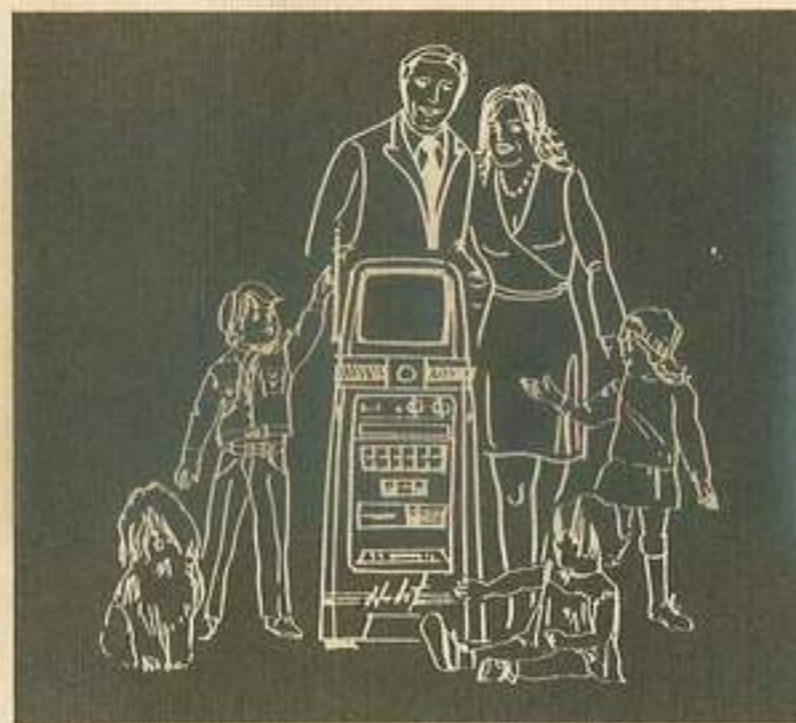


Hubot



O W N E R ' S M A N U A L

PREPARING FOR USE

Hubot comes completely assembled and ready for operation. After removing him from the shipping container refer to Section 2 for detailed operating instructions.

Save the original Hubot shipping material; it can be used if you need to ship Hubot. For maximum protection, ship Hubot as he was originally packed at the factory.

Hubot is ready for action as soon as you unpack him. Simply turn the main power OFF/ON switch to ON. The operating menu should then be displayed on the TV screen. Refer to Section 2 for detailed operating instructions.

If you Hubot's battery is low, refer to Section 2 for battery charging procedures.

Table of Contents

TABLE OF CONTENTS

Page

	USING THIS MANUAL _____	2
<i>Section 1</i>	GETTING TO KNOW HUBOT _____	
	SPECIFICATIONS _____	1
	PHYSICAL DESCRIPTION _____	4
	CARE OF HUBOT _____	7
	CARE OF DISKS _____	8
	PRECAUTIONS _____	9
<i>Section 2</i>	USING HUBOT _____	
	PREPARING FOR USE _____	1
	POWER-UP _____	
	USING THE HuComm INSTRUCTION LANGUAGE _____	
	THE HuComm MENU _____	
	SELECTING A TASK _____	
	PERFORMING A TASK _____	
	RETURNING TO THE MENU _____	
	USING CPM 2.2 _____	
	POWER-DOWN _____	
	STANDBY MODE _____	
	CHARGING MODE _____	
	STORAGE MODE _____	
<i>Section 3</i>	HELP _____	
	TROUBLESHOOTING _____	1
	BUILT-IN SELF TESTS _____	
<i>Section 4</i>	GLOSSARY _____	1
<i>Section 5</i>	INDEX _____	1

USING THIS MANUAL

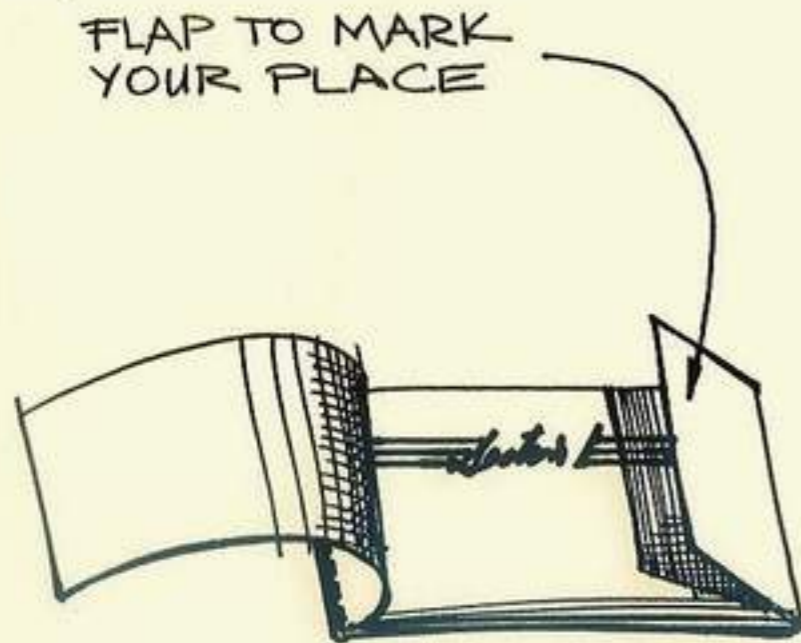
The birth of Hubot was a concerted effort by our engineers at Hubotics Inc., and we are delighted that you purchased Hubot. Your Hubot is the ultimate intelligent home appliance. Built from quality material for durability and years of reliable service, Hubot applies the science of robotic technology in many creative new ways. His sole purpose is to make your home a far more pleasant and exciting place to live than ever before. Hubot has more functions than any other home robot on the market, and truly reflects your personal requirements in its design.

In the realm of robotics, flexibility is a key concept. This is achieved with Hubot's specially designed computer based control system (SysCon). The control system's unique design greatly enhances Hubot's present and future capabilities and provides for easy operation and application.

Instructions in this booklet offer complete directions for operation, and detailed descriptions for all user controls. Here is an overview of each section.

SECTION 1

Along with the basic description of Hubot, a list of features and major operating controls and their functions, this section explains how to take care of Hubot and its operating parts. Special attention is drawn to precautionary measures taken in the operation and handling of Hubot.



SECTION 2

This section is a step-by-step guide to the actual operation of Hubot. It contains the Hucomm Instruction Language and Hucomm Menu.

SECTION 3

Section 3 contains information on troubleshooting and self tests for Hubot when help is needed.

SECTION 4

Section 4 is a glossary of commonly used robotics and computer terms.

SECTION 5

Section 5 contains the index for this manual.

Section 1

SPECIFICATIONS

PHYSICAL SPECIFICATIONS

Dimensions

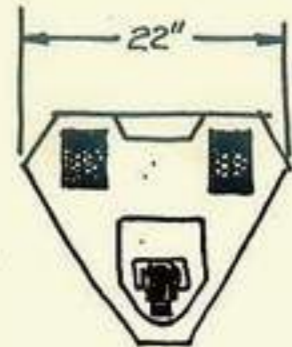
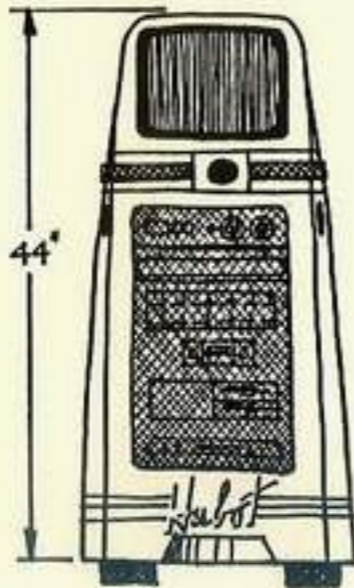
Diameter	22 inches
Height	44 inches
Weight	65 Pounds

Hubot Linear Speed

Uni-body polyethylene

Hubot Linear Speed

5 inches per second
(Approximately)



