Model 3200/PCS-2B
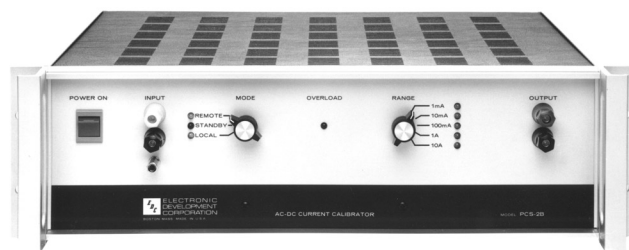
Manual and Remote Controlled (PCS-2B - IEEE-488 Programmable)
AC/DC Current Standard/Calibrator

KH KROHN-HITE CORPORATION

Operating Manual

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3200/PCS2-B
OPERATORS
MANUAL

Serial No._____

MODEL 3200/PCS2-B
OPERATORS
MANUAL

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                * Applicable to Model PCS-2B only

NOTE: Errata and addendum (if any) will appear in the back of this manual.

3200/PCS-2B MANUAL

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* Applicable to Model PCS-2B ONLY.

LIMITED WARRANTY

The Krohn-Hite Corporation 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 Krohn-Hite 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 Krohn-Hite factory and upon examination be deemed defective.

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

Krohn-Hite 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 Krohn-Hite. No other person or persons is authorized to assume in the behalf of Krohn-Hite 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 Krohn-Hite employee or authorized representative may result in this warranty becoming void.

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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 Krohn-Hite 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 Krohn-Hite 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 AND SPECIFICATIONS**

1.1.0 <u>General Description</u>

1.1.1 This high current calibrator is an accurate voltage to current amplifier or transconductance amplifier. The application of a precise voltage to the input terminals produces a proportional current into any load within the compliance range of the instrument. The input voltage can be AC or DC up to 1 kHz.

1.1.2 The unit is laboratory calibrated with instruments and load resistors traceable to US NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGY.

1.1.3 The circuitry is solid state. Derated components are used throughout to minimize temperature effects. The input is protected against over-voltage and has a high output impedance.

1.1.4 The models 3200 and PCS-2B are equipped for rack mounting in a standard 19 inch rack. It is completely enclosed in dust covers and therefore suitable for bench top use. Tilt bale is available on request.

1.1.5 The instrument has been designed to be easily transported from one location to another and will be within operational specifications within one minute after power is applied.

1.1.6 The unit may be permanently mounted in a standard 19" rack and requires only 5" of space.

1.2.0 <u>Applications</u>
Direct calibration of watt meters (with applicable voltage standard), meter shunts, ac & dc current meters, current to voltage transducers, current to pneumatic transducers, dvms, dmms, and relay coil current testing.

1.3.0   General Specifications

1.3.1   Power Requirement (selectable):
         115 or 220 Vac ±10%; 50/60 Hz; 150 W

1.3.2   Temperature:
         Calibration   23 º C ± 1 º C
         Nominal Operating   20 º C to 30 º C
         Safe Operation   0 º C to 55 º C
         Storage   -20 º C to 60 º C
         Temperature Coefficient   50 ppm/º C - 10A & 1A Ranges;
                                    10 ppm/º C - 100, 10 & 1 mA Ranges.

         *Temperature coefficient is an adder to uncertainty specification that does not apply unless
          operating more than ± 5 º C from the calibration temperature

1.3.3   Weight: 23 Lbs.; 10.44 Kg
         Shipping Weight: (USA) 25 Lbs.; 11.35 Kg

1.3.4   Dimensions: 5.22H x 17W x 15D inches (12.25 x 43.18 x 38.1 cm)
         Rack Mountable: 5.22H x 19W x 16D Inches (12.25 X 48.26 X 40.64 cm)

1.3.5   Protection:
         A front panel lamp illuminates to indicate when the compliance voltage has been exceeded or
         when a malfunction has occurred.

1.3.6   Calibration Cycle:
         One Year

1.3.7   Certification:
         A Certificate of Compliance traceable to the U.S. National Institute of Standards
         and Technology is supplied.

1.4.0   Input Specifications

1.4.1   Input Voltages:
         0 to ± 11 Vdc or 0 to 11 Vac (rms)

1.4.2   Input Impedance:
         10 kOhms (all ranges)

1.4.3   AC Band Width:
         40 Hz to 1 kHz

1.5.0   Output Specifications.

1.5.1   Ranges:
         10 A, 1A, 100 mA, 10 mA, 1 mA

1.5.2   Resolution:
         10 µA, 1 µA, 100 nA, 10 nA, 1 nA
         (Limited by the resolution of the voltage calibrator)

1.5.3   Accuracy:
         AC: ±(0.05% of setting +0.01% of range +20 µA)
         DC: ±(0.01% of setting +0.01% of range +10 µA)

1.5.4   Compliance Voltage:
         1 mA to 1 A Ranges: 5 Vdc or peak ac
         10 Amp Range: 1.5 Vdc or peak ac

1.5.5   Load Regulation: (*non-additive)
         1 mA, 10 mA, 100 mA ranges: ± 0.02%
         1 Amp, 10 Amp ranges: ± 0.02%

1.5.6   Line Regulation: (*non-additive)
         ± 0.0005% for ± 10% line change

1.5.7   Stability:
         DC mode - ± 0.001% of range
         AC mode - ± 0.005% of range

1.5.8   Isolation:
         Floating Output. Limited only by the isolation of the driving voltage source.

1.5.9   Distortion:50 Hz to 1 kHz.
         1 mA to 1A Ranges: < 0.1%
         10 Ampere Ranges: < 0.5%
         (Added to the distortion of the AC voltage calibrator)

1.5.10   Ripple & Noise, rms: (non-additive)in band-pass 0.1 Hz to 100 kHz

Range	1 mA	10 mA	100 mA	1A	10A
Ripple & Noise	1.5 µA	3.0 µA	40 µA	80 µA	375 µA

1.6.0   IEEE 488 Specifications. (PCS-2B ONLY)

1.6.1   The Model PCS-2B may be programmed over the IEEE488 Interface Bus. The interface
         functions contained in this unit are SH0 AH1 T0 L2 SR0 RL0 PP0 DC0 DT0 C0 E1.

SECTION II

2.0.0 **INSTALLATION**

2.1.0 <u>Mounting</u>

2.1.1 The 3200/PCS-2B 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.

2.1.2 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.

2.2.0 <u>Mating Connectors & cables</u>

2.2.1 The instrument is supplied with a mating AC power cord. Part number CAB008.

2.2.2 IEEE 488 Connector   (PCS-2B only)

2.2.3 A one or two meter IEEE STD. 488 cable may be obtained from Krohn-Hite Corp. Part Number CAB011 for one meter & CAB010 for two meters

SECTION III

3.0.0 **OPERATION OF THE INSTRUMENT**

3.1.0 General

3.1.1 The model 3200/PCS-2B is a voltage to current amplifier which requires only a driving source to generate output currents to 10 amperes.

3.1.2 Operation is simple and straight forward with a few reasonable precautions to prevent damage to equipment under test.

3.2.0 Interconnections

3.2.1 The 3200/PCS-2B should be plugged into the AC line with the power switch OFF.

3.2.2 The shorting bar supplied with the unit should be on the output terminals.

NOTE: *Open Circuit Compliance Voltage Is 7.5 Volts*.

3.2.3 The load may be connected to the output terminals. The connections should be made to the inside portion of the five-way binding post. This serves two purposes, it permits removal of the shorting bar when desired, or its reinsertion; also, a more secure, and electrically low ohmic connection may be made, reducing the IR drop at the binding post. This is critical at the high current levels where unnecessary IR drops reduce the available compliance voltage at the load.

3.2.4 Select the desired range with the five-position range switch.

3.2.5 Connect suitable AC or DC voltage source to the input terminals. Select the desired input voltage to deliver the required output current. The output current and input voltage required may be derived as follows:

$$I_{OUT} \quad \frac{V_{INPUT} \times RANGE}{10} \quad (1)$$

$$V_{INPUT} \quad \frac{10 \times I_{OUT}}{RANGE} \quad (2)$$

NOTE: *the Maximum Input Voltage Is 10 Vdc or rms ac.*

3.2.6   Turn on Model 3200/PCS-2B. When the overload light extinguishes, the shorting plug on the output terminals may be removed. If the overload light comes on again, check load and output connections. The load may be wrong for the current being called for:

$$R_{L,MAX} \quad \frac{E\ compliance}{I_{OUT}} \quad (3)$$

3.3.0   <u>Special Operating Considerations</u>

3.3.1   Reasonable care should be exercised in the selection of wire size used to connect high current loads to the 3200/PCS-2B. A choice of size, with a high IR drop, or a poor connection at the 3200/PCS-2B or the load will limit the compliance voltage available at the load.

3.3.2   Accurate measurements of the current through the load should be made at the load, not at the 3200/PCS-2B terminals, i.e., as in determining resistance values of shunts, etc.

3.3.3   The model 3200/PCS-2B is factory tested and calibrated with 1kΩ , 100Ω, 10Ω, 1Ω, and 0.1Ω on the 1 mA, 10 mA, 100 mA, 1A, and 10A ranges, respectively.

3.3.4   Although all precautions have been made to minimize the effects of thermals, it is a good practice to allow, when time permits, 15 minutes between high current usage (1 or 10 amps) and milliamp range measurements. The unit does not exceed its basic accuracy specifications for the low ranges. However, some drift does occur in the sensing circuits due to high current operation which may affect critical milliampere measurements.

3.4.0   Programming via the IEEE-488 Bus (PCS-2B ONLY)

3.4.1   The model PCS-2B 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

3.4.2   The model 3200/PCS-2B may be programmed over the IEEE-488 INTERFACE BUS.
        The interface functions contained in this unit are:
        SH0 AH1 T0 L2 SR0 RL0 PP0 DC0 DT0 C0 E1.

3.4.3   The output range the Model PCS-2B may be controlled over the bus. Simplified commands
        will program the output to the correct level.

3.4.4   When the Model PCS-2B is first placed into remote operation, the range data must be sent
        over the bus before the instrument will put out a current.

3.4.5   The range is selected by sending over the numeric data, as a single byte string, representing
        the range byte:

        "0" = 1mA; "1" = 10mA; "2" = 100mA; "3" = 1A; "4" = 10A; "5-9" = STANDBY

3.4.6   Setting the instrument's LISTEN ADDRESS. The PCS-2B is a "LISTEN ONLY" instrument.
        Its' LISTEN ADDRESS is set with a "DIP SWITCH" located on the mother board.

3.4.7   Use switches 1 through 5. They are arranged in a BINARY CODE.

        SW1 = BIN 1; SW2 = BIN 2; SW3 = BIN 4; SW4 = BIN 8;
        SW5 = BIN 16; `ON` = TRUE; `OFF` = FALSE

        Binary numbers 0 through 30 are acceptable. Do not set all 5 switches to "ON".

3.4.8   Interface Messages. The PCS-2B 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. At "POWER-ON", and Remote Mode, the instrument will be in the Listener Idle State and its analog output will be 0. The instrument will also go to its Listener Idle State when in the Local Mode.

3.4.9   DATA BYTE STRING FORMAT. In general, the PCS-2B is programmed with a single character data byte string. ATN must be FALSE on these bytes.

RANGE CHARACTER FUNCTION CODES

0 = 1mA
1 = 10mA
2 = 100mA
3 = 1A
4 = 10A

The range will change immediately upon receipt of the new Range Byte.

NOTE: ***Check your user's manual for permissible String labels. Some labels are reserved by the operating system, or permit only single character definitions***.

3.4.10   Lab Windows Driver available upon request.

3.5.0   Sample Programs (PCS-2B)

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

1. The PCS-2B looks for 1 byte at a time and any additional bytes sent can cause errors.

2. Some software used to communicate between the host computer and the IEEE interface can generate and send unseen bytes which will be interpreted by the 3200/PCS-2B as command bytes.

3. Sending an "UNLISTEN" command after each command string will reset the PCS-2B'S internal counter so that a "LISTEN" command followed by the 1 byte command string will set the unit to a new range.

3.5.2   In the following examples:
The Interface is IEEE-488 (GP/IB)
The Unit Address is (BINARY) 5 with the dip switch set:

1	2	3	4	5	6	7
ON	OFF	ON	OFF	OFF	OFF	OFF

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3.5.3   Sample Program Hewlett-Packard Model 9825

The Following Sample Programs Are Intended as Guides to Help You Program This
Calibrator. In The Following Example:

The Language Is Basic
The Interface is IEEE-488 (GP/IB)
The Unit Address is (BINARY) 5 with the dip switch set:

1	2	3	4	5	6	7
ON	OFF	ON	OFF	OFF	OFF	OFF

```
10  REM MANUAL INPUT PROGRAM FOR PCS-2B
50  PRINT"[CLR HOME]"
60  PRINT"" :PRINT""
70  PRINT" ENTER RANGE":PRINT"0 FOR 1mA":PRINT"1 FOR 10mA" 80  PRINT"2
    FOR 100mA"
90  PRINT"3 FOR 1A":PRINT"4 FOR 10A"
100 INPUT R$: IF LEN(R$)<>1 GOTO50
110 PRINT"[CLR HOME]":PRINTED$:
120 A$=R$
130 REM A$ IS DATA MESSAGE SENT ON THE BUS TO PCS-2B
140 PRINT"":PRINT"    INPUT TO PCS-2B ON THE BUS IS A$, A$="A$
150 T$=CHR$(13)
160 OPEN5,5
170 OUTPUT 705 USING "#,K";A$
180 CLOSE5
190 PRINT"INPUT COMPLETE":PRINT"":PRINT""
200 PRINT"TO ENTER MORE DATA, PRESS SPACE BAR":PRINT""
210 GETX$:IFX$=""THEN210
220 GOTO70
```

NOTE: *line 170: 705 = device address; a$= setting e.g."1"*
       please consult hp user manual.

3.5.4 Sample Programs   Hewlett-Packard Model 85

In The Following Example:

The Language Is Basic
The Interface is IEEE-488 (GP/IB)
The Unit Address is (BINARY) 5 with the dip switch set:

1	2	3	4	5	6	7
ON	OFF	ON	OFF	OFF	OFF	OFF

```
10  REM MANUAL INPUT PROGRAM FOR PCS-2B 20  PRINT"[CLR HOME]"
60  PRINT"":PRINT""
70  PRINT" ENTER RANGE":PRINT"0 FOR 1mA":PRINT"1 FOR 10mA":PRINT"2
    FOR 100mA"
80  PRINT"3 FOR 1A":PRINT"4 FOR 10A"
90  INPUT R$:IF LEN(R$)<>1 GOTO50
100 PRINT"[CLR HOME]":PRINT""
110 A$=R$
120 REM A$ IS DATA MESSAGE SENT ON THE BUS TO PCS-2B
130 PRINT"":PRINT"    INPUT TO PCS-2B ON THE 488 BUS IS A$, A$="A$
140 OUTPUT 705 USING "#,K";A$
150 PRINT"INPUT COMPLETE":PRINT"":PRINT""
160 PRINT"TO ENTER MORE DATA, PRESS SPACE BAR":PRINT""
170 GETX$:IFX$=""THEN160
180 GOTO70
```

NOTE: *line 170: 705 = device address; a$= setting e.g."1"*
        please consult hp user manual.

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win-man\3200-PCS2B