed 120 kHz signal from its secondary winding through C13 and F1 to the AC line through the line plug. The BSR X-10 modules, also connected to the AC line, decode these coded pulsed signals. When a Module receives its signal, it is activated and performs its function.

U2D turns on the Interface LED (V1) when processor U1 sends BSR X-10 compatible control pulses into the AC line cord.

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CIRCUIT BOARD X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

A. Find the circuit component number (R5, C3, etc.) on the "Circuit Board X-Ray View."

B. Locate this same number in the "Circuit Component Number" column of the "Parts List."

C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.

(Shown from the component side. The foil on the component side is shown in red.)

SEMICONDUCTOR IDENTIFICATION CHART

DIODES

COMPONENT NUMBER	HEATH PART NUMBER	TYPE NUMBER	DESCRIPTION
D1, D2, D3, D4, D7, D8	57-65	1N4002	
D5	56-26	1N149	
D6, D9	56-84	1N4148	
D11	56-605	1N4746	

TRANSISTORS

COMPONENT NUMBER	HEATH PART NUMBER	TYPE NUMBER	DESCRIPTION
Q1	417-875	2N3904	
Q2	417-811	MPSL01	

INTEGRATED CIRCUITS

COMPONENT NUMBER	HEATH PART NUMBER	TYPE NUMBER	DESCRIPTION
U1	444-205	Available only from Heath Co.	

(Cont'd)

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Integrated Circuits (Cont'd)

COMPONENT NUMBER	HEATH PART NUMBER	TYPE NUMBER	DESCRIPTION
U2	443-603	4011	
U3	442-741	2209	
U4	443-1109	2531	
U5	442-54	UA7805	

(Cont'd)

LIGHT EMITTING DIODE (LED)

COMPONENT NUMBER	HEATH PART NUMBER	TYPE NUMBER	DESCRIPTION
V1	412-640	LST5053	

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APPENDIX

PROGRAMMING COMMAND SYNTAX

The command syntax for program control with the Interface is defined by the BSR format as shown below. **Normally, two commands are required to implement a complete control action.**

[House Code] [Command Word 1] [RETURN]
[House Code] [Command Word 2] [RETURN]
For example:
A 1 [RETURN]
A ON [RETURN]

The **House Code** is any upper case ASCII character between A and P. It specifies which group of modules is selected.

The **Command Word #1** is the unit code number (1 — 16), or the special commands "A" and "C." Note that "A" and "C" do not require the second command word, since they constitute a complete command.

A = All on (turns on all light control modules, but not appliances)
C = Clear (turns all modules off)

Command Word #2 tells the selected unit what to do. One or two letters are required as shown below. Additional letters, shown inside the parentheses, are acceptable but are not required.

B(R) = Bright. If a bulb is on, brightens it one step*; if the bulb is off, turns it on full.
D(IM) = Dim. If a bulb is on, dims the bulb one step*; if the bulb is off, turns it on full.
ON = On. Turns the specified unit on full.
OF(F) = Off. Turns the specified unit off.

NOTE: You cannot send a new command to the Interface while the Transmit LED is lit (about one-half second).

*The BSR 1-ampere dimming wall and lamp modules have 16 levels between full on and full off.

PROGRAM EXAMPLES

For an example, suppose you wanted to turn on a light (at house code "A", unit number 3), then dim the light ten steps, and finally turn it off. These are the necessary commands:

[A][3][RETURN] [A][ON][RETURN]	Selects the unit and turns it on.
[A][3][RETURN]**[A][D] repeat nine more times	Dims the unit one step; you will need to generate nine more "dim" commands to reach the desired level. For your own software, you will want to be able to type in the level of light that you wish and have the computer send the right number of "dim" or "bright" commands.
[A][3][RETURN]**[A][OF]	Turns the unit off. You could also use "[C]" by itself, to turn everything off.

The following is a simple program to accept commands from the keyboard and send them to the Interface. This program repeats without changing the house code, which is entered only once, in line 10. The program runs on HDOS MBASIC and uses the LPH14.DVD driver, renamed LP.DVD. NOTE: You must set the baud rate of the LP.DVD driver to the same rate you programmed your GD-1530.