ELECTRICAL SPECIFICATIONS

Power Supply

Type	Sealed lead acid battery
------	--------------------------

Output	12 Volts, 40 amp-hour
--------	-----------------------

Battery Charger

Input	110 VAC 50/60 Hz
-------	------------------

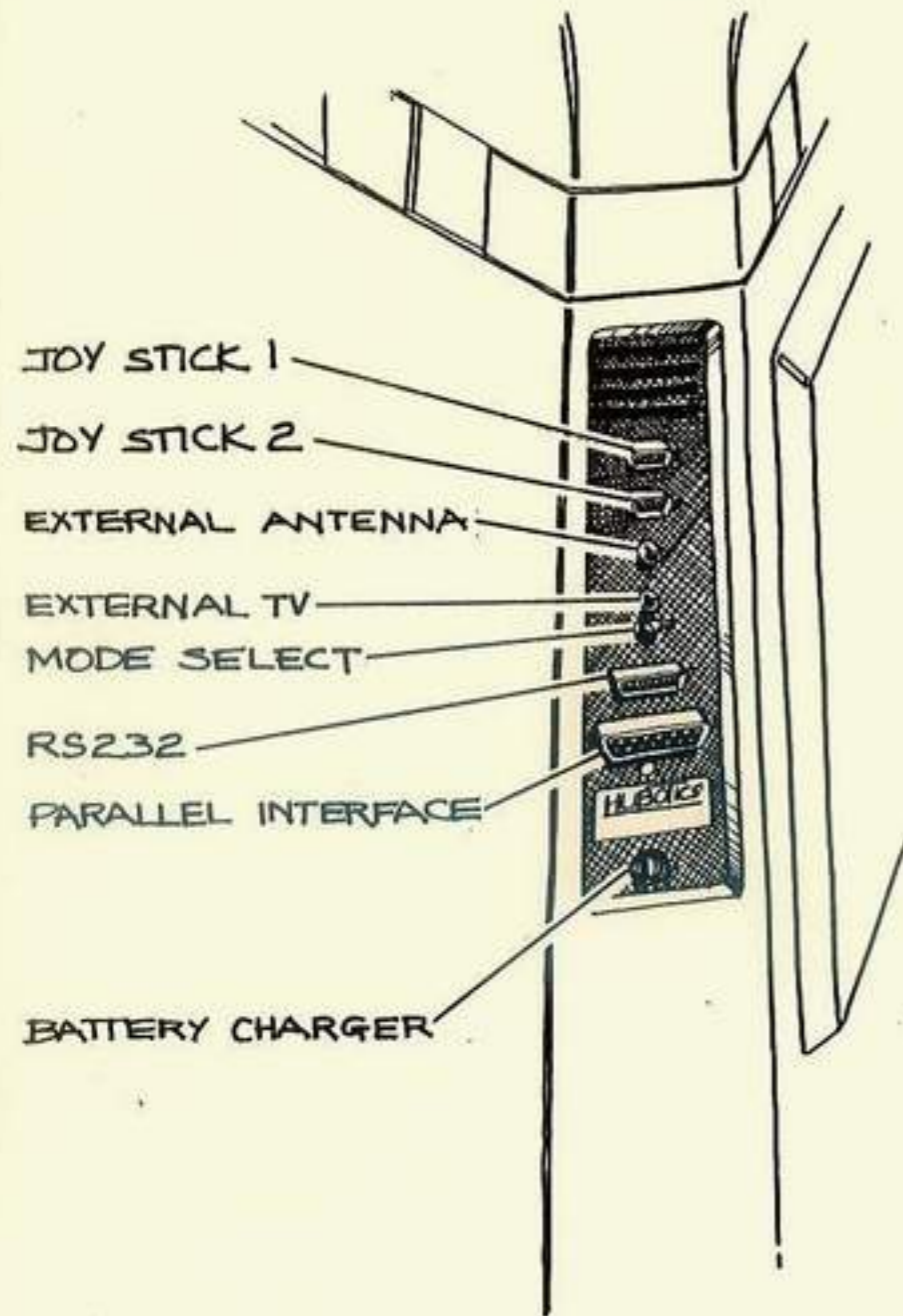
Output	13.5 Volts auto float
--------	-----------------------

COMPUTER SPECIFICATIONS

Microprocessor	SysCon 3-280A
----------------	---------------

Memory Capacity

User Ram	64K
----------	-----



Software

CP/M 2.2
HCL (HubotCommand Language)

Keyboard

64 Key ASCII
(detachable)

Display

80 columns, 24 lines

Disk Drive

5 1/4" floppy; single sided,
double density

Interface panel ports

1 RS232
1 External antenna
1 parallel/centronics
1 external video
1 battery charger

ENTERTAINMENT FEATURES

Television

12" back and white

Sound Center

Radio

AM/FM stereo

Cassette

Auto reverse

Equalizer

4 band

Speakers

2 dual way

Games

Atari cassette
capable (2 joysticks
included)

Visual Response

1200 word library
(expandable - text
to speech)

Visual Effects

Strobing OSP collar lights

Obstacle recognition

OSP collar (sonic trans-
ducer)

OPTIONAL FEATURES

Printer

24 column, matrix

Disk Drive

dual, 5 1/4, DS/DD

Voice Command

Microphone, real
speech synthesis,
voice command firmware

Sentry Package

Heat/smoke/intrusion
alarm 360 degree obstacle
recognition

Auto Recharger

Automatic battery
charging station for Hubot

Dexterity

Articulating arm

Vacuuming

Light duty, dual roller

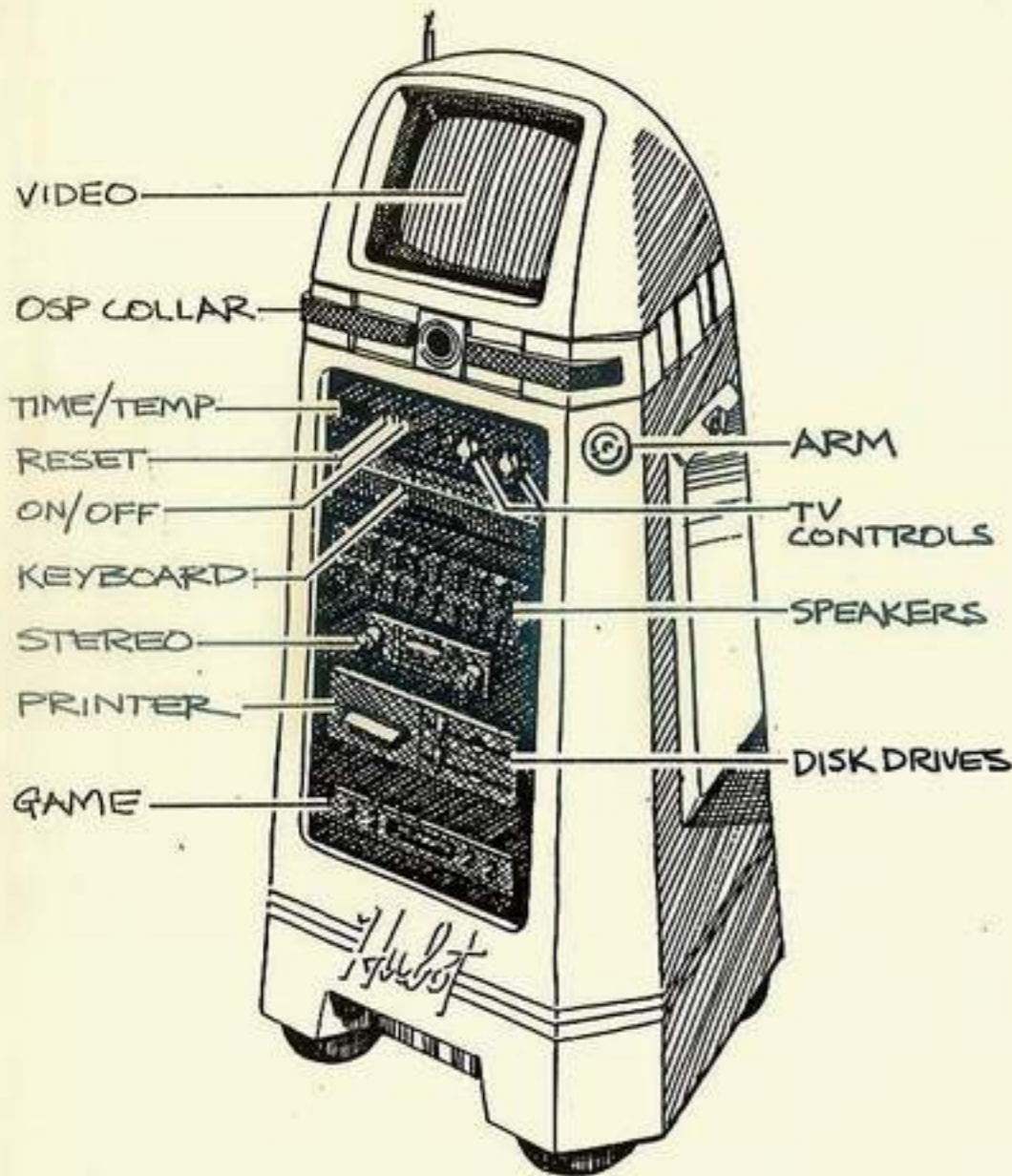
Telephone

Remote telephone/
300 baud modem

Smart Servant

Household appliance control

PHYSICAL DESCRIPTION



Video Monitor

12-inch black and white video monitor can be used as a computer CRT, video game screen, or a normal full channel TV.

OSP™ Collar (Processor)

Provides Hubot with "eyes" by SONAR (Sound Navigation and Ranging) scanning for obstacles in his path. Also house strobing light arrays.

Time/Temperature

LED (Light Emitting Display diode display indicates time and temperature 24 hours a day.

Main Power OFF/ON/

OFF - Hubot Deenergized
ON - Hubot functional

RESET Switch

RESET - Restarts Computer

Keyboard

Detachable 64 key ASCII keyboard. Major means of communicating with your Hubot.

Printer (optional)

24 column matrix printer can be installed here.

Disk Drive Units

5 1/4" floppy disk, single sided, double density

Speaker System

2 hi-fidelity, 2-way speaker sets

TV Controls

Provides for TV volume control and selection of stations.

