62-5018

Instruction Manual

for

Model 8200

6½ - Digit
Voltage & Current
CALIBRATOR

DATA PRECISION

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1 INTRODUCTION

1.1 GENERAL

The Data Precison Model 8200 Calibrator is a precision 6½-digit (1,048,575 counts), microcomputer-controlled, voltage and current standard, providing a completely isolated analog signal from 0.1μV to 100V (or up to 1000V with the 1KV option), or 1μA to 100mA, for the test and calibration of high-precision analog circuits. When enhanced with the optional IEEE488 bus interface, the Model 8200 may be remotely programmed as a voltage or current standard for ATE applications. The Model 8200 is configured in a standard 3½-inch high, 19-inch wide metal case, suitable for rack mounting (with the rack mounting option, A6. Its light weight of less than 17 pounds, and its universal powering capability (115 or 230Vac) make the Model 8200 a convenient, portable standard for use in a variety of test/inspection environments.

1.2 FEATURES

The Model 8200 provides three selectable full scale ranges for dc voltage generation (100mV, 10V, and 100V) and one range scale for dc current generation (100mA). Polarity for each is independently selected by front-panel control, while the decimal point is positioned automatically in the 6½-decade display. A field-installable 1KV option provides an extended range up to 1000V.

Accuracy of the analog voltage output is within 10ppm of the reading + 1ppm of the full scale range. Accuracy of the current output is within 0.01% of the reading + 1μA.

High speed settling is compatible with the designed use of the Model 8200 as part of a computer-controlled ATE system. Output values settle from one level to the other in the same range within 1ms, and within 15ms when a range change has been made.

Stable outputs are designed for long periods of unattended use. Long-term drift of less than 10ppm may be expected over 60 days. Temperature coefficients over an operating range from 15°C to 35°C introduce 1ppm/°C of reading + 0.2ppm of full scale range on the 10V scale, and 2ppm/°C of reading + 0.2ppm of full scale range on either 100mV or 100V ranges. The dc current temperature coefficient is 10ppm of reading and 2ppm of range.

Front-panel controls and the display operate in a "full duplex" mode. That is, the operator indicates his desired change in output to the microcomputer, while the display is controlled **directly** by the microcomputer, *after the change in value has been verified to be a valid one and then transmitted by the microcomputer to the display.*

Front-panel setup of varying output magnitudes is designed for optimum human-engineered convenience. Each of the 6 decade selectors at the front panel may be operated in either clockwise or counterclockwise (increment or decrement action) without limit so that the output value may be changed by the selected incremental resolution **without having to change decade selectors** . The instrument performs full carry or full borrow to or from higher decades to the limits of the selected full scale range.

Fail-safe operating modes protect the tested components from inadvertent high signals. The Model 8200 **returns to 0** when a change in polarity is commanded, or when a range scale is changed.

Remote programming is field installable. The IEEE488 bus interface assembly may be installed within the Model 8200 chassis as a user-installable procedure. The assembly is plug-connected within the Calibrator, and the programming has been installed for the remote operation.

1.3 INSTALLATION

Model 8200 Calibrator is wrapped in a plastic water-proof bag, placed between foam shock isolators, and shipped in a protective carton. You will find the documentation inside the shipping carton. This includes the Certificate of Conformance, Warranty registration, Final Acceptance Test Data, and this Instruction Manual. The instrument is shipped, ready for use. Ordered options have been installed, and the ac line cord is included. Ordered accessories will be shipped in their own containers as separate items.

After unpacking, examine the contents carefully. Inspect the packing case and the instrument for any signs of damage during shipment and report immediately to the carrier. Fill out and return the warranty card in order to register your instrument and to establish your warranty service interval.

Retain the packing material for reshipment. When shipping the Model 8200 Calibrator, use foam shock isolators and pack in the original shipping carton, if available. If original shipping material is no longer available, use some shock isolators, such as bubble plastic, and wrap securely within a suitable carton.

1.4 INSTALLING & POWERING THE MODEL 8200

The Model 8200 Calibrator is designed for bench-top or rack-mounted installations (with the rack mount option). Figure 1-1 indicates the space required for the instrument in any application. The bottom cover of the calibrator is fitted with "feet" for non-skid bench use, and a built-in tilt stand may be extended for convenient viewing and front-panel operation. No cooling fan is used, and no special temperature controls are needed. The ambient, however, should remain fairly stable during use in order to obtain the full benefits of the instrument accuracies and stability.

