

# *Model 4503*

*AC Voltage Calibrator*

*1mVac to 111.110Vac*

*IEEE-488 Remote Controlled*



**KH KROHN-HITE  
CORPORATION**

*Operating Manual*

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# 4503 OPERATORS MANUAL

Serial No. \_\_\_\_\_

# **4503 OPERATORS MANUAL**



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## **4503 MANUAL LIST OF DRAWINGS**

DESCRIPTION	DRAWING NO.
Block Diagram	B-4096A
Power Supply	B-4091B
Control Board	B-4095A
MPU	B-4093B
MPU/IO	B-4083
MPU-488 & Aux. Instrument Interface	B-4094B
PWM DAC	B-4090C
Squarewave Phase Locked Loop	B-4084
Sinewave Oscillator	B-4082E
A.G.C. Circuitry	B-4089G
Output Stage	B-4092J

## **LIST OF PICTORIALS FOR MODEL 4503**

DESCRIPTION	
Calibration & Test Point Layout	B-4122D

## LIMITED WARRANTY

The Krohn-Hite Corporation (K-H) warrants to the original purchaser each instrument manufactured by them to be free from defects in material and workmanship. This warranty is limited to servicing, repairing and/or replacing any instrument or part thereof returned to the K-H factory for that purpose in accordance with the instructions set forth below; and furthermore to repair or replace all materials, except tubes, fuses, transistors and other semiconductor devices which shall within ONE YEAR of shipment to the original purchaser be returned to the K-H factory and upon examination be deemed defective.

K-H instruments may not be returned to the factory under the terms of this warranty without the prior authorization of the K-H Service Department. All instruments returned to K-H for service hereunder should be carefully packed and shipped. All transportation charges shall be paid by the purchaser.

K-H reserves the right to discontinue instruments without notice and to make changes to any instrument at any time without incurring any obligation to so modify instruments previously sold.

This warranty is expressly in lieu of all other obligations or liabilities on the part of K-H. No other person or persons is authorized to assume in the behalf of K-H any liability in the connection with the sale of its instruments.

***CAUTION:*** *The instrument you have purchased is a precision instrument manufactured under exacting standards. Any attempts to repair, modify or otherwise tamper with the instrument by anyone other than an K-H employee or authorized representative may result in this warranty becoming void.*

# **FACTORY SERVICE REQUEST AND AUTHORIZATION**

## **WARRANTY SERVICE**

Instruments may be returned only on prior authorization. Please obtain a RETURN AUTHORIZATION NUMBER either directly from the factory or from an authorized K-H Representative. (See General Information below.)

## **CHARGEABLE REPAIRS**

If requested, an estimate of charges will be submitted prior to repairs. We suggest that you request a RETURN AUTHORIZATION NUMBER to facilitate handling.

## **GENERAL INFORMATION**

A) Please provide the following information in order to expedite the repair:

- 1) Indicate MODEL
- 2) Serial Number
- 3) Complete description of the trouble:

Symptoms, measurements taken, equipment used, lash-up procedures, attempted repairs, suspected location of failure and any other pertinent information.

- B) Freight Charges must be PREPAID.
- C) The RETURN AUTHORIZATION NUMBER should be noted on your documentation.
- D) See Packing Suggestions - next page.



## PACKING SUGGESTION

Although your K-H instrument is built for laboratory, production environment and some field environment, it is NOT ruggedized. Therefore ...

1. Be sure the carton is **STRONG** enough to carry the weight of the instrument, e.g. use double wall corrugation.
2. Be sure the carton is **LARGE** enough to allow for sufficient packing material, e.g., at least 2 inches all around the instrument. The packing material should be able to be compressed and then return to its approximate original volume.
3. For better handling, the shipment should always be by **AIR FREIGHT** (except for short distances). You might use either UPS "blue label" or common air freight carrier, second day air.

Please do not bounce it across the country in a truck. It may not hurt it, but it certainly is not going to do a laboratory instrument much good.