Articulated Arm (optional) Port

Robotic arm can be installed here.

Video Game Module

- Power Switch
- TV Type Switch
- Cartridge Slot
- Game Select Switch
- Game Reset Switch

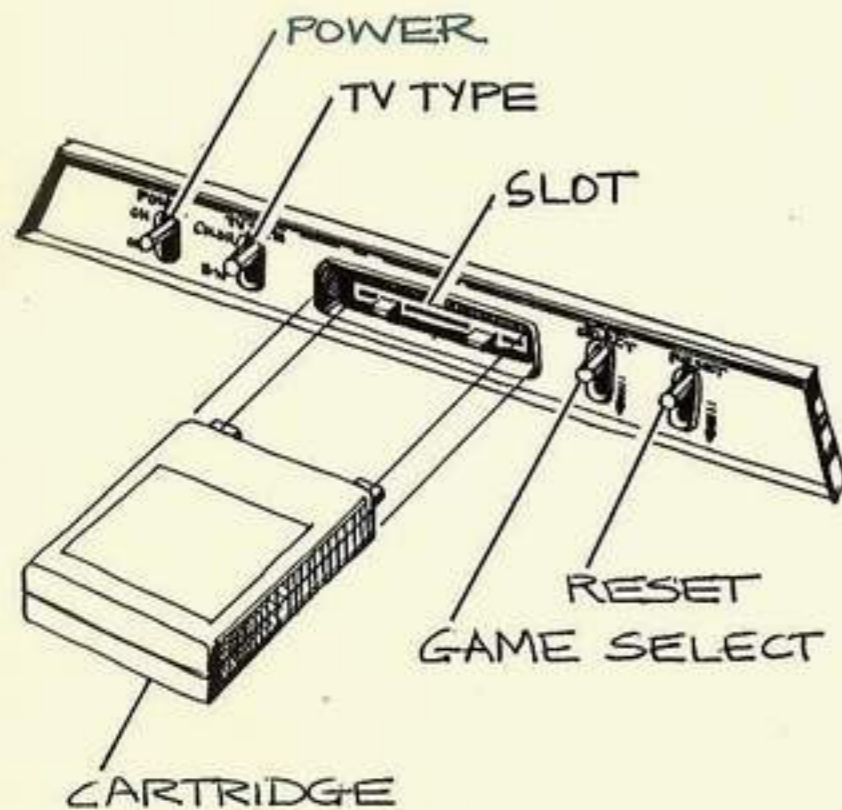
Game OFF/ON

Selects operation for color or black and white TV

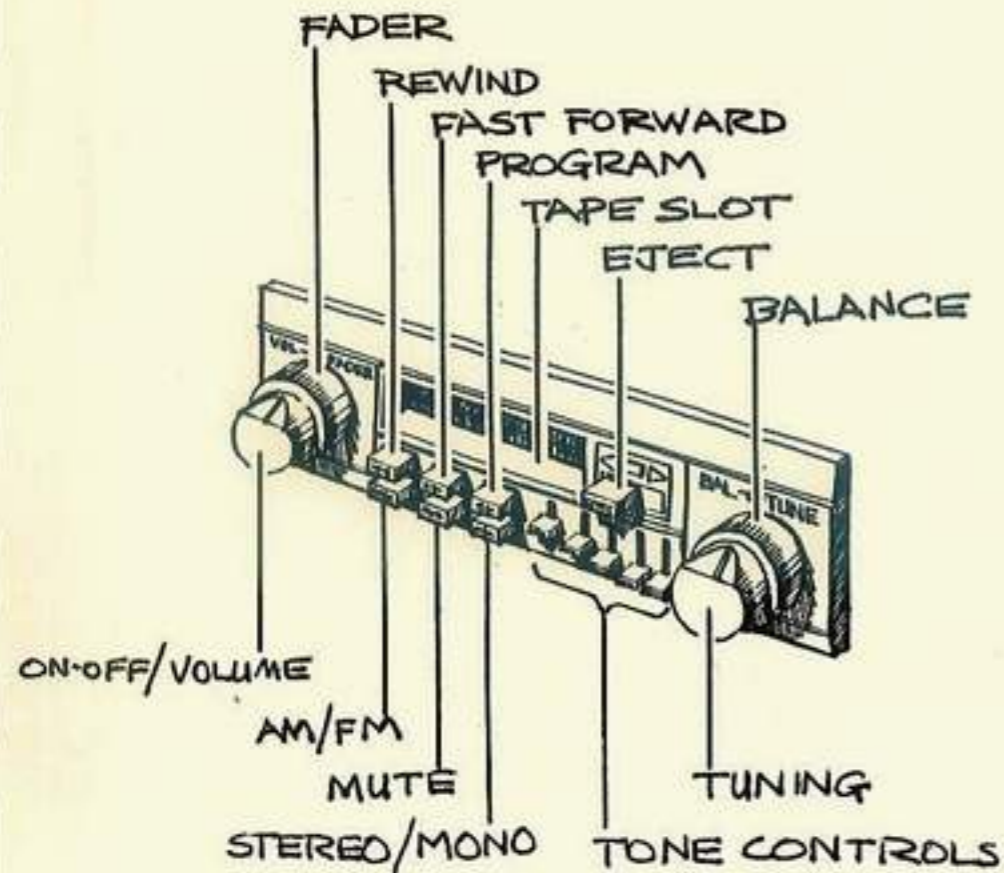
Accepts Atari 2600 game cartridges

Select game you wish to play. Momentary depression steps through game selection one at a time. Holding down switch causes high speed previewing of

Begins game play or restarts game already started.



RADIO



- Tape Slot
Gently push cassette tape into the slot until it drops into the unit.
- Fader Control
This function is not available.
- ON/OFF Volume
Power On-turn right; power OFF-turn left until Stop. Adjust volume-turn either direction for volume.
- Program
Push the button to automatically reverse direction of tape play.
- Fast Forward/Rewind
Switch selection causes high speed forward or reverse tape movement.
- AM/FM
Down enables AM reception, up enables FM reception.
- Balance
Control balance between right and left channels.
- Eject
Push to eject the cassette.
- Tuning
Station select switch.
- Tone Controls
Five slider switches for tone control.
- Mute
In disables muting circuits for reception of FM band.
- Stereo/Mono
In for Monoaural output. Out for Stereo output.

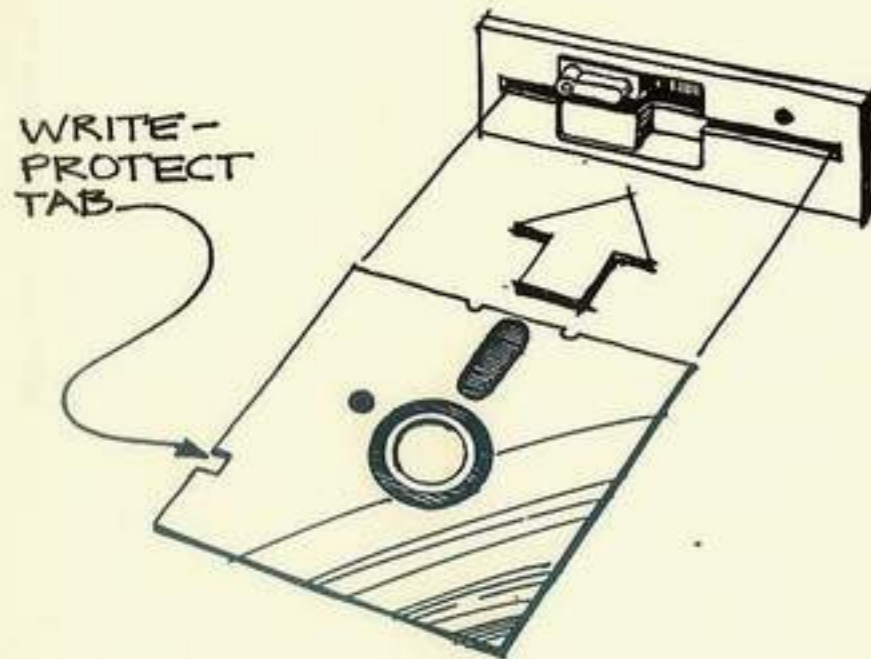
TAKING CARE OF DISKS

DON'TS

- Do not clean diskettes.
- Do not touch any exposed diskette surfaces.
- Do not fasten paper clips to diskette envelopes.
- Do not use lead or grease pencils when writing on diskette envelope labels.

DO'S

- Do protect diskette from liquids, dust, and metallic substances.
- Do return the diskette to envelope when moved from disk drive.
- Do keep diskette away from magnetic fields or materials that may be magnetized.
- Do store diskettes in a drawer or cabinet when not in use.



INSERT DISKETTE
AS SHOWN

PRECAUTIONS

Hubot is a sensitive, high quality instrument and should be regarded as such. Because he is an electronic device the danger of electrical shock exists if he is used carelessly.



DON'TS

Do not attempt to disassemble Hubot. To prevent electrical shock, do not reach inside Hubot's body.

Do not abuse Hubot. Avoid striking, shaking, etc. Hubot contains sensitive electronic components that can be damaged by improper handling or storage.