1Ø	LINE INPUT"ENTER HOUSE CODE : ";H$	Get house code
2Ø	OPEN"O",1,"LP:"	Open RS-232 output channel
3Ø	LINE INPUT"ENTER COMMAND : "A$	Get control command
4Ø	PRINT #1,H$;A$	Send command string to buffer
5Ø	CLOSE #1	Clear buffer (send)
6Ø	GOTO 2Ø	Go back for another

Below is an example with the operator using the program to turn on module A1. The operator's responses are in bold type.

ENTER HOUSE CODE : **A [RETURN]**
ENTER COMMAND : **1 [RETURN]**
ENTER COMMAND : **ON [RETURN]**

The program will continue to prompt for COMMAND input.

** The first command word is optional if you have previously selected the desired unit, and have not altered the selection by sending another code, on a "C" or an "A" command.

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The next program adds the ability to check the input for errors.

For HDOS

```
1Ø GOSUB 21Ø:REM GET HOUSE CODE
2Ø OPEN "O",1,"AT:"
3Ø PRINT:LINE INPUT"ENTER COMMAND: ";A$
4Ø IF LEFT$(A$,1)="N" OR LEFT$(A$,1)="n" THEN GOSUB 21Ø:GOTO 3Ø
5Ø IF LEFT$(A$,1)="Q" OR LEFT$(A$,1)="q" THEN END
6Ø IF VAL(A$)>Ø AND VAL(A$)<17 THEN GOTO 16Ø
7Ø IF LEFT$(A$,1)="C" OR LEFT$(A$,1)="c" THEN A$="C":GOTO 16Ø
8Ø IF LEFT$(A$,1)="A" OR LEFT$(A$,1)="a" THEN A$="A":GOTO 16Ø
9Ø IF LEFT$(A$,1)="D" OR LEFT$(A$,1)="d" THEN A$="D":GOTO 16Ø
1ØØ IF LEFT$(A$,1)="B" OR LEFT$(A$,1)="b" THEN A$="B":GOTO 16Ø
11Ø IF LEFT$(A$,1)="O" OR LEFT$(A$,1)="o" GOTO 13Ø
12Ø GOTO 15Ø
13Ø IF MID$(A$,2,1)="N" OR MID$(A$,2,1)="n" THEN A$="ON":GOTO 16Ø
14Ø IF MID$(A$,2,1)="F" OR MID$(A$,2,1)="f" THEN A$="OF":GOTO 16Ø
15Ø PRINT:PRINT CHR$(7);"INPUT ERROR":GOTO 3Ø
16Ø PRINT "SENDING :";H$;" ";A$
17Ø PRINT#1,H$;A$
18Ø CLOSE#1
19Ø FOR I=1 TO 2ØØ:NEXT
2ØØ GOTO 2Ø
21Ø PRINT:LINE INPUT "ENTER NEW HOUSE CODE : ";H$:IF H$="" THEN 21Ø
22Ø IF ASC(H$)<65 THEN 21Ø
23Ø IF ASC(H$)<81 THEN RETURN
24Ø IF ASC(H$)<97 THEN 21Ø
25Ø IF ASC(H$)>112 THEN 21Ø
26Ø H$=CHR$(ASC(H$)-32):RETURN
```

This last program is expanded further, and uses H-19/H-89 graphics for a more impressive display. Note the special symbol (Δ), which is used to represent a space. Since spaces are critical to proper appearance of the graphics, all spaces in this program are represented using this symbol.

