

## DVC-8500

### HIGH-PRECISION VOLTAGE SOURCE

#### FEATURES

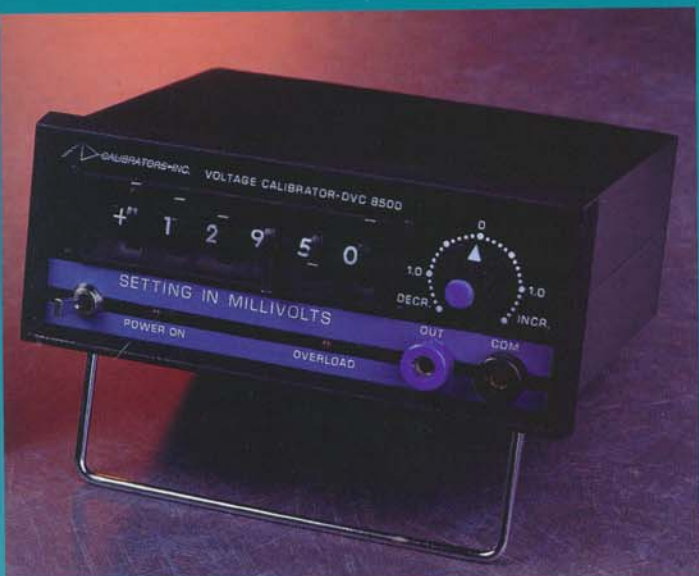
- $\pm 19.999$  Volts full-scale output range
- Millivolt settability with accuracy of  $\pm 25$  ppm of setting  $\pm 1/2$  LSB (0.005% of full-scale range)
- Rated accuracy up to 25mA output
- Unique/Ergonomically correct front panel lever switches
- Vernier control provides  $\pm 1.5$  mV offset with 50  $\mu$ V graduations
- Current from short-circuit-proof output transformer isolated  $\pm 300$  volts to AC line
- Aluminum case includes bench-top stand
- Optional panel mount kit
- Choice of 100, 115, or 230 VAC power supplies
- Calibration traceable to NIST

#### GENERAL DESCRIPTION

The DVC-8500 is a low-cost 4 1/2 digit voltage reference source with a full-scale output range of -19.999 Volts to +19.999 Volts in 1 millivolt steps. The calibrator features high performance for such a small, low-cost instrument.

An active buffered output amplifier provides very low output impedance and up to 25 milliamps output current. An oven-stabilized zener diode internal reference provides an overall output accuracy of  $\pm 500 \mu$ V and  $\pm 25$  ppm of the setting with zero drift of  $\pm 5 \mu$ V/ $^{\circ}$ C and full-scale drift of 4 ppm/ $^{\circ}$ C max. Output is set by unique front-panel lever switches which provide rapid, positive contact adjustment. Voltage outputs may be continuously varied within  $\pm 1.5$  millivolts of selected readings by using a front panel vernier control. The DVC-8500 output is available from both front panel banana jacks and a rear panel 36-pin gold-plated PC connector fitted with lug terminals.

The rear connector has sense feedback inputs to reduce errors caused by cable resistance. A front-panel LED overload lamp lights if the output exceeds 25 mA and current limiting occurs at 70 mA output. The output circuit accepts up to  $\pm 25$  mA source or sink current at rated accuracy. The rear connector also includes a low-Z output of the +10 Volt reference source with 5 mA maximum drive for external reference tracking. Wideband output noise is 25 microvolts, pk-pk maximum. Powered by a choice of 100, 115 or 230 VAC  $\pm 10\%$ , and 47 to 440 Hz at 10 watts, the DVC-8500 offers transformer isolation up to  $\pm 300$ V dc. Output line rejection is within  $\pm 50$  microvolts of zero. The black-anodized extruded aluminum housing provides excellent shielding from electrical noise. The small size and light-weight design of the DVC-8500 makes it an ideal portable instrument for a technician's repair kit. When mounted on its bench-top tilt stand, the DVC-8500 uses very little space and can be positioned close to test circuits.



The DVC-8500 features convenient lever switches for output setting with vernier control for fine adjust

00000



## FUNCTIONAL SPECIFICATIONS

TYPICAL BETWEEN 0 AND +50°C AT STEADY AMBIENT TEMPERATURE AFTER 5 MINUTES WARMUP.