Do not use strong or abrasive detergents when cleaning Hubot's housing.

Do not expose Hubot to rain or moisture or try to operate him in wet areas. Do not operate Hubot if he becomes wet.

Do not block air vents.

DO'S

Do refer any servicing to qualified service personnel.

Do handle Hubot with care. Always cover Hubot with his dust cover or store him in his shipping container when he's not in use or if in shipment.

Do use a dry cloth to clean Hubot. In case the dirt is hard to remove, use a mild detergent and wipe gently.

Do take immediate action if Hubot is wet. Power off and disconnect from AC power if connected. Dry him thoroughly.

Do keep front and rear air vents clear for proper ventilation.

Do not use Hubot in extreme environment where high humidity or high temperature exists.

Do not lay Hubot on his side.

Do operate in from 32 F to 104 F (0 C to 40 C) and humidity no higher than 75%.

Do keep Hubot in an upright position.

Section 2

PREPARING FOR USE

Hubot comes completely assembled and ready for operation. After removing him from the shipping container refer to Section 2 for detailed operating instructions.

Save the original Hubot shipping material; it can be used if you need to ship Hubot. For maximum protection, ship Hubot as he was originally packed at the factory.

Hubot is ready for action as soon as you unpack him. Simply insert the disk and turn Hubot ON by pressing the ON/OFF button located on his front panel. The operating menu should then be displayed on the TV screen.

his features after you typed in "GREET".

SIMPLE! WASN'T IT? ...

If you have never operated a computer before, congratulations! Now, read on for a new and exciting experience that awaits you as you learn more about Hubot and his computer capabilities.

The following are terms you should familiarize yourself with as they will appear throughout this manual and on Hubot's monitor.

CURSOR A lighted marker that indicates where the next character typed will be displayed on the screen.

HIGHLIGHTING An enhancement making certain words appear brighter on your screen. The HIGHLIGHTED word or phrase indicates the current feature to be activated.

The following keys are used to move Hubot through his functions. Learn them and the function they perform and you and Hubot can begin to really have fun.

SPACEBAR By pressing, tells Hubot you wish to make choices in his menu.

RETURN KEY By pressing, tells (or commands) Hubot to perform a specific function, such as turn his TV on.

ESCAPE KEY By pressing, tells Hubot to return to his menu.

Okay, enough reading and learning for now. Just follow the simple instructions on the following pages and Hubot's monitor and enjoy!!

Using the POWER switch, turn Hubot to the ON position. Hubot will respond with the following display on his monitor:

HUBOTICS 2.2

CP/M 2.2

A>

type in SPKESY and press RETURN.

Hubot will respond by saying:

"I am a Hubot. How may I serve you? Ready."

The monitor will now display:

Hubotics, Inc.
SpeakEasy
Copywrite, 1983...(1.2)

Hubot can be:

- Smart
- Fun
- Mobile

Press SPACEBAR to select highlighted feature.

Press RETURN to run highlighted feature.

Hubot's FUN menu is designed to utilize his home entertainment features and by following the easy instructions you can begin to enjoy him immediately.

The FUN menu contains the following choices:

RADIO
TV
ATARI
GAMES - HU-LIBS
 TIE-TAC
 ELIZA
 KIDS
 WEEKDAY

TALK
LIGHTS

Hubot is now ready to begin performing for you. Just follow the instructions as they appear on his monitor.

Take a few minutes to practice using the SPACEBAR to select the HIGHLIGHTED feature. Notice how SMART, FUN, MOBILE become HIGHLIGHTED as the cursor changes position.

FUN MENU
RADIO FEATURE

1. Using the SPACEBAR, select FUN and press RETURN.
2. Using the SPACEBAR, select RADIO and press RETURN. Hubot will say, "Radio Selected".
3. The radio will now come on.

NOTE: Now is a good time to select your favorite station and volume level.

4. To turn the radio off, press RETURN and Hubot will automatically return to his FUN menu.
5. To select a different feature, press the SPACEBAR until that feature is HIGHLIGHTED.

1. Using the SPACEBAR, select TV and press RETURN.
2. The TV will now come on.
Hubot will say, "TV selected".

The monitor will display the following:

Open disk drive door. Press RETURN when ready.

NOTE: Now is a good time to select channel, and volume level. Should your monitor need adjusting there are three small screws located in the lower left hand corner of the monitor molding. The top screw controls the Horizontal Hold; the middle screw controls Contrast; and, the bottom screw controls Brightness.

3. To turn the TV off, press the ESCAPE button and Hubot will automatically return to his FUN menu.

1. Using the SPACEBAR, select ATARI and press RETURN.
2. Video games will now come on.
Hubot will say, "Atari selected".

The monitor will display the following:

Open disk drive door. Press RETURN when ready.

NOTE: Now is a good time to insert the game cartridge you received with your Hubot.

To use the video game player, joysticks must be plugged into Hubot's appropriate rear panel port(s). The joysticks are located inside the door on his right side.

3. To turn the games off, press the ESCAPE button and Hubot will automatically return to his FUN menu.

1. Using the SPACEBAR, select GAMES and press RETURN.
2. Your monitor will display the following and Hubot will say, "Games selected".

GAME MENU

- (1) Hu-Libs
- (2) Tic-Tac
- (3) Eliza
- (4) Kids
- (5) Weekday

Enter choice (1 to 5)?
(Press ESC then RETURN to end)

3. Using the keyboard type in your choice and follow the prompts appearing on your monitor.
4. To turn the games off, press ESCAPE and then RETURN and Hubot will automatically return to his FUN menu.

1. Using the SPACEBAR, select TALK and press RETURN.
2. The monitor will display the following:

ENTER TEXT:

Using your keyboard, type in what you want Hubot to say and press RETURN. You can continue to repeat by pressing the RETURN key.

3. Press the ESCAPE key and Hubot will automatically return to the FUN menu.

1. Using the SPACEBAR, select LIGHTS and press RETURN.
2. The monitor will display the following:

Enter light pattern (0-255):

Using your keyboard type in your choice and press RETURN. Your monitor will now display:

Enter rotation count (0 to 7):

Type in your choice and press RETURN.

NOTE: You may wish to try several different combinations for the pattern you want.

3. When you press RETURN after typing in your second choice, Hubot automatically returns to his FUN menu.

Hubot's MOBILE menu is designed to give you the capability of moving Hubot throughout your home using his joystick and to change his distance detection and speed.

The MOBILE menu contains the following choices:

JOYSTICK

SONAR RANGE

INFRARED SENSORS

SPEED

CALIBRATION

As in Hubot's FUN menu, choices are selected using the SPACEBAR to HIGHLIGHT your choice. Once you have selected a feature, press the RETURN key and watch Hubot's monitor for additional instructions.

To return to Hubot's main menu, press the ESCAPE key. Your monitor will display:

HUBOT CAN BE

SMART
FUN
MOBILE

1. Using the SPACEBAR, select MOBILE and press RETURN.
2. Using the SPACEBAR, select JOYSTICK and press RETURN. Your monitor will display the following:

Connect Joystick to port #1
Press RETURN when ready

NOTE: The joysticks are located inside the right door panel. Plug one into the port marked Joystick #1.

3. Press RETURN if you haven't already done so. Your monitor will display:

Please move keyboard to storage position

4. Move the keyboard to the storage position if you haven't done so already.

Your monitor will display:

Use joystick as follows:

- MOVE joystick - FORWARD for forward movement
- REVERSE for reverse movement
- LEFT for left movement
- RIGHT for right movement

Press RETURN to terminate manual mode:

5. Release the keyboard and press RETURN if you haven't done so already. Hubot will then automatically return to his MOBILE menu.

1. Using the SPACEBAR, select RANGE and press RETURN.

Your monitor will display:

Enter maximum detection distance,
ft. (1.0 to 9.1)

NOTE: Range is used to set maximum detection
distance of Hubot's sonar.

2. Type in your choice and press RETURN.

Your monitor will display:

"Maximum detection is now _____ "

3. When you have typed in new distance and have pressed RETURN, Hubot will automatically return to his MOBILE menu.

1. Using your SPACEBAR, select INFRARED and press RETURN.
2. Your monitor will display:

SELECT IR: DO YOU WISH THE IR DETECTORS ON OR OFF?

- ON
- OFF

NOTE: Designed as a safety feature, the IR sensors detect low objects and are highly sensitive to light.

3. Using your SPACEBAR, select your choice and press RETURN.
4. Hubot will automatically return to his MOBILE menu.

1. Using the SPACEBAR, select SPEED and press RETURN.
2. Your monitor will display:

```
Current FORWARD speed value = 10
Enter NEW speed value (1-10):
Current ROTATION speed value = 6.
Enter NEW rotation speed value (1-6):
```

Type in your choice and press RETURN.

NOTE: Hubot's normal speed is 10 inches per second. By entering different choices you can slow him down or speed him up.