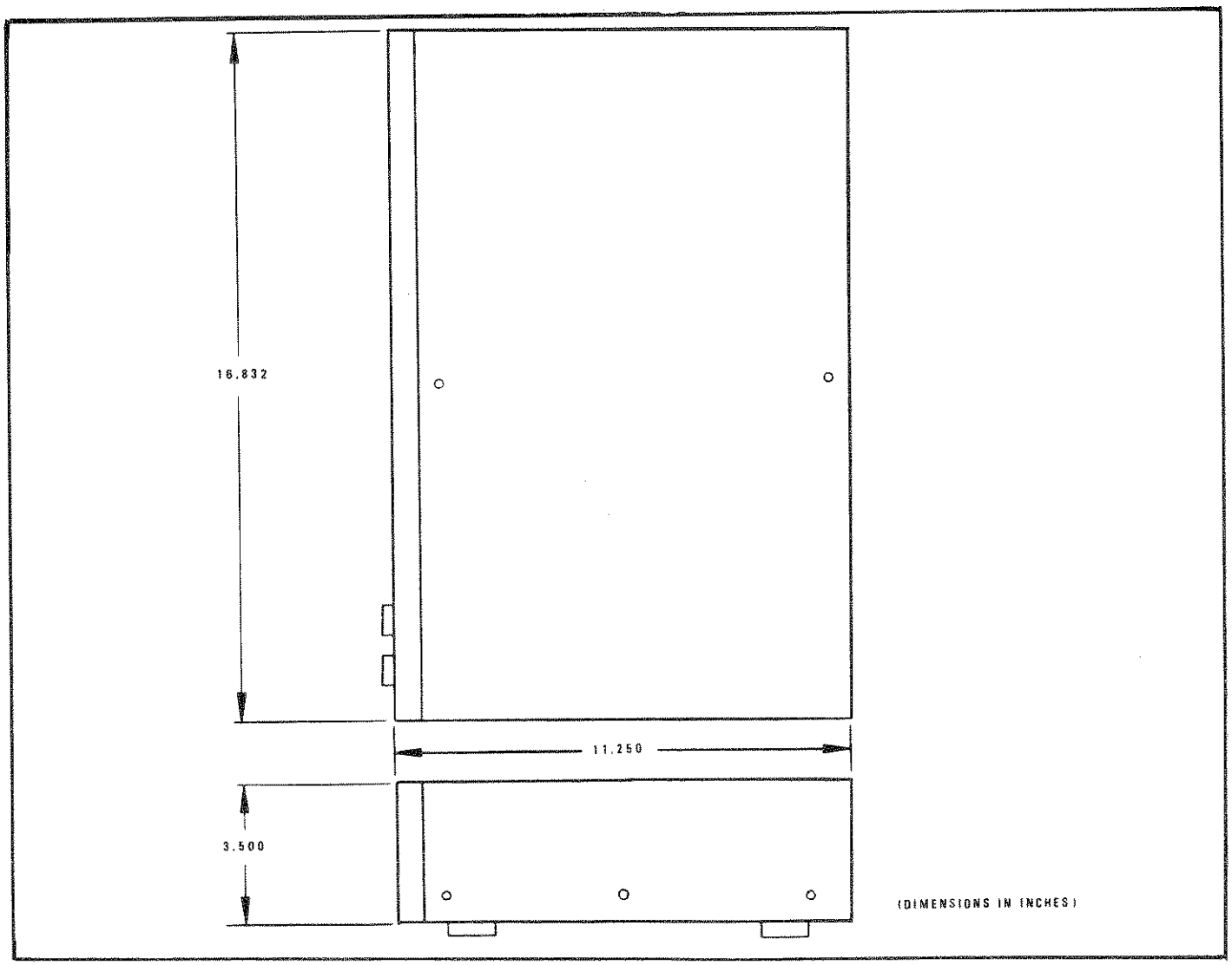
The Model 8200 Calibrator is designed for 115 and 230 volt rms sourcing. A rear-panel switch configures the input transformer primary for the available power.

CAUTION

Check the rear panel and confirm the switch setting for the available power. See Chapter 2, Figure 2-2, for further details and information.

Connect the ac line cord to the rear-panel power receptacle.

Refer to Chapter 2, Operating Instructions, for instructions on connecting the 8200 to instruments under test. Allow at least ½ hour for warmup before using the Calibrator in any application.