4. **QUESTIONS?** Just contact us. We will be pleased to help you.

# SECTION I

## 1.0.0 DESCRIPTION & SPECIFICATIONS

### 1.1.0 General Description

- 1.1.1 The model 4503 is a remotely controlled, A.C. voltage reference system for application with automatic test equipment. It is a highly versatile reference source, designed to meet the needs of computer systems production line testing, ATE systems, and standards laboratories.
- 1.1.2 The instrument has a specified accuracy, and is traceable through a bank of saturated standard cells, to the National Bureau of Standards.
- 1.1.3 The model 4503 is programmable via the IEEE-488 bus.
- 1.1.4 The instrument is overload and short-circuit proof, and is fully operational in normal environmental conditions.

### 1.2.0 Output Specification

#### 1.2.1 Amplitude Setability & resolution

Amplitude True rms - Ranges and Resolution

Range plus <u>20% over-range</u>	<u>Stability</u>	Resolution <u>Discrete steps</u>
10 mV	1 mV to 12.11110 mV	10 nV
100 mV	10 mV to 121.1110 mV	100 nV
1 V	100 mV to 1.211110 V	1 $\mu$ V
10 V	1 V to 12.11110 V	10 $\mu$ V
100 V	10 V to 121.1110 V	100 $\mu$ V

### 1.2.2 Amplitude Accuracy

Amplitude Ranges		
f Band	10 mV, 100 mV, 1 V	10 V, 100 V
30 Hz - 15 kHz	$\pm (0.04\% \text{ of Setting} + 0.004\% \text{ of Range} + 25 \mu\text{V})$	$\pm (0.04\% \text{ of Setting} + 0.004\% \text{ of Range})$
15 kHz - 40 kHz	$\pm (0.1\% \text{ of setting} + 0.02\% \text{ of range} + 20 \mu\text{V})$	$\pm (0.1\% \text{ of setting} + 0.02\% \text{ of range})$
40 kHz - 120 kHz	$\pm (0.40\% \text{ of Setting} + 0.06\% \text{ of Range} + 35 \mu\text{V})$	$\pm (0.40\% \text{ of Setting} + 0.06\% \text{ of Range})$

#### Basis for Accuracy Statement

The statement includes all peripheral, additive specifications (Errors for line and load changes, ambient temperature changes and stability are included in the accuracy statement and are designed \*"non additive"). Thus, this instrument may be used under minimally controlled environment and un-monitored conditions. NOTE: All specifications, including accuracy, are valid and warranted for one year.

### 1.2.3 Harmonic Distortion and Noise: (Bandpass 10 Hz to 1 MHz)

f Band	10 mV - 10 V	100 V
30 Hz - 50 Hz	0.5% of Setting +20FV	0.6% of Setting
50 Hz - 100 Hz	0.07% of Setting +20FV	0.07% of Setting
100 Hz - 20 kHz	0.06% of Setting +20FV	0.06% of Setting
20 kHz - 40 kHz	0.08% of Setting +20FV	0.2% of Setting
40 kHz - 60 kHz	0.2% of Setting +20FV	0.4% of Setting
60 kHz - 100 kHz	0.2% of Setting +20FV	0.6% of Setting

### 1.2.4 Compliance Current (Loading)

Voltage Range	Output Current
10 mV, 100 mV	$Z_{out} = 10 \text{ Ohms}$
1 V, 10 V, 100 V	10 mA

### 1.2.5 Load Regulation

(\*non-additive) No load to full load.  
millivolt ranges, not applicable; 1V, 10V and 100V range, <10kHz 0.005%, >10kHz 0.01%.