3. After typing in your choice and pressing RETURN, Hubot will automatically return to his MOBILE menu.

1. Using your SPACEBAR, select CALIBRATION and press RETURN.

2. Your monitor will display:

STRAIGHT CALIBRATION PARAMETER (RANGE 1 to 9999)
CURRENT VALUE IS 0
ENTER NEW VALUE

DIAGONAL CALIBRATION PARAMETER (RANGE 1 to 9999)
CURRENT VALUE IS 0
ENTER NEW VALUE

ROTATIONAL CALIBRATION PARAMETER (RANGE 1 to 9999)
CURRENT VALUE IS 0
ENTER NEW VALUE

NOTE: To properly calibrate Hubot, the following values should be used: straight calibration - 191; diagonal calibration - 270; and rotation calibration - 1206.

3. Using your keyboard, type in your choice and press RETURN.

4. After entering your last choice and pressing RETURN, Hubot automatically returns to his MOBILE menu.

Before using Hubot's SMART menu and TASK TEACHER feature you should read and be familiar with the following.

TASK TEACHER is used to teach Hubot task(s) you want him to perform repeatedly. As you begin teaching him you must name each task(s). It is suggested you use names that are easy to remember. You may teach him only one feature or you can combine several features under one task. Once you have completed teaching a task you must save the task. This is accomplished using the END TASK feature. If you do not use the END TASK feature at the end of teaching Hubot a task(s) he will be unable to remember what you have just taught him. To have Hubot perform the task you have taught him, use the TASK RUN feature and follow the prompts on your monitor.

1. Using the SPACEBAR, select TASK TEACHER and press RETURN.

Your monitor will display the following:

Enter NAME for task and press RETURN

2. Type in on your keyboard the task name you have chosen and press RETURN.

NOTE: Naming tasks is an important step in teaching Hubot. It is suggested you use names that will be easy to remember. Until you are more familiar with Hubot, you may wish to write the names down on a separate piece of paper.

Your monitor will now display the following:

```
TASK TEACHER
- Sonar Range
- TV
- Radio
- Atari
- Delay
- Talk
- Chain
- Sub-Task
- Task
- Lights
- Collar
- Sleep
- End Task
```

NOTE: By selecting any number of the above features you can teach Hubot a variety of tasks to perform in your home. IMPORTANT: After teaching Hubot his task(s) you must use the END TASK feature to save what you have just taught him.

Task Teacher Notes:

If you enter a name for a task that already exists, your monitor will display:

TASK J.TSK already exists:
Do you wish to delete? (Yes/No)

If you type in NO, the following message will appear:

To continue teaching this file, use Task Run command load and run this file to its end point. Then return to Task Teacher.

Press ESCAPE to return to TASK RUN.

If you type in YES, that task will be erased from the disk.

The following sample task has been written to show you the concept of teaching Hubot to perform tasks for you. After following these steps, use the instructions for each feature to write your own programs or tasks for Hubot to perform.

1. Select HomeBase. HomeBase feature to zero Hubot's position and press RETURN.
2. Select TASK TEACHER and press RETURN.
3. Name the task, SAMPLE, and type it on your keyboard. Press RETURN.
4. Select MOVE/TURN and following the instructions on the monitor, move Hubot forward about 3 feet. Press RETURN to terminate MOVE/TURN.
5. Select RADIO and ON. Press RETURN.
6. Select DELAY and DELAY FOR SPECIFIED TIME. Enter 15 seconds and press RETURN.
7. Select RADIO and OFF. Press RETURN.
8. Select TALK. Type in what you would like Hubot to say and follow monitor instructions.
9. Select MOVE/TURN and move Hubot backwards about 3 feet.
10. Select END TASK and press RETURN. Hubot will automatically return to TASK TEACHER.
11. Select HomeBase to zero his position and press RETURN.
12. Select TASK RUN and type in SAMPLE and press RETURN and follow your monitor prompts.

Using the following pages to learn the features available, you can teach Hubot tasks you want him to perform. By following the same steps as you did creating the SAMPLE, you can create the programs you desire.

1. Using the SPACEBAR, select MOVE/TURN and press RETURN.

Your monitor will display:

Connect joystick to port #1
Press RETURN when ready

2. Press RETURN if you haven't done so already. Your monitor will display:

Please move keyboard to storage position

Your monitor will now display:

Use joystick as follows:
Move joystick - FORWARD
 - REVERSE
 - LEFT
 - RIGHT

Press and release fire button to learn move.
Press RETURN key to TERMINATE learn mode.

1. Using the SPACEBAR, select SONAR RANGE and press RETURN.

Your monitor will display the following:

Enter maximum detection distance
(1.0 minimum, 9.0 ft. maximum):

NOTE: This feature determines the range of detection for objects in Hubot's path. Using his sonar, his range is from 1.0 to 9.0 feet.

2. Choose the range you want and type it on your keyboard.

EXAMPLE: 3.0 (3 feet)

3. Press RETURN. Hubot will display the following:

Maximum detection distance is now 3.0

and automatically return to TASK TEACHER menu.

1. Using the SPACEBAR, select TV and press RETURN.

Your monitor will display:

```
TEACH TV: Do you wish the TV on or off?  
- ON  
- OFF
```

2. Using the SPACEBAR, select your choice and press RETURN.
3. Hubot will automatically return to his TASK TEACHER menu after you press RETURN.

1. Using the SPACEBAR, select RADIO and press RETURN.

Your monitor will display:

TEACH RADIO: Do you wish the RADIO on or off?
- ON
- OFF

2. Using the SPACEBAR, select your choice and press RETURN.
3. Hubot will automatically return to his TASK TEACHER menu after you press RETURN.

1. Using the SPACEBAR, select ATARI and press RETURN.
Your monitor will display:
TEACH GAME: Do you wish the GAME on or off?
- ON
- OFF
2. Using the SPACEBAR, select your choice and press RETURN.
3. Hubot will automatically return to his TASK TEACHER menu after you press RETURN.

1. Using the SPACEBAR, select DELAY and press RETURN.

Your monitor will now display the following:

```
Delay until keyboard entry
Delay for specified time
```

NOTE: This feature can be used to teach Hubot to perform tasks at a specified time and in conjunction with other features.

2. Using the SPACEBAR, select DELAY FOR SPECIFIED TIME.

Your monitor will display the following:

```
Teach delay for specified time
Enter hours:
Enter minutes:
Enter seconds:
```

3. Type in the times you choose and press RETURN after each entry. After entering your choices the monitor will display the time you typed in:

```
Delay time = 0: 1: 15 (ie., 1 min. 15 sec.)
```

and Hubot will automatically return to his TASK TEACHER menu.

4. If you select "Delay Until Keyboard Entry" Hubot will automatically return to his TASK TEACHER menu. At this time, when in TASK RUN, a message "Press RETURN to continue" will appear on the screen.

1. Using the SPACEBAR, select TALK and press RETURN.

Your monitor will display the following:

Enter text: ,

2. Type in the text you wish Hubot to learn. To listen to him say the text, press the RETURN key.

NOTE: You may wish to experiment with spelling words phonetically rather than the correct spelling.

EXAMPLE: The word "HI" should be spelled "HYE".

3. To save the text you have entered, press the TAB key.
4. By pressing the ESCAPE key, Hubot will automatically return to the TASK TEACHER menu.

1. Using your SPACEBAR, select CHAIN and press RETURN.

Your monitor will display:

ENTER TASK NAME TO CHAIN

NOTE: This feature allows you to link tasks together or to have them run continuously until you reset the system.

2. Enter task name and press RETURN.
3. Hubot will automatically return to his SMART menu.

1. Using your SPACEBAR, select TASK and press RETURN.

Your monitor will display:

Enter task name:

NOTE: This feature allows you to incorporate tasks already taught into new tasks you are currently teaching.

2. Type in name of task already in Hubot's directory and press RETURN.
3. After you press RETURN, Hubot will automatically return to the TASK TEACHER menu.

1. Using the SPACEBAR, select LIGHTS and press RETURN.

Your monitor will,display:

Teach light pattern:
Enter light pattern (0 to 255):
Enter rotation count (0 to 7):

NOTE: You may want to try several variations in this feature to find a pattern that you like.

2. Type in any number from 0 to 255 and press RETURN.
3. Type in any number from 0 to 7 and press RETURN.
4. Once you have typed in your choice press RETURN and Hubot will return to the TASK TEACHER menu.

1. Using the SPACEBAR, select COLLAR and press RETURN.

Your monitor will display:

Teach collar movement:

Enter collar angle to turn to (-9 to +9):

NOTE: Type a single number only. Minus (-) represents counterclockwise and plus (+) represents clockwise. The larger the number, the greater the rotation.

3. Type in your choice and press RETURN.
4. Once you have pressed RETURN, Hubot will automatically return to TASK TEACHER menu.

NOT IMPLEMENTED

1. Using the SPACEBAR, select SLEEP and press RETURN.

Your monitor will display:

No function should follow a sleep function.
Remove disk(s) from drive(s)
Press return to continue

2. After you have removed your disk(s) and pressed RETURN, the monitor will clear and put Hubot in his SLEEP feature. This feature should be used whenever Hubot is idle rather than turning him off.
3. To reactivate Hubot from the SLEEP feature, insert the disk into the disk drive and release the keyboard from its storage position. The A will appear on your monitor.
4. Type in SPKESY, and press RETURN to begin your menu selection.