2

### VOLTAGE OUTPUT

<b>OUTPUT TYPE</b>	Shielded transformer isolated, active low impedance DC voltage output, current limited.
<b>OUTPUT VOLTAGE RANGE</b>	0 to +19.999 Volts DC or 0 to -19.999 Volts DC, lever switch selected, 1 mV steps (Range $\pm 20.0005$ Volts using vernier control).
<b>OUTPUT CURRENT RANGE</b>	0 to 25 mA (source current) to rated voltage output accuracy.
<b>OUTPUT OVERLOAD</b>	Greater than 25 mA (source current) will illuminate front panel LED overload lamp. Output is current limited (continuous short-circuit proof) to 70 mA (source current) at any voltage up to $\pm 20V$ dc.
<b>OUTPUT IMPEDANCE</b>	Less than 10 milliohms.
<b>CAPACITIVE LOAD</b>	No limitation.

### PERFORMANCE

<b>ACCURACY @ +25°C</b>	Within $\pm 25$ ppm of setting, $\pm 500 \mu V$ when calibrated (0.005% of full-scale range). Set within $\pm 1$ mV increments. A front panel vernier control provides $\pm 1.5$ mV continuous offset with 50 $\mu V$ graduations.
<b>WITH VERNIER CONTROL AT ZERO RESOLUTION</b>	
<b>TEMP. DRIFT OF ZERO</b>	Within $\pm 5 \mu V/^{\circ}C$
<b>TEMP. DRIFT OF CAL.</b>	Within $\pm 4$ ppm of setting/ $^{\circ}C$
<b>OPER. TEMP. RANGE</b>	0°C to +50°C
<b>STORAGE TEMP. RANGE</b>	-25°C to +85°C
<b>WARM-UP TIME</b>	5 minutes to rated accuracy
<b>OUTPUT NOISE</b>	25 $\mu V$ pk-pk, wideband (no cap load)
<b>REFERENCE SOURCE</b>	6.4V oven-stabilized low TC zener reference diode
<b>AC LINE VOLTAGE REJ.</b>	Zero: $\pm 50 \mu V$ over full line range. Calibration: $\pm 25$ ppm of setting over full line range
<b>POWER TRANSFORMER ISOLATION</b>	1000 Megohms. Transformer primary has a grounded shield for capacitive isolation.
<b>BREAKDOWN</b>	300 VRMS, min.

### FRONT PANEL

<b>OUTPUT SEL. SWITCHES</b>	Six lever-operated detented switches are set in millivolts ( $\pm 19999$ mV range)
<b>POLARITY</b>	2 positions, + or -
<b>LEADING DIGIT</b>	2 positions, 0 or 1
<b>4 DIGITS</b>	10 positions, 0 thru 9
<b>OUTPUT VERNIER</b>	Rotary potentiometer, range $\pm 1.5$ mV of selected output. Graduated in 50 $\mu V$ divisions. Clockwise rotation labeled "INCR" (increase) will increase the absolute value of the selected output. Counter-clockwise rotation labeled "DECR" (decrease) will decrease the absolute value of the selected output.
<b>OVERLOAD LIGHT</b>	Red LED lamp illuminates if output exceeds $\pm 25$ mA.
<b>POWER SWITCH</b>	Toggle switch, AC power on or off.
<b>POWER LIGHT</b>	Red LED lamp illuminates when AC power is on.

### INPUT/OUTPUT CONNECTORS

<b>FRONT PANEL</b>	Voltage output (blue) and output common (black) available from two (2) gold plated brass banana jacks, 0.166" (4.22 mm) i.d., 0.56" (14.2 mm) deep, 0.75" (19.05 mm) between centers. (Order test leads, model 38-8193902)
<b>REAR CONNECTIONS: VOLTAGE OUTPUT</b>	Parallel connection with front panel jack.
<b>OUTPUT AND REF. COM.</b>	Parallel connection with front panel jack. Transformer isolated $\pm 300V$ from case ground.
<b>REFERENCE OUTPUT</b>	Low impedance $\pm 10$ Volts dc output from +6.4V ref. diode. Drain must not exceed $\pm 5$ mA maximum. Ref. output is opposite polarity of calibrator output.
<b>SENSE INPUT</b>	Connect to remote load to compensate for cable resistance voltage drops. See diagram. This input must be tied to voltage output if not used.
<b>SENSE COMMON</b>	Return for sense inputs. Tie to output common if sense is not used.

### POWER SUPPLY