For CP/M

```
1ØΔREMΔΔΔΔΔ*************************************
2ØΔREMΔΔΔΔΔ*ΔHEATHΔΔBSRΔX-1ØΔΔSYSTEMΔCONTROLLERΔ*
3ØΔREMΔΔΔΔΔ*ΔVERSIONΔΔΔ1.2.ØΔΔ(Ø1-DEC-82)Δ<JWF>Δ*
4ØΔREMΔΔΔΔΔ*ΔCOPYRIGHTΔ(C)Δ1983ΔΔHEATHΔΔCOMPANYΔ*
5ØΔREMΔΔΔΔΔ*************************************
6ØΔREM
7ØΔCLEAR:ESC$=CHR$(27):HOME$=ESC$+"H":CR$=ESC$+"y5":WIDTHΔ255:VERS$="1.2"
8ØΔREVV$=ESC$+"p":NOMV$=ESC$+"q":BK$=CHR$(8):ERA$=ESC$+"E":BEL$=CHR$(7)
9ØΔGRF$=ESC$+"F":CHAR$=ESC$+"G":TAB$=CHR$(9):CO$=ESC$+"x5":H$="A"
```

```
100 PRINT ERA$;:GOTO 220
110 REM BLANK LINE ROUTINE
120 PRINT TAB$;REVV$;"                                    ";
130 PRINT "                        ";NOMV$:RETURN
140 REM INPUT HOUSE CODE SECTION
150 PRINT TAB$;"Input House Code (use letters AA thru P)"
160 A$=INPUT$(1):IF ASC(A$)>64 AND ASC(A$)<81 THEN H$=A$:GOTO 210
170 IF ASC(A$)>96 AND ASC(A$)<113 THEN H$=CHR$(ASC(A$)-32):GOTO 210
180 IF A$=ESC$ THEN GOTO 210
190 PRINT BEL$;ESC$+"A";TAB$;"Input Error.";BEL$;"                          "
200 FOR X=1 TO 750:NEXT X:PRINT BEL$;ESC$+"A";ESC$+"J";:GOTO 150
210 PRINT ESC$+"A";ESC$+"J";:RETURN
220 REM MAIN MENU SECTION
230 PRINT HOME$;:PRINT:PRINT:GOSUB 110
240 PRINT TAB$;REVV$;"      Heath/BSR Controller/Computer Interface Program";
250 PRINT "      ";NOMV$:GOSUB 110:PRINT:PRINT:GOSUB 110
260 PRINT TAB$;REVV$;"    Version ";VERS$;"     ";NOMV$;"  C O M M A N D S";
270 PRINT REVV$;"      House code = ";H$;"  ";NOMV$:GOSUB 110
280 PRINT TAB$;REVV$;
290 PRINT "    C = Clear      A = All On      O = On       F = Off    ";NOMV$
300 PRINT TAB$;REVV$;"    B = Bright     D = Dim        E = End    ";
310 PRINT "  H = House  ";NOMV$
320 PRINT TAB$;REVV$;"    T = Test  All  R = Restart  01-16, units ";
330 PRINT "Z = Help   ";NOMV$:GOSUB 110:PRINT CO$;
340 A$=INPUT$(1)
350 IF A$="C" OR A$="c" THEN A$="C":GOSUB 520:GOTO 340
360 IF A$="A" OR A$="a" THEN A$="A":GOSUB 520:GOTO 340
370 IF A$="E" OR A$="e" OR A$=ESC$ THEN PRINT ERA$;CR$;NOMV$;:END
380 IF A$="H" OR A$="h" THEN GOSUB 140:GOTO 230
390 IF A$="R" OR A$="r" THEN GOTO 10
400 IF A$="Z" OR A$="z" THEN GOSUB 550:GOTO 100
410 IF A$="O" OR A$="o" THEN A$="ON":GOSUB 520:GOTO 340
420 IF A$="F" OR A$="f" THEN A$="OFF":GOSUB 520:GOTO 340
430 IF A$="D" OR A$="d" THEN A$="D":GOSUB 520:GOTO 340
440 IF A$="B" OR A$="b" THEN A$="B":GOSUB 520:GOTO 340
450 IF A$="T" OR A$="t" THEN A$="A":GOSUB 520:A$="C":GOSUB 520:GOTO 340
460 IF A$="O" THEN GOTO 480
470 IF VAL(A$)=1 THEN GOTO 490 ELSE GOTO 500
480 A$=INPUT$(1):IF VAL(A$)>.5 AND VAL(A$)<10 THEN GOSUB 520:GOTO 340 ELSE 500
490 A$=A$+INPUT$(1):IF VAL(A$)>9 AND VAL(A$)<17 THEN GOSUB 520:GOTO 340
500 PRINT TAB$;"Input Error.";BEL$:FOR X=1 TO 100:NEXT X
510 PRINT BEL$;:FOR X=1 TO 200:NEXT X:PRINT ESC$+"A";ESC$"J";:GOTO 340
520 REM MOVE TO DEVICE DRIVER
530 FOR X=1 TO 250:NEXT X
540 LPRINT H$;A$+CHR$(13):PRINT BEL$;:RETURN
550 REM HELP SECTION
```