SMART MENU
TASK TEACHER
END TASK

1. Using the SPACEBAR, select END TASK and press RETURN.

Your monitor will display:

End task
Wait - Saving File

NOTE: This feature is used to save tasks that you want Hubot to perform. You must always use this feature after teaching a task or it will not be saved.

2. Hubot will automatically return to TASK TEACHER when he has saved the task.

1. Using the SPACEBAR, select TASK RUN and press RETURN.

Your monitor will display:

Enter name of task to run and press return

2. Type in the name of the task and press RETURN.

Your monitor will display:

Select ask direction

Forward

Reverse

3. Using the SPACEBAR, select your choice and press RETURN.

Your monitor will display:

Set run mode:

Normal

Single Step

If you select Single Step your monitor will display:

Task run - Single step operation menu:

Step forward

Step reverse

Normal mode

End task

4. Using your SPACEBAR, select your choice and press RETURN.

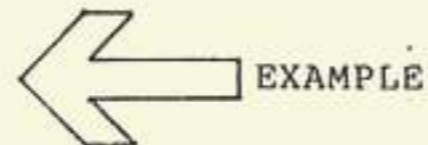
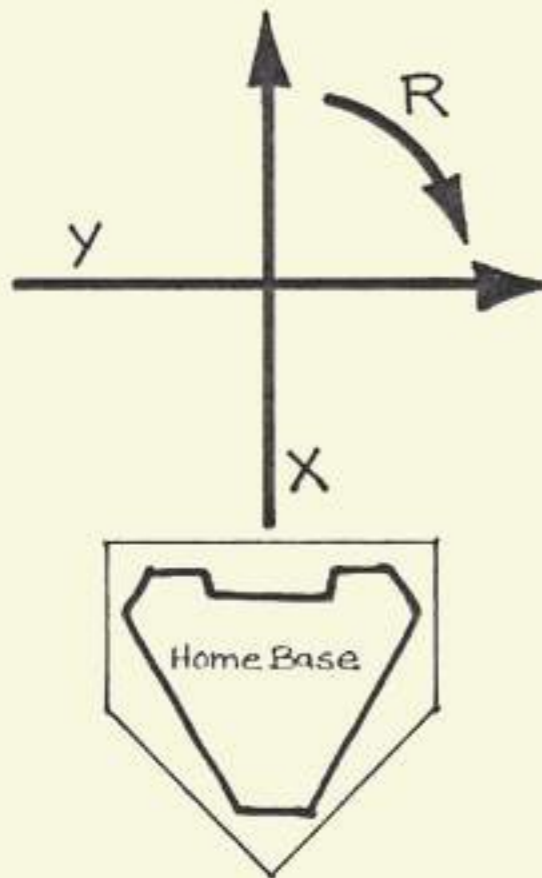
5. When Hubot has performed the task you requested, he will automatically return to his SMART menu.

1. Using your SPACEBAR, select HomeBase and press RETURN.

Your monitor will display:

Select Hubot positioning mode:
 HomeBase
 Off Home

Hubot's computer is designed to remember paths you teach him. He moves on an internal grid system and remembers his moves based on the grid pattern preprogrammed in his memory. There are 10 grids per foot. X represents forward and backward movement; Y represents movement to the left and right; and, R represents rotating moves (all relative to HomeBase).



By selecting HomeBase feature, Hubot automatically establishes his X,Y,R coordinates at zero and will remember his movement from that point in TASK TEACHER - MOVE/TURN.

The following exercise is designed to demonstrate the features HomeBase and Off-Home. To determine a physical homebase, use the HomeBase Plate you purchased with your Hubot, or use tape to mark his wheel locations on your floor.

EXERCISE:

1. Determine a physical HomeBase, or starting point and move Hubot to that point.
 2. Select HomeBase feature to zero his position.
 3. Select TASK TEACHER - MOVE/TURN and move him forward.
 4. After you complete the move, select END TASK.
 5. Select HomeBase feature - OFF-HOME, and Hubot will tell you his present X,Y,R location.
 6. To teach another task, you can select either HomeBase and determine a secondary physical position; or, you can select OFF-HOME and enter the new coordinates.
2. Using your SPACEBAR, select your choice and press RETURN.

If you select HomeBase your monitor will display:

Hubot's current position is X=0 Y=0 R=0

If you select OFF HOME your monitor will display Hubot's actual position relative to HomeBase.

For example:

```
Current Hubot position X=10 y=0 R=0
Define Hubot position (XYR)
Enter X - axis position
Enter Y - axis position
Enter R - axis position
Current Hubot position is now X=   Y=   R=
```

3. Using the keyboard, type in the current Hubot position or return to HomeBase to zero his position.
4. After pressing RETURN, Hubot automatically returns to his SMART menu.

CP/M Operation Manuals can be obtained from:

DIGITAL RESEARCH
POST OFFICE BOX 579
PACIFIC GROVE, CALIFORNIA 93950

SMART MENU
SET TIME/DATE

1. Using the SPACEBAR, select SET TIME/DATE and press RETURN.

Your monitor will display the following:

Please enter time of day:
Hours
Minutes
Seconds
AM or PM

2. Type in the correct time and press RETURN after each entry.
3. Hubot will automatically return to his SMART menu after you press RETURN.

1. Using your SPACEBAR, select VOICE PROMPTING and press RETURN.

Your monitor will display:

Voice Operation

On

Off

NOTE: This feature allows you the choice of having Hubot's voice on or off.

2. Using your SPACEBAR, select your choice and press RETURN.
3. After you press RETURN, Hubot will automatically return to his SMART menu.

1. Using the SPACEBAR, select SLEEP and press RETURN.

Your monitor will display:

Remove disk(s) from drive(s)
Press RETURN to continue

2. After you press RETURN Hubot's monitor will clear and Hubot will be in his SLEEP mode.

NOTE: This is the recommended procedure to follow when Hubot is not being used rather than turning him OFF. At this time his battery charger should be connected to ensure he has a full charge for use at a later time.

3. To wake him up, insert the disk, remove the keyboard from its storage position, and press RETURN.

Your monitor will display:

A

4. Type in SKPESY and press RETURN.
5. When Hubot has performed the task you requested he will automatically return to his SMART menu.

Section 3

If you are having difficulties operating Hubot, please check the following list of symptoms and remedies. When Hubot doesn't do what you expect, be sure to refer to operating instructions in this manual to confirm that you are operating properly.

If the following quick checks don't solve the problem, contact our support groups, Microcomputer Training Corporation at (800) 352-9776 for further assistance.

SYMPTOM: No video display

PROBABLE CAUSE:

1. Diskette is inserted into drive incorrectly. Determine that notch is in lower left hand corner before inserting.
2. Diskette has been damaged. Insert new diskette and destroy damaged one.
3. Disk drive lever not in proper position. Turn lever down to secure disk.
4. Keyboard is in storage position. Release the keyboard by gently lifting up and pulling towards you.
5. Battery needs to be charged. Connect battery per instructions in manual and allow to charge overnight.

SYMPTOM: Keyboard locked up. Cursor or highlighting will not move

PROBABLE CAUSE:

1. A series of commands could not be understood by Hubot. Press the RESET button. If this doesn't unlock the monitor, turn Hubot off and then back on. Be sure to refer to your manual for easy ste-by-step operation of Hubot.

Because of Hubot's high reliability of modern, solid-state components, there should be very little maintenance or service.

It is important to keep Hubot and diskettes dust-free. Hubot can be cleaned with a damp, lint-free cloth. A mild kitchen detergent can be used if necessary.



Section 4

GLOSSARY

ABSOLUTE ADDRESS: The identification of a unique storage location in the computer system (the address) that is permanently assigned by the machine designer.

ACCESS TIME: The time required to begin and complete the read and write function of a specified block of data.

ADAPTIVE: The ability of the robot to "learn", modify its control system and respond to a changing environment.

ADDRESS: A number or reference name that identifies a memory location where information is stored.

ADDRESS REGISTER: A register in which an address is stored.

ALGORITHM: A defined process or set of rules that leads to and assures development of a desired output from a given input. A sequence of formulas and algebraic/logical steps to calculate or determine a given task.

ALPHANUMERIC: Pertaining to a character set that contains both letters and numerals, and usually other special characters.

ANALOG: Pertaining to data in the form of continuously variable physical quantities or to devices that operate on such data.

ANALOG COMPUTER: A computer that operates on analog data by performing physical processes on these data. Contrast with digital computer.

ANALOG-TO-DIGITAL (A/D) CONVERTER: A device that changes physical motion or electrical voltage into digital factors.

ANSI: The American National Standards Institute, composed of representatives from industrial firms, technical societies, consumer organizations, and government agencies. This group develops and approves such things as technical terminology, symbols, abbreviations, coding structures, performance characteristics, methods of rating, etc. Because the organization was known formerly as the United States of America Standards Institute, this group is sometimes referred to as USASI.

APPLICATION PROGRAM: A program that puts the resources and capabilities of the computer to use for some specific purpose or task, such as word processing, database management, graphics, or telecommunications. These programs may be supplied to the user by the manufacturer, purchased from a software house, or written by the user himself.

APPLICATION SOFTWARE: The component of a computer system consisting of application programs.