### 1.2.6 Line Regulation

(\*non-additive)  
 $\pm 0.001\%$  of setting for 10% line change

### 1.2.7 Amplitude Stability and Temperature Coefficient

Stability: (\*non-additive)  
24 hours            0.005%  
1 month            0.007%  
6 months           0.01%

Temperature Coefficient:  
Ambient:            0.005%/EC  
Operating Limit: 0.007%/EC

### 1.2.8 Frequency Setability & Resolution

Range	Setability	Resolution (100ppm)
100kHz	10kHz to 111.10kHz	10Hz
10kHz	1kHz to 11.110kHz	1Hz
1kHz	100Hz to 1.1110kHz	0.1Hz
100Hz	30Hz to 111.10Hz	0.01Hz

### 1.2.9 Frequency Accuracy

(Crystal Controlled) 0.001% of setting

### 1.2.10 Frequency Stability

24 hours:            0.0005% of Setting  
1 month:            0.0008% of Setting  
6 months:           0.001% of Setting

### 1.2.11 Auxiliary Square-wave Output

This is an auxiliary output synchronous with the sine-wave output, D-connector Pin 9. Digital ground is D-connector pins 23-25. Output will drive 10 TTL loads.

### 1.3.0 General Specifications

1.3.1 Power: (Selectable) 115 or 230 V  $\pm 10\%$ , 50 W, 50-60 Hz  $\pm 5\%$

1.3.2 Weight:        Net                15 lbs.  
                     Shipping:        21 lbs. (approx.)

1.3.3 Dimensions:    Width 16.9 x height 3.5 x depth 20.5 inches  
                         Width 429 x height 89 x depth 521 mm  
                         Width (Rack mountable) 19.0 inches; 483 mm

1.3.4 Temperature:   Calibration temperature:         $23^{\circ}\text{E} \pm 1^{\circ}\text{EC}$   
                         Ambient temperature:     $20^{\circ}\text{E}$  to  $30^{\circ}\text{EC}$   
                         Operating Limit:         $10^{\circ}\text{E}$  to  $50^{\circ}\text{EC}$   
                         Storage temperature:     $-40^{\circ}\text{E}$  to  $85^{\circ}\text{EC}$

## **SECTION II**

### **2.0.0 4503 INSTALLATION**

#### **2.1.0 Mounting**

The 4503 is designed for mounting in a standard 19" rack. It is recommended that nylon washers be placed under the rack mounting screws to prevent scratching the mounting ears.

#### **2.2.0 Mating/Connectors**

The instrument is supplied with a mating AC power cord. It is K-H part number P2392. A one or two meter IEEE STD. 488 Cable may be obtained from K-H. It is K-H part number CAB011 or CAB010.

#### **2.3.0 4503 Incoming/check**

2.3.1 Turn unit on. The OL light will be on and then fade out. Set Amplitude range switch to 10 V. Dial up 10 on MSD (all others at 0). Set frequency range to 100 Hz. Dial up 10 on MSD (all others at 0).

2.3.2 Frequency check: Connect frequency counter to the output terminals. Turn frequency range control to 100 kHz. Check the following frequencies:

- 1) 10.00 kHz
- 2) 11.11 kHz
- 3) 22.22 kHz
- 4) 33.33 kHz
- 5) 44.44 kHz
- 6) 55.55 kHz
- 7) 66.66 kHz
- 8) 77.77 kHz
- 9) 88.88 kHz
- 10) 99.99 kHz
- 11) 111.10 kHz
- 12) 121.10 kHz

Set frequency magnitude MSD to 10. Check at range settings of 10 kHz, 1 kHz, and 100 Hz.

- 2.3.3 Output Voltage check: Connect DVM to output terminals. Set at the following ranges and check with DVM.

Amplitude - Set 10 on MSD (all others at 0).

Frequency - Set range at 1 kHz. Set 10 on MSD (all others at 0).

Set range at 1 V. Should read 1 V rms AC  $\pm 0.04\%$ .

Set range at 10 V. Should read 10 V rms AC  $\pm 0.04\%$ .

Set range at 100 V. Should read 100 V rms AC  $\pm 0.04\%$ .