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```
560 PRINT ERA$;
570 PRINT TAB$;TAB$;"HELP LIST FOR THE BSR CONTROLLER SYSTEM":PRINT
580 PRINT TAB$;"COMMAND LETTER                    COMMAND  FUNCTION"
590 PRINT TAB$;GRF$;"aaaaaaaaaaaaaaa          ";
600 PRINT "aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa";CHAR$
610 PRINT TAB$;"A - (All on)              Turns on all light units."
620 PRINT TAB$;"C - (Clear)               Master Clear, all units."
630 PRINT TAB$;"H - (House Code)          Allows you to enter a different"
640 PRINT TAB(35);"house code.  Present house code is"
650 PRINT TAB(35);"displayed in upper right of screen."
660 PRINT TAB$;"O - (On)                  Turns on the selected unit(s) only."
670 PRINT TAB$;"F - (Off)                 Turns off selected unit(s) only."
680 PRINT TAB$;"D - (Dim)                 Dims selected light(s) only."
690 PRINT TAB$;"B - (Bright)              Brightens selected light(s) only."
700 PRINT TAB$;"T - (Test run)            Causes all lights to be turned on"
710 PRINT TAB(35);"and then off once."
720 PRINT TAB$;"E - (End)                 Ends Program and clears screen."
730 PRINT TAB$;"R - (Restart)             Restarts Program."
740 PRINT TAB$;"01 thru 16                Numbers 01 thru 16  select unit to"
750 PRINT TAB(35);"acted on by such commands  as B,O,D"
760 PRINT TAB(35);"and F. For numbers  below 10 a zero"
770 PRINT TAB(35);"must be typed in first."
780 PRINT TAB$;"Z - (Help)                Print this list."
790 PRINT TAB$;GRF$;"aaaaaaaaaaaaaaa          ";
800 PRINT "aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa";CHAR$
810 PRINT TAB$;TAB$;TAB$;TAB$;"  ";REVV$;
820 PRINT "  Hit any key to Return to Program.  ";NOMV$;:A$=INPUT$(1):RETURN
```

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ILLUSTRATION BOOKLET

Part of 595-2932-01

PARTS PICTORIAL

Model GD-1530

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SCHEMATIC OF THE HEATHKIT® RS-232C to BSR X-10 INTERFACE MODEL GD-1530

NOTES:

1. REFER TO THE X-RAY VIEW FOR THE PHYSICAL LOCATION OF PARTS.
2. ALL RESISTORS ARE 1/4-WATT, 5% UNLESS MARKED OTHERWISE.
3. ALL CAPACITOR VALUES LARGER THAN 1.0 ARE IN pF UNLESS SPECIFIED OTHERWISE. CAPACITOR VALUES LESS THAN 1.0 ARE IN µF.
4. ☐ INDICATES A WIRE CONNECTION TO THE CIRCUIT BOARD.
5. ⏚ INDICATES A CABINET GROUND.
6. ▽ INDICATES A CIRCUIT BOARD GROUND.
7. SCHEMATIC: PARTS IN SHADED AREAS ARE CRITICAL FOR CONTINUED SAFETY. REPLACE ONLY WITH THE EXACT HEATH COMPANY PART NUMBER.