ARTICULATED ARM: A robot arm constructed to simulate the human arm, consisting of a series of rotary motions and joints.

ARTIFICIAL INTELLIGENCE: The capability of a computer to perform functions that are normally attributed to human intelligence, such as learning, adapting, recognizing, classifying, reasoning, self correction, and improvement.

ASCII: American Standards Code for Information Interchange. A uniform code in which alphabetic, numeric, and special characters plus several special symbols, are represented by 8-bit configurations.

ASSEMBLE: To prepare an object language program from a symbolic language program by substituting machine operation codes for symbolic operation codes and absolute addresses for symbolic addresses.

ASSEMBLER: A language translator that converts a program written in assembly language into an equivalent program in machine language. An assembler generally translates input symbolic codes into machine instructions, item for item, and produces, as an output, the same number of instructions or constants that were defined in the input symbolic codes.

ASSEMBLY LANGUAGE: A low-level programming language in which individual machine-language instructions are written in a symbolic form more easily understood by a human programmer than machine language itself.

ASYNCHRONOUS: Characterizing different time intervals between events or occurrences.

ASYNCHRONOUS DATA SET: A data set that can receive serial bits at any rate up to a specified maximum.

BASE: A number base. A quantity used implicitly to define some system of representing numbers by positional notation. The base of the decimal system is ten; the base of the binary system is two.

BASE ADDRESS: A given address from which an absolute address is delivered by combination with a relative address. The address contained in an index register.

BASIC: Beginner's All-purpose Symbolic Instruction Code; a high-level programming language designed to be easy to learn and use.

BAUD: A unit of transmission speed equal to the number of signal changes in one second. The relationship of bauds to bits-per-second depends on the data set's design. In some data sets, 1200 bauds are equivalent to 1200 bits per second, a one-to-one relationship. In other data sets, the baud rate may be 1/3 or 1/3 of the bit-per-second rate.

BINARY: Consisting of or marked by two things or parts; relating to, being, or belonging to a system of numbers having two as its base; using the two digits 0 and 1. Commonly used in computers, since the values 0 and 1 can easily be represented in physical form in a variety of ways, such as the presence or absence of current, positive or negative voltage, or a white or black dot on the display screen.

BINARY-CODED DECIMAL (BCD): Describing a notation in which the individual decimal digits are represented by a pattern of four bits e.g., the number twelve is represented as 0001 0010 for 1 and 2, respectively. In pure or straight binary notation, twelve is represented as 1100.

BIT (BINARY DIGIT): The smallest element of binary machine language represented by a magnetized spot on a recording surface or a magnetized element of a storage device. Whether the bit represents a 0 or a 1, i.e., is ON or OFF, is determined by ascertaining whether the magnetism was created by a positive or negative electrical charge.

BLOCK: A physical unit of data that can be conveniently stored by a computer on an input or output device. The term is synonymous with physical record. The block is normally composed of one or more logical records or a portion of a logical record.

BRANCH: To depart from the normal sequence of executing instructions in a computer.

BUFFER: A temporary storage device used to compensate for a difference in rate of flow of data or time of occurrence of events when transmitting data from one device to another.

BYTE: A sequence of adjacent bits operated upon as a unit and usually shorter than a word.

CARTESIAN COORDINATES: A set of three numbers defining the location of a point within a recti-linear coordinate system consisting of three perpendicular axes (X,Y,Z).

CATHODE RAY TUBE (CRT): A vacuum tube in which a beam of electrons can be focused to a small point on a luminescent screen and can be varied in position and intensity to form a pattern. The CRT can be used as an output terminal for computer systems.

CENTRAL PROCESSING UNIT (CPU): The central processor of the computer system contains the internal memory unit (memory), the arithmetic logic unit (ALU), and the input/output control unit (I/O Control).

CHIP: An integrated circuit.

CLOCK: A device that generates signals used for synchronization.

CLOSED SUBROUTINE: A subroutine that can be stored at one place and can be connected to a routine by linkages, or calling sequences, at one or more locations. usually, it is stored separately from the main routine and a branch instruction transfers program control to the beginning of the subroutine. At the end of the subroutine, another branch instruction transfers control back to the proper point in the main routine.

CODE: A system of symbols representing rules for handling the flow or processing of information.

CODING: Writing instructions for a computer either in machine or non-machine language.

COMMAND: The portion of an instruction which specifies the operation to be performed. A term used with hardware operations.

COMPATIBILITY, UPWARD: The compatibility provided for a program written for a lower level EDP system to be run on a higher level system.

COMPILER: A computer program that operates on symbolic input data to produce machine instructions. A compiler is more powerful than an assembler. It is able to replace certain input items with a series of instructions. The program which results from compiling is a translated and expanded version of the original program.

COMPLEX SENSORS: Vision, sonar and tactile sensors that will enable a robot to interact with the work environment.

COMPUTER: A device capable of accepting data in the form of facts and figures, applying prescribed processes to the data and supplying the results of these processes as meaningful information. This device usually consists of input and output devices, storage, arithmetic and logic units, and a control unit. Usually, an automatic, stored-program machine is implied.

COMPUTER WORD: A sequence of bits or characters treated as a unit and capable of being stored in one computer location. Synonymous with machine word.

COPY-PROTECT: To prevent the copying of information recorded on a storage medium, such as a disk containing software sold as a commercial product.

CRT (cathode ray tube): A vacuum tube in which a beam of electrons are focused to a small point on a luminescent screen and can be varied in position to form a pattern.

CURSOR: The pointer on the CRT screen that indicates the current position on the screen of the CRT terminal. The underline character is the visual image on the CRT screen of the cursor's position.

CYCLE TIME: The time required to access a single character of data from the computer's memory and make it available to the ALU or I/O controller.

DAISY-WHEEL PRINTER: An impact printer that prints by striking a wheel containing raised characters against an inked ribbon.

DEBUG: To locate and correct any errors in a computer program.

DECIMAL: Pertaining to a characteristic or property involving a selection, choice, or condition in which there are ten possibilities.

DEMULATE: To recover the information being transmitted by a modulated signal; for example, a conventional radio receiver demodulates an incoming broadcast signal to convert it into sound emitted by a speaker.

DENSITY: The closeness of space distribution on a storage medium.

DIAL-UP SERVICE: A communication service, supplied by a common carrier, in which the user dials a number to reach the desired party. The cost for this service is a function of the time used and the distance involved (unless the user has arranged for a special billing system such as WATS).

DIGIT: A single symbol or character representing a quantity.

DIGITAL IMAGE: Digital representation of an image given by a discrete function.

DIGITAL IMAGE ANALYSIS: A multi-stage process that leads to the 'understanding of a digital image, the recognition of certain objects, or the recognition of certain attributes in given objects in the image. Stages of the image analysis process may be: image digitizing, image preprocessing, feature extraction, pattern recognition.

DISKETTE: A term sometimes used for the small (5-1/4 inch) flexible disks used with some disk drives.

DISK ENVELOPE: A removable protective paper sleeve used when handling or storing a disk; must be removed before inserting the disk in a disk drive. Compare disk jacket.

DISK JACKET: A permanent protective covering for a disk, usually made of black paper or plastic; the disk is never removed from the jacket, even when inserted in a disk drive. Compare disk envelope.

ENCODER: A transducer used to convert position data into electrical signals. The robot system uses an incremental optical encoder to provide position feedback

for each joint. Velocity data is computed from the encoder signals and used as an additional feedback signal to assure servo stability.

GARBAGE: Unwanted and meaningless information in memory.

GRADIENT: A vector indicating the change of gray scale values in a certain neighborhood of a pixel. The gradient can be obtained by applying a difference operation on the neighborhood. Often only the magnitude is calculated as a means to obtain the contour of an object.

GRAPHIC SYSTEM: A system that collects, uses and presents information in pictorial form.

HIGH-LEVEL LANGUAGE: A simplified computer programming language that uses English-like statements for instructions and is oriented to the program to be solved or the procedure to be used.

IMAGE: A photographic picture, e.g., as being picked up by a TV camera. Mathematically, an image can be described by a function of 2 variables.

IMAGE ENHANCEMENT: The process of enhancing the quality of the appearance of an image. Image enhancement operations may be: noise filtering, contrast sharpening, edge enhancement, etc.

IMPACT PRINTER: A printer that prints by mechanically striking an inked ribbon, as in a typewriter.

INITIALIZE: (1) To set to an initial state or value in preparation for some computation. (2) To prepare a blank disk to receive information by dividing its surface into tracks and sectors; also format.

INPUT: Information transferred into a computer from some external source, such as the keyboard, a disk drive, or a modem.

JOINT: A single degree of arm rotation. There are up to six joints in a robot arm.

JOINT INTERPOLATED MOTION: A method of coordinating the movement of the joints such that all joints arrive at the desired location simultaneously. This method of servo control produces a predictable path regardless of speed and results in the fastest cycle time for a particular move.

KNOWLEDGE ENGINEERING: The use of artificial intelligence techniques and a base of information or knowledge (facts, rules and procedures) about a specific activity to control systems automatically. This type of system is called a "knowledge based system".