1-1. Outline & Mounting Dimensions

2 SPECIFICATIONS & OPERATION

2.1 SPECIFICATIONS

2.1.1 Voltage Mode

Range	Full Scale	Resolution	Current	Accuracy	Output Impedance
± 100 mV	± 104.8575 mV	0.1 μV	----	± (60ppm rdg + 1μV)	100 ohms
± 10 V	± 10.48575 V	10 μV	100 mA, max	± (10ppm rdg + 10μV)	10 milliohms
± 100 V	± 104.8575 V	100μV	10 mA, max	± (10ppm rdg + 100μV)	20 milliohms

Noise (dc - 10 kHz):

10V Range: 10μV rms
100V Range: 100μV rms

Settling Time:

1 msec to rated accuracy (without range change)

Stability:

10ppm for 60 days

Temperature Coefficient (15°C to 35°C):

10V: ± (1ppm/°C rdg + 0.2ppm/°C range)

100V: ± (2ppm/°C rdg + 0.2ppm/°C range)

2.1.2 Current Mode

Range	Full Scale	Resolution	Compliance Voltage	Accuracy
± 100 mA	± 100.000 mA	1μA	10V	± (0.01% rdg + 1μA)

Temperature Coefficient:

± (10ppm/°C + 2ppm/°C range)

2.1.3 Voltage/Current Mode Performance

Warmup Time

1 hour to rated accuracy

Output:

10V and 100V Ranges: Floating, 4-terminal, with remote sensing and guard.
100mV Range: Rear-panel, shielded, connector; 2 terminals plus guard.
100mA Range: Floating, 2-terminal, plus guard.

Common Mode Voltage:

500V max, guard to case

Calibration Interval:

60 days

Power:

115/230V, 50 - 60 Hz, 25 Watts

Controls and Indicators:

6 rotary decade selector switches, unlimited travel, clockwise or counter clockwise, with carry and borrow, as required
1 rotary range and mode selector switch
1 rotary polarity selector switch
7 LED display indicators, 0.8 in high; 6 full decades, overflow, + , − .
4 Annunciators: **mV, mA, REM,** and ⚠ (for 1000V selection). **V** is understood when no other selection is made.
1 pushbutton power switch

2.1.4 Options

IEEE488 Interface (GPIB)

Rack Mounting

Rear Terminals

1kV Amplifier

2.1.5 IEEE488 OPTION

Address:

Address is determined by five dip switches mounted on the option assembly board.

Local - Remote:

When addressed to **listen**, and when sent a character, the 8200 assumes **REMOTE** operating status, and can no longer be programmed from the front panel. The instrument retains its previous output setting until receipt of a valid character string as specified below. **LOCAL** operating status is resumed on receipt of an **L** at any time, or by a power **OFF/ON** cycle.

Character Strings:

All characters are **ASCII.**
Parity bit is ignored.

Voltage Mode:

1st character	V	Voltage mode
2nd character	0	100mV range
	1	10V range
	2	100V range
	3	1000V range
3rd character	+	Plus polarity
	−	Minus polarity
4th through 10th characters	0 to 9	Magnitude (*NUL*, . , or *SPACE* is ignored after polarity is received.)

Current Mode:

1st character	A	100mA range
2nd character	+	Plus polarity
	−	Minus polarity
3rd through 8th character		Magnitude (As above, for voltage mode)

Characters received before a **V** or **A** are ignored. Once a **V** or **A** is received, the string must conform to the format specified above.
Invalid characters reset the pointer, and they must be followed by a complete new string.
Receipt of the last character in the string initiates an output.
Out-of-range values cause a zero output.

2.2 OPERATION

2.2.1 Front Panel Features

Table 2-1 describes the front panel features that are indicated in Figure 2-1.