- 2.3.4 A two position slide switch is mounted on the rear panel which is used to set the line voltage requirements to 115 Vac or 230 Vac. Make sure this switch is in the proper position for your line power prior to turning the instrument on for the first time.

## **SECTION III**

### **3.0.0 OPERATION OF THE INSTRUMENT**

#### **3.1.0 Front Panel Controls & Annunciators**

##### **3.1.1 Power Switch**

Push on - Push off with indicator.

##### **3.1.2 Remote-Local Switch**

In the LOCAL positions the Model 4503 instrument is programmable by the other front panel controls. In the REMOTE position it is programmable via the IEEE 488 bus.

- 3.1.2.1 In the LOCAL AMPS position the voltage output range of the unit is 10 volts. This mode is used to drive auxiliary current sources.

**NOTE:** When the LOCAL AMPS position is in use the auxiliary current amplifier must be placed in the appropriate RANGE with the RANGE switches on the current unit. Also the output of the Model 4503 must be connected to the input of the current amplifier.

### **CAUTION**

***THE OUTPUT OF THE MODEL 4503 MUST BE DISCONNECTED FROM THE CURRENT AMPLIFIER INPUT TERMINALS FOR NORMAL VOLT OUTPUT FROM THE MODEL 4503 TO AVOID POSSIBLE DAMAGE TO EITHER INSTRUMENT.***

##### **3.1.3 Amplitude Range Switch**

It has six ranges: 10 mV, 100 mV, 1 V, 10 V, 100 V, and 1000 V. In the 1000 V range the actual output of the unit is the same as the 10 volt range and is used to drive an auxiliary 1000 volt booster amplifier. Within one range, one may span 10% to 121.1% of full scale, with the amplitude magnitude switches.

##### **3.1.4 Amplitude Magnitude Switches & Displays**

There are six, the MSD goes from 1 to 11, while the other five go from 0 to 10. The amplitude is calibrated in rms units. The amplitude magnitude is indicated by a 6 1/2 digit display.



### 3.1.5 Frequency Range Switch

It has four ranges: 100 Hz, 1000 Hz, 10 kHz, and 100 kHz. Within one range, one may span 10% to 121.1% of full scale, with the frequency magnitude switches.

### 3.1.6 Frequency Magnitude Switches & Displays

There are four, the MSD goes from 1 to 11, while the other 3 go from 0 to 10. The frequency magnitude is indicated by a 4 1/2 digit display

### 3.1.7 Front Panel Annunciators

#### 3.1.7.1 Amplitude Annunciators

One of the group from 1, 10, 100, and 1000, and one of the group from mV, V, mA, and A, and the appropriate decimal point will light depending on the amplitude range.

#### 3.1.7.2 Frequency Annunciators

One of the group from 100, 1000, 10 k and 100 k and the appropriate decimal point will light depending on the frequency range.

#### 3.1.7.3 Mode Annunciators

Either LOC (Local) or REM (Remote) will light depending on the front panel selected mode.

#### 3.1.7.4 OVLD (Overload) Annunciator

If a short circuit is placed across the output terminals, on amplitude ranges 1V or higher, the unit will automatically go into an idle state and the "OVLD" (overload) annunciator will light. If the short is removed, the unit may be restored to normal operation by turning any knob in manual mode, or sending a new 488 message in remote mode. If the unit has an internal malfunction in the amplitude A.G.C. circuit or one of the phase locked loops, the unit will also go into the idle state. If the malfunction was a transient, the unit may be restored to normal operation as described previously.

### 3.2.0 Remote Programming Via The IEEE 488 bus (GPIB)

- 3.2.1 Introduction. The K-H model 4503 is compatible with the IEEE Std. 488/1978. The applicable reference publication is: IEEE Standard Digital Interface for Programmable Instrumentation (IEEE Std. 488/1978).

Publisher: The Institute of Electrical and  
Electronics Engineers, Inc.  
345 East 47th Street  
New York, NY 10017

The <GP-IB> makes it possible for a user to connect various instruments and components together into a functional system. However, this system will not work without the proper software.

The operating system software offers a set of functions and commands which the user can assemble into a written program. Once written, the user's application program, in conjunction with the operation system software, will allow the various instruments on the <GP-IB> to generate signals, take measurements, and allow the instrument controller to manage the resulting information.

All commands sent over the <GP-IB> must be expressed in the controller's own language such as BASIC, FORTRAN, etc.

There are three steps that must be taken when using the <GP-IB> to make the system operate. The user must:

- a. Understand what tasks must be performed.
- b. Use the controller's language.
- c. Know what kind of information the instruments are capable of exchanging.
- d. READ THE CONTROLLER PROGRAMMING MANUAL THOROUGHLY!!!

- 3.2.2 The interface capabilities of the 4503 are SH1, AH1, T6, L4, SR1, RL0, PP2, DC0, DT0, E1, (see para. 3.2.9 for PP2 exception).

- 3.2.3 Interface Messages. The K-H 4503 will respond to the following interface messages:

"MLA". - My Listen Address. Upon receipt of this message, the instrument will enter its listener active state and be ready to accept a string of data bytes. ATN must be true.

"UNL". Unlisten. Upon receipt of this message, the instrument will enter its listener idle state and will not listen to any subsequent data byte strings. ATN must be true.

"IFC". Interface Clear. Upon receipt of this command the instrument will enter its listener idle state.

"Power-On" Clear. On "Power-On", and remote mode, the 4503 will be in the listener idle state.

The instrument will also go to its listener idle state when in the local mode.

3.2.4 There are several groups of commands which the 4503 will act upon, when received over the bus.

- A. Normal messages to program the unit's output to a specified voltage.
- B. Normal messages to program the unit's output to a specified frequency.
- C. Messages requesting specific responses on the condition of the 4503.
- D. Serial Poll in response to a SRQ.
- E. Parallel Poll to indicate device status.
- F. Interface Clear (IFC)

3.2.5 Setting the Instrument's Address. The K-H 4503 bus address is set with a "dip switch" located on the rear panel.

**NOTE: THE BUS ADDRESS IS DISPLAYED UPON GOING FROM REMOTE TO LOCAL, AND THE DISPLAYED ADDRESS IS THE DEVICE NUMBER THE MODEL 4503 WILL RESPOND TO. HOWEVER, IF THE ADDRESS SWITCH IS CHANGED WHILE IN THE REMOTE MODE, THE DISPLAY WILL NOT INDICATE THE NEW ADDRESS, ALTHOUGH THE INSTRUMENT WILL NOW RESPOND TO THE NEW ADDRESS.**

3.2.5.1 Use switches 1 through 5. They are arranged in BINARY code.

SW1 = Bit 1  
SW2 = Bit 2  
SW3 = Bit 4  
SW4 = Bit 8  
SW5 = Bit 16  
ON = True  
OFF = False

Binary numbers 0 through 30 are acceptable.

**DO NOT SET ALL 5 SWITCHES TO "ON".**

- 3.2.6 The output amplitude and frequency of the Model 4503 are individually controlled over the bus. Simplified commands will program the output to the correct level and frequency. The best range of voltage and frequency are selected, assuring the output will be at the level that gives the best specs for the range.
- 3.2.7 When the Model 4503 is first placed into the remote mode, both amplitude and frequency data must be sent over the bus before the instrument will put out a voltage.
- 3.2.8 The amplitude is selected by sending over an "I" or "V", then numeric data and the Range byte.
- 3.2.9 The frequency is selected by sending over an "F", then numeric data and the Range byte.
- 3.2.10 Data Byte String Format. In general, the 4503 is programmed with either an eight character data byte string, or a six byte string. ATN must be false on these bytes.

ASCII CHARACTER	FUNCTION	CODES
1		V = Voltage Amplitude Data Follows I = Current Amplitude Data Follows* F = Frequency Data Follows 0 = Remote Standby
2	MSD	1 - 10
3	2SD	0 - 10
4	3SD	0 - 10
5	4SD	0 - 10
6	5SD	0 - 10 (Not sent for Frequency Data)
7	6SD	0 - 10 (Not sent for Frequency Data)
8 (6 freq) Range w EOI		0 = N/U      1 mA      100 Hz 1 = 10 mV    10 mA    1 kHz 2 = 100 mV   100 mA   10 kHz 3 = 1 V       1 A       100 kHz 4 = 10 V      10 A      N/U 5 = 100 V     100 A     N/U 6 = 1000 V    N/U       N/U
9 (7 freq)		CR LF or LF if EOI has not been sent

To send a "10" to an individual decade, the colon character, ":" hex 3A is placed in the string to be sent over the bus. The analog output will change to a new value after receiving the end of message.

**NOTE: THE 4503 MUST RECEIVE AN END OF MESSAGE TERMINATOR TO ACT ON THE MESSAGE. IT WILL RECOGNIZE CR LF, LF, OR EOI SENT WITH THE LAST BYTE, AS A TERMINATOR.**

- 3.2.11 The K-H MODEL 4503 responds per IEEE 488 (GPIB)-1978 convention to a Serial Poll. A Serial Poll conducted in response to a SRQ sent to the 4503, will result in the 4503 transmitting over the bus the following status byte:

DI1-DI7 false, DI8 true

\* The range of the current amplifier must be programmed to correspond to the range programmed to the model 4503.

- 3.2.12 The K-H MODEL 4503 does not permit the Parallel Poll Configure, (PPC) command as implemented in the IEEE 488 (GPIB)-1978 convention. However, the unit may be configured by transmitting an ASCII "P", followed by the PPR byte. From that point the K-H MODEL 4503 will respond to Parallel Polling.

- 3.2.13 Remote Standby Command

The K-H MODEL 4503 can be programmed into a standby state by using the following data string "000000". When in remote standby the display will show dashes "- - - -". The 4503 must receive both a valid frequency and amplitude string to leave the remote standby state.

- 3.2.14 Talk Enable Modes

The controller may request specific status information from the K-H MODEL 4503. The messages to be sent to the K-H MODEL 4503 prior to sending an MTA are as follows:

- a. Last Data Sent

1. Last Message sent over Bus B(eoi)
2. Last amplitude data sent A(eoi)
3. Last frequency data sent F(eoi)

- b. Whats wrong ?(eoi)

3.2.15 Upon receipt of any of the above messages, and upon receipt of MTA, the K-H MODEL 4503 will respond with the appropriate information:

- a1. B: From 1 to 20 bytes
- a2. A: Amplitude data in the same form as it was sent
- a3. F: Frequency data in the same form as it was sent
- b. ?: One or more of the following ASCII messages:

"DATA ERROR"  
"FREQUENCY ERROR"  
"AMPLITUDE ERROR"  
"NO FREQUENCY DATA"  
"NO AMPLITUDE DATA"  
"NOT PROGRAMMED"  
"COMMAND ERROR"  
"NOTHING WRONG"  
"REMOTE STANDBY"

3.2.16 The "Whats Wrong" request may be sent at any time, the K-H MODEL 4503 will respond with, "NOTHING WRONG" or one of the messages of Para 3.2.14,b. It is also used when the controller responds to an SRQ and the 4503 response signifies an error condition.

3.2.17 The K-H MODEL 4503 bus address may be changed with a bus command. To change the bus address, send over the ASCII message, "ADDRESSXX" (XX Represents the new address and MUST BE TWO BYTES). To restore default address, as set on the address switch send over the ASCII message, "ADDRESS"(eoi).

### 3.3.0 Sample Programs

The following sample programs are intended as guides to help you program this calibrator.

NOTE: THE 4503 MUST RECEIVE AN END OF MESSAGE TERMINATOR TO ACT ON THE DATA SENT ACROSS THE BUS. IT WILL RECOGNIZE CR/LF; LF, OR EOI WITH THE LAST BYTE AS A TERMINATOR.

#### 3.3.1 In each of the following examples:

The LANGUAGE is in BASIC, unless noted.

The INTERFACE is IEEE-488 (GP/IB)

The ADDRESS is (Binary) 5 with the dip switch set:

1	2	3	4	5	6	7
on	off	on	off	off	off	off

##### 3.3.1.1 Sample Program using: COMMODORE Models

##### 3.3.1.2 Sample Program using: HEWLETT-PACKARD MODEL 9825

##### 3.3.1.3 Sample Program using: HEWLETT-PACKARD MODEL 1720A

##### 3.3.1.4 Sample Program using: FLUKE MODEL 85

### 3.3.1.1 Sample Program Commodore Models

The following sample program is intended as a guide to help you program this calibrator.

```
10 REM MANUAL INPUT PROGRAM FOR K-H. 4503
20 PRINT "{clr home}"
30 ED$="    KROHN-HITE CORP "
40 PRINTED$:PRINT"":PRINT"ENTER <V>OLTAGE <I> CURRENT OR <F>REQUENCY
50 INPUT P$
60 PRINT "{clr home}"
70 PRINT""
80 PRINT"INPUT MAGNITUDE, 6 DIGITS FOR AMPLITUDE, 4 DIGITS FOR FREQUENCY
90 PRINT" FOR DECIMAL 10 USE :":PRINT""
100 INPUT M$
105 IF P$="V"AND LEN(M$)<>6THEN60
110 IF P$="I"AND LEN(M$)<>6THEN60
120 IF P$="F"AND LEN(M$)<>4THEN60
130 PRINT "{clr home}":PRINTED$:PRINT""
140 PRINT" ENTER RANGE":PRINT"0 FOR 1 mA OR 100Hz"
150 PRINT"1 FOR 10mV or 10 mA or 1kHz"
160 PRINT"2 FOR 100mV or 100 mA or 10kHz"
170 PRINT"3 FOR 1 V or 100 mA or 100 kHz"
175 PRINT"4 FOR 10 V or 1 A"
180 PRINT"5 FOR 100 V or 10 A"
185 PRINT"6 FOR 1000 V"
190 INPUT R$: IF LEN(R$)<>1 GOTO130
200 PRINT "{clr home}":PRINTED$:PRINT
220 REM A$ IS DATA MESSAGE SENT ON THE BUS TO 4503
230 PRINT"":PRINT"    INPUT TO 4503 ON THE BUS IS A$, A$="A$
240 T$=CHR$(13)
250 OPEN5,5
260 PRINT#5,A$,T$;
270 CLOSE5
280 PRINT"INPUT COMPLETE":PRINT"":PRINT""
290 PRINT"TO ENTER MORE DATA, PRESS SPACE BAR":PRINT""
300 GETX$:IFX$=""THEN300
310 GOTO20
```



### 3.3.1.2 Sample Program Hewlett-Packard Model 9825

The following sample program is intended as guide to help you program this calibrator.

```
10 REM MANUAL INPUT PROGRAM FOR K-H. 4503
20 PRINT "{clr home}"
30 ED$=" KROHN-HITE CORP "
40 PRINTED$:PRINT"":PRINT"ENTER <V>OLTAGE <I> CURRENT OR <F>REQUENCY
50 INPUT P$
60 PRINT"{clr home}"
70 PRINT""
80 PRINT"INPUT MAGNITUDE, 6 DIGITS FOR AMPLITUDE, 4 DIGITS FOR FREQUENCY
90 PRINT" FOR DECIMAL 10 USE :":PRINT""
100 INPUT M$
105 IF P$="V"AND LEN(M$)<>6THEN60
110 IF P$="I"AND LEN(M$)<>6THEN60
120 IF P$="F"AND LEN(M$)<>4THEN60
130 PRINT"{clr home}":PRINTED$:PRINT""
140 PRINT" ENTER RANGE":PRINT"0 FOR 1 mA OR 100Hz"
150 PRINT"1 FOR 10mV or 10 mA or 1kHz"
160 PRINT"2 FOR 100mV or 100 mA or 10kHz"
170 PRINT"3 FOR 1 V or 100 mA or 100 kHz"
175 PRINT"4 FOR 10 V or 1 A"
180 PRINT"5 FOR 100 V or 10 A"
185 PRINT"6 FOR 1000 V"
190 INPUT R$: IF LEN(R$)<>1 GOTO130
200 PRINT"{clr home}":PRINTED$:PRINT""
210 A$=(P$+M$+R$)
220 REM A$ IS DATA MESSAGE SENT ON THE BUS TO 4503
230 PRINT"":PRINT" INPUT TO 4503 ON THE BUS IS A$, A$="A$
240 T$=CHR$(13)
250 OPEN5,5
260 WRT7XX,A$;CHR$(13):REM: OR WRTXX,"T123456R";CHR$(13);
270 CLOSE5
280 PRINT"INPUT COMPLETE":PRINT"":PRINT""
290 PRINT"TO ENTER MORE DATA, PRESS SPACE BAR":PRINT""
300 GETX$:IFX$=""THEN300
310 GOTO20
```

### 3.3.1.3 Sample Program Hewlett-Packard Model 85

The following sample program is intended as a guide to help you program this calibrator.

```
10 REM MANUAL INPUT PROGRAM FOR K-H. 4503
20 PRINT "{clr home}"
30 ED$="    KROHN-HITE CORP "
40 PRINTED$:PRINT"":PRINT"ENTER <V>OLTAGE <I> CURRENT OR <F>REQUENCY
50 INPUT P$
60 PRINT"{clr home}"
70 PRINT""
80 PRINT"INPUT MAGNITUDE, 6 DIGITS FOR AMPLITUDE, 4 DIGITS FOR FREQUENCY
90 PRINT" FOR DECIMAL 10 USE :":PRINT""
100 INPUT M$
105 IF P$="V"AND LEN(M$)<>6THEN60
110 IF P$="I"AND LEN(M$)<>6THEN60
120 IF P$="F"AND LEN(M$)<>4THEN60
130 PRINT"{clr home}":PRINTED$:PRINT""
140 PRINT" ENTER RANGE":PRINT"0 FOR 1 mA OR 100Hz"
150 PRINT"1 FOR 10mV or 10 mA or 1kHz"
160 PRINT"2 FOR 100mV or 100 mA or 10kHz"
170 PRINT"3 FOR 1 V or 100 mA or 100 kHz"
175 PRINT"4 FOR 10 V or 1 A"
180 PRINT"5 FOR 100 V or 10 A"
185 PRINT"6 FOR 1000 V"
190 INPUT R$: IF LEN(R$)<>1 GOTO130
200 PRINT"{clr home}":PRINTED$:PRINT""
210 A$=(P$+M$+R$)
220 REM A$ IS DATA MESSAGE SENT ON THE BUS TO 4503
230 PRINT"":PRINT"    INPUT TO 4503 ON THE BUS IS A$, A$="A$
240 OUTPUT 705 ;A$
250 PRINT"INPUT COMPLETE":PRINT"":PRINT""
260 PRINT"TO ENTER MORE DATA, PRESS SPACE BAR":PRINT""
270 GETX$:IFX$=""THEN270
310 GOTO20
```

3.3.1.4 Sample program using <FLUKE MODEL 1720A> controller  
to operate K-H MODEL 4503.

Language: Basic

```
10 INIT PORT 0
20 REMOTE_@5
30 PRINT_@5,"V1234561_"
40 PRINT_@5,"F12341_"
```

RUN (RET)

NOTE: " \_ " designates space