LETTER-QUALITY PRINTER: A printer that produces results comparable in quality to those produced by an electric typewriter.

MACHINE LANGUAGE: The form in which instructions to a computer are stored in memory for direct execution by the computer's processor.

MAIN MEMORY: The memory component of a computer system that is built into the computer itself and whose contents are directly accessible to the processor.

MEMORY LOCATION: A unit of main memory that is identified by an address and can hold a single item of information of a fixed size.

MICRO ARRAY COMPUTER: A special purpose multi-processor system designed for high speed calculations with arrays of data.

MICROCOMPUTER: A computer whose processor is a microprocessor.

MICROPROCESSOR: A single integrated circuit containing most of the elements of a computer.

MODEM: Modulator/demodulator; a peripheral device that enables the computer to transmit and receive information over a telephone line.

MODULATE: To modify or alter a signal so as to transmit information; for example, conventional broadcast radio transmits sound by modulating the amplitude (amplitude modulation, or AM) or the frequency (frequency modulation, or FM) of a carrier signal.

PARALLEL INTERFACE: An interface in which many bits of information (typically eight bits, or one byte) are transmitted simultaneously over different wires or channels. Compare serial interface.

PARALLEL PRINTER: A printer that accepts information from the computer by way of a parallel interface.

PERIPHERAL: At or outside the boundaries of the computer itself, either physically (as a peripheral device) or in a logical sense (as a peripheral card).

PERIPHERAL DEVICE: A device, such as a video monitor, disk drive, printer, or modem, used in conjunction with a computer; often (but not necessarily) physically separate from the computer and connected to it by wires, cables, or some other form of interface, typically by means of a peripheral card.

PRINTED-CIRCUIT BOARD: A hardware component of a computer or other electronic device, consisting of a flat, rectangular piece of rigid material, commonly

fiberglass, to which integrated circuits and other electronic components are connected.

PROCESSOR: The hardware component of a computer that performs the actual computation by directly executing instructions represented in machine language and stored in main memory.

PROGRAM: (1) A set of instructions describing actions for a computer to perform in order to accomplish some task, conforming to the rules and conventions of a particular programming language. (2) To write a program.

PROGRAMMER: The human author of a program; one who writes programs.

PROGRAMMING: The activity of writing programs.

PROGRAMMING LANGUAGE: A set of rules or conventions for writing programs.

RADIO-FREQUENCY MODULATOR: A device for converting the video signals produced by a computer to a form that can be accepted by a television receiver.

RANDOM-ACCESS MEMORY: Memory in which the contents of individual locations can be referred to in an arbitrary or random order.

READ: to transfer information into the computer's memory from a source external to the computer (such as a disk drive or modem) or into the computer's processor from a source external to the processor (such as the keyboard or main memory).

READ-ONLY MEMORY: Memory whose contents can be read but not written; used for storing firmware. Information is written into read-only memory once, during manufacture;

it then remains there permanently, even when the computer's power is turned off, and can never be erased or changed.

ROBOT: A robot is a reprogrammable multi-functional manipulator designed to move material, parts, tools, or specialized devices, through variable programmed motions for the performance of a variety of tasks.

ROUTINE: A part of a program that accomplishes some task subordinate to the overall task of the program.

RUN: (1) To execute a program. (2) To load a program into main memory from a peripheral storage medium, such as a disk, and execute it.

RS232C: Standard computer interface data link used by CRT and TTY terminals.

SAVE: To transfer information from main memory to a peripheral storage medium for later use.

SCREEN: See display screen.

SCROLL: To change the contents of all or part of the display screen by shifting information out at one end (most often the top) to make room for new information appearing at the other end (most often the bottom), producing an effect like that of moving a scroll of paper past a fixed viewing window. See viewport, window.

SECTOR: A portion of the recording surface of a disk consisting of a fixed fraction of a track.

SERIAL INTERFACE: An interface in which information is transmitted sequentially, one bit at a time, over a single wire or channel. Compare parallel interface.

SERIAL PRINTER: A printer that accepts information from the computer by way of a serial interface.

SYSTEM: A coordinated collection of interrelated and interacting parts organized to perform some function or achieve some purpose.

SYSTEM PROGRAM: A program that makes the resources and capabilities of the computer available for general purposes, such as an operating system or a language translator. Compare application program.

SYSTEM SOFTWARE: The component of a computer system consisting of system programs.

TELECOMMUNICATIONS: The transmission of information across long distances, such as over telephone lines.

TELEVISION RECEIVER: A display device capable of receiving broadcast video signals (such as commercial television) by means of an antenna.

TELEVISION SET: See television receiver.

TEMPLATE: A predefined set of contents (numbers, text, and formulas) for an electronic worksheet, designed for some specific purpose or task.

TEXT FILE: A file containing information expressed in text form; compare binary file.

THERMAL PRINTER: A printer that prints by applying small points of heat to a specially treated heat-sensitive paper.

TRANSDUCER: A device for converting energy from one form to another.

TROUBLESHOOT: To locate and correct the cause of a problem or malfunction in a computer system. Typically used to refer to hardware-related problems.

USER: The person operating or controlling a computer system.

USER INTERFACE: The rules and conventions by which a computer system communicates with the human user.

VIDEO MONITOR: A display device capable of receiving video signals by direct connection only, and which cannot receive broadcast signals such as commercial television. Compare television receiver.

VISION SYSTEM: A device that collects data and forms image that can be interpreted by a robot computer to determine the position or to "see" an object.

WORD PROCESSOR: An application program for creating and modifying text.

WRAPAROUND: The automatic continuation of text from the end of one line to the beginning of the next, as on the display screen or a printer.

WRITE: To transfer information from the computer to a destination external to the computer (such as a disk drive, printer, or modem) or from the computer's processor to a destination external to the processor (such as memory).

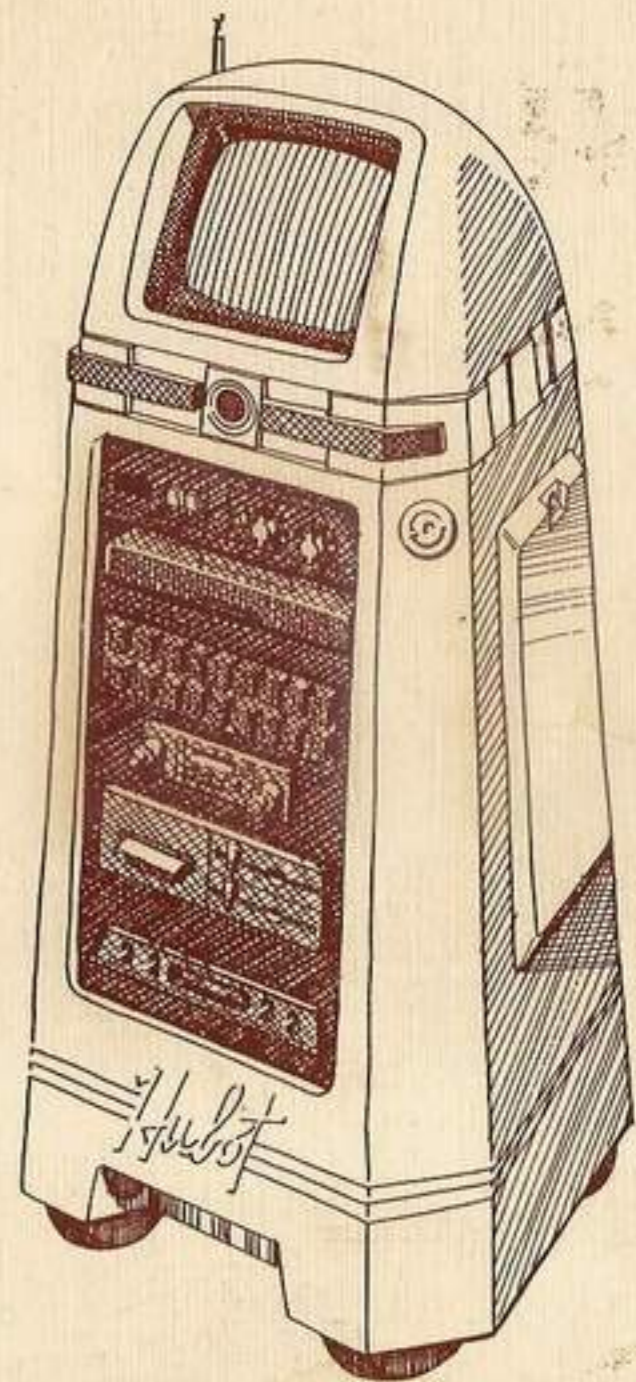
WRITE-ENABLE NOTCH: The square cutout in one edge of a disk's jacket that permits information to be written on the disk. If there is no write-enable notch, or if it is covered with a write-protect tab, information can be read from the disk but not written onto it.

WRITE-PROTECT: To protect the information on a disk by covering the write-enable notch with a write-protect tab, preventing any new information from being written onto the disk.

WRITE-PROTECT TAB: A small adhesive sticker used to write-protect a disk by covering the write-enable notch.

Section 5





Hubot

HUBOTICS

5375 Avenida Encinas
Carlsbad, California 92008
(619) 438-9028