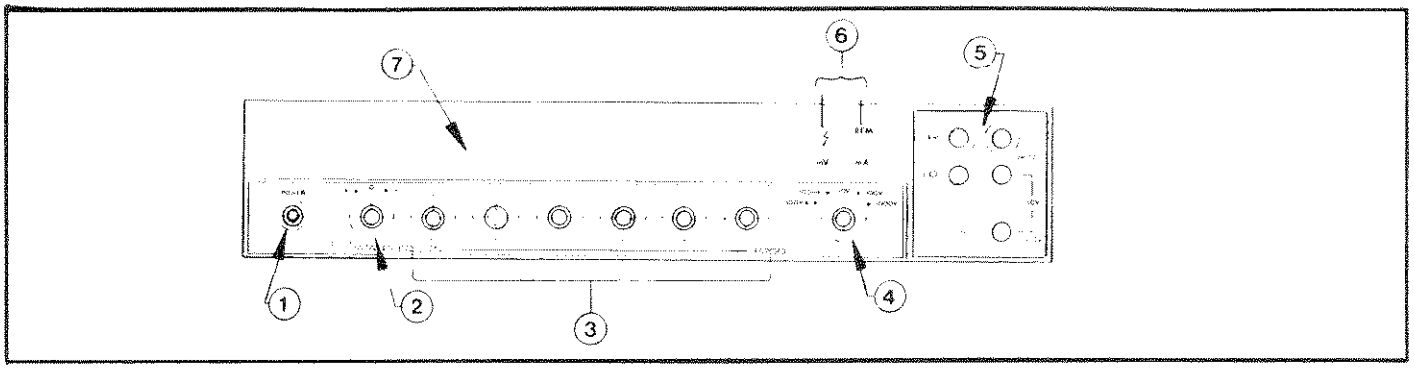
2.2.2 Rear Panel Features

Table 2-2 describes the features of the rear panel indicated in Figure 2-2.

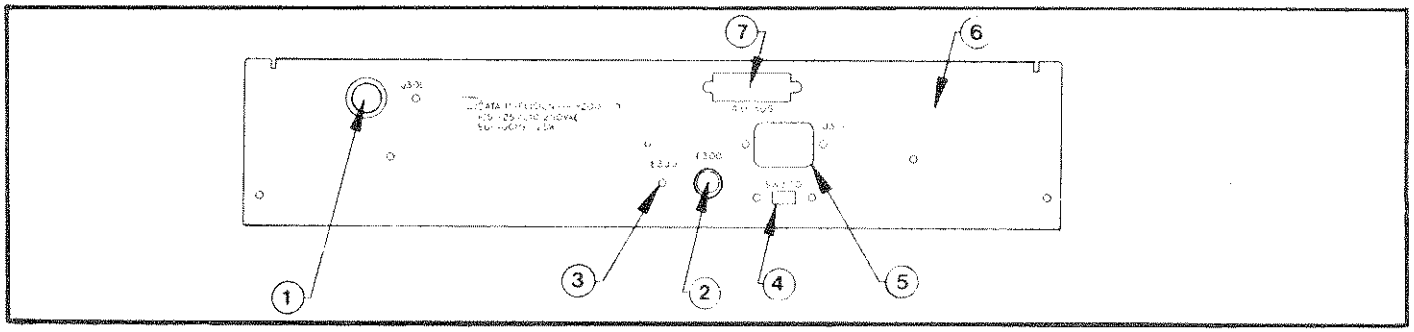
*All capitals or bold type letters are used for names as they appear on the front panel.
Reference designations in parentheses correspond to designations used in schematic diagrams.

Table 2-1
FRONT PANEL CONTROLS & INDICATORS

Ref	Name*	Description / Function
1	POWER (SW200)	Push-push switch. Connects fused main power to transformer primary. See rear panel description for power source information.
2	Polarity +, 0, – (SW201)	3-Position rotary switch. Selects positive, or negative polarity for analog output signal. Center position (0) is default for positive polarity.
3	Decade Selectors (SW202-SW207)	6 decade rotary selector switches. Unlimited travel in either clockwise or counterclockwise direction. Applies + 5V through "interrupter" wafer to contact brushes that provide indications of movement and direction (cw or ccw) to microporcessor.
4	Range **100mA, 100mV, 10V, 100V, 1000V** (SW208)	5-Position rotary switch. Selects operating mode (voltage or current) and full scale range of the output signal. If selected 1000V range is not supported by installed option, **Error** message is displayed.
5	Output **HI, LO,** HI **SENSE,** LO **SENSE, GUARD**	5 five-way binding posts. Installed to accept standard banana-plug connectors. Jumper straps are provided to connect output to sense terminals and GUARD to LO terminals. See rear panel description for 100mV full scale output.
6	Annunciators **mV, mA, REM,** ↯	4 LED lamps that are operated in response to the commanded range selection (100mV, 100mA, or 1000V) or when control is being exercised over the IEEE488 bus (**REM**).
7	Display	6½-digit display. All are driven by computer control. Polarity sign is incorporated in MSD. Decimal point is positioned automatically by selection of the full scale range.



2-1. Front Panel Features



2-2. Rear Panel Features.

Table 2-2
REAR PANEL FEATURES

Ref	Name*	Description / Function
1	100mV Connector (J301)	3-terminal, shielded, connector. For calibrator 100mV full scale range output.
2	Fuse (F300)	½-Amp, Slo-Blo Fuse. Fuses line connection to primary of power transformer.
3	Earth Ground	Binding post for chassis or power-line grounding connection in addition to the 3rd wire in the power cord.
4	Power Select Switch (SW300)	Slide switch. Configures power transformer primary for 115 or 230Vac input. Window in rear panel provides visibility of the selected power configuration.
5	Connector (J300)	Recessed male connector for 3-wire (power plus neutral) power cord. Power cord furnished with instrument.
6	Label	Identifying label for Model 8200 Calibrator. Nameplate data includes serial number.
7	Connector	IEEE488 interface connector, when option is installed.

Note: Rear-Panel Terminals are not shown. They parallel the connections at the front panel.

2.3 OPERATING PROCEDURES

2.3.1 Powering the Calibrator

The Model 8200 must be connected to a source of ac power via a 3-conductor cable furnished as part of the standard instrument. Source power may be nominal 115 or 230Vac, nominal 50 or 60 Hz. A slide switch in the rear-panel assembly configures the instrument for the power to be applied.

WARNING

Before connecting power, check the line voltage available, and see that the visible numbers are in accord with the available supply.

Configure the power transformer for the available line power.
Connect the power cable.
Make appropriate earth ground connections to the rear-panel binding post (see Table 2-2).
Turn power on at the front panel (Table 2-1) and allow the calibrator at least 1 hour to warm up.

2.3.2 Application Setups (Fig. 2-3, 2-4)

1. Make connections to the front panel for voltages over 100mV, and for any current source applications. Connect output **HI** to load positive terminal. Connect **LO** to load negative terminal. Connect **HI SENSE** to load positive or to **HI** at front panel by jumper strap (supplied). Similarly, connect the output **LO SENSE** to load negatve terminal or to **LO** at front panel by jumper strap (furnished). Connect the **GUARD** to the application instrument chassis or to the front-panel **LO SENSE** terminal by a jumper strap.
2. If the 100mV full scale range is to be used, make connections at the rear-panel connector, J301. A 3-conductor mating connector for the rear-panel input is supplied with the instrument. The third conductor within the mating connector is connected to the calibrator GUARD. A separate earth ground terminal, E301, is provided in the rear panel connector for additional power or chassis grounding applications.

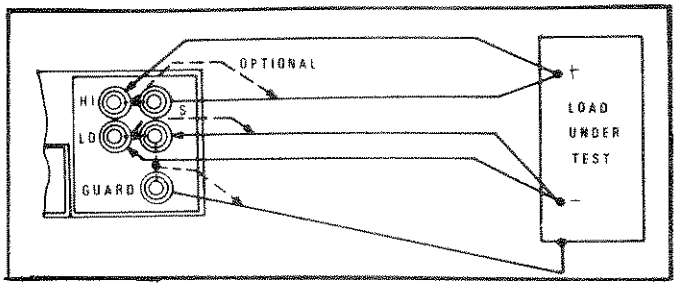
WARNING

If the rear panel output option is installed in the 8200, be sure that connections at front and rear panel are not incompatible. It is recommended that a cover plate be used to protect the front terminals when the rear terminals are in use

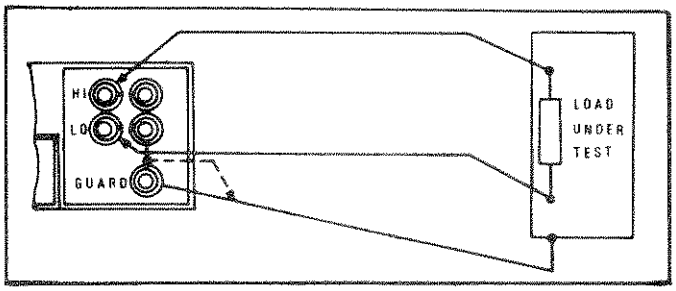
2.3.3 Local Control

1. At the front panel, select the polarity (SW201), and range (SW208).

The calibrator's response to any selection of a new polarity or range will display a zero value in the display. This will prevent an unwanted value from being applied to the instrument under test when changing the test conditions.



2-3. Setup for Use as a Voltage Standard



2-4. Setup for Use as a Current Standard

2. Operate the rotary decade switches until the desired magnitude of the output signal is displayed.

The front panel switches and display are related in what is known as a "full duplex" mode. That is, the display digits are not hardware-linked to the respective switches. Instead, the switches are used to signal the microprocessor to modify the value, and the processing action updates the display digits, *only as a result of the programmed development of the output analog value.*

Each rotary decade switch is capable of unlimited travel in either a clockwise (incrementing) or counterclockwise (decrementing) direction. The microprocessor responds to these commands by incrementing or decrementing the value up to the maximum limit of the selected range scale (see specifications), or to zero.

A change through zero requires the change in polarity sign, and this must be accomplished by the use of polarity switch SW201. This design feature prevents you from applying an unwanted value to the instrument under test.

Six rotary decade switches are provided to signal the modification of 6½ decades of analog output. The MSD is "controlled" as a carry from the major front-panel decade switch.

The designed capability of unlimited carry (or borrow) to (or from)the next higher decade greatly simplifies the use of the 8200 in applying a varying stimulus to a system under test. A desired increment or decrement in any one of the decades may be "stepped" into the output ***simply by continuous rotation of that one decade switch corresponding to the desired resolution. It is not necessary to operate more than one decade switch for any desired output value.***

Consider, for example, how easily the transition is made through a major carry when using the 8200. If you were checking the threshold performance around 3 volts, and expected the value to be between 2.800 and 3.200, you would set the 8200 to an initial value of 2.80000 and increment the third decade (from the least). The value would step from 2.80000 to 2.80100, to 2.80200, etc. At 2.80900, the next step would be 2.81000. At 2.89900 and at 2.99900 the next steps would be 2.90000 and 3.00000, respectively, ***with only one step of the decade switch***. In most other test instrumentation, on the other hand, the change from 2.99900 to 3.00000 would require changing all 4 decades (2999).

2.4 REMOTE CONTROL

2.4.1 IEEE488 Setup

The IEEE488 option board contains a 5-section dip switch which must be set with the listen address of the 8200 before it can be controlled by an external source.

The Model 8200 IEEE488 option board is shipped from the factory with the dip switches set for address 20 (10100).

To obtain access to this switch, remove the top cover by removing 6 side fastening screws (3 on each side) and 2 top fastening screws (front and back). See Figure 2-3. The IEEE488 option board is mounted on standoffs towards the rear of the chassis, and its connection to the external bus is accomplished by a standard connector mounted in the rear panel.

Determine the address to be used for this 8200 Calibrator, and set the 5 sections of the dip switch accordingly. Table 2-3 lists the binary-to-decimal conversions for the 5 selectable sections.

2.4.2 Procedure

1. Address the 8200 to **listen**.
2. Send a string in ASCII, beginning with character **V**, for voltage output, or **A**, for current output.
   Any characters transmitted before the **V** or **A** will be ignored.
3. Transmit the appropriate string, as defined in the specifications, paragraph 2.1.5, and repeated below.
   When the last character in the string has been received, the 8200 will generate an Interrupt to the microprocessor, and will change the complete stored decimal value to that transmitted by the remote controller (as distinct from the incrementing process described for operation under local control.
   When the 8200 receives a valid remote command (as defined above), it locks out the front-panel and displays the annunciator **REM**. It remains in Remote control, until commanded to return to local, or until power is turned off, and then on again.
   When the 8200 receives an invalid command, or invalid character, the transmission string must be retransmitted.

2.4.3 Returning to Local Control

The 8200 Calibrator may be commanded to return to local control by transmitting the single character **L** following a valid address to listen.

Table 2-3
CHARACTER STRINGS
All characters are **ASCII.**
Parity bit is ignored.

Voltage Mode:		
1st character	V	Voltage mode
2nd character	0	100mV range
	1	10V range
	2	100V range
	3	1000V range
3rd character	+	Plus polarity
	–	Minus polarity
4th through 10th characters	0 to 9	Magnitude (*NUL*, . , or *SPACE* is ignored after polarity is received.)
Current Mode:		
1st character	A	100mA range
2nd character	+	Plus polarity
	–	Minus polarity
3rd through 8th character		Magnitude (As above, for voltage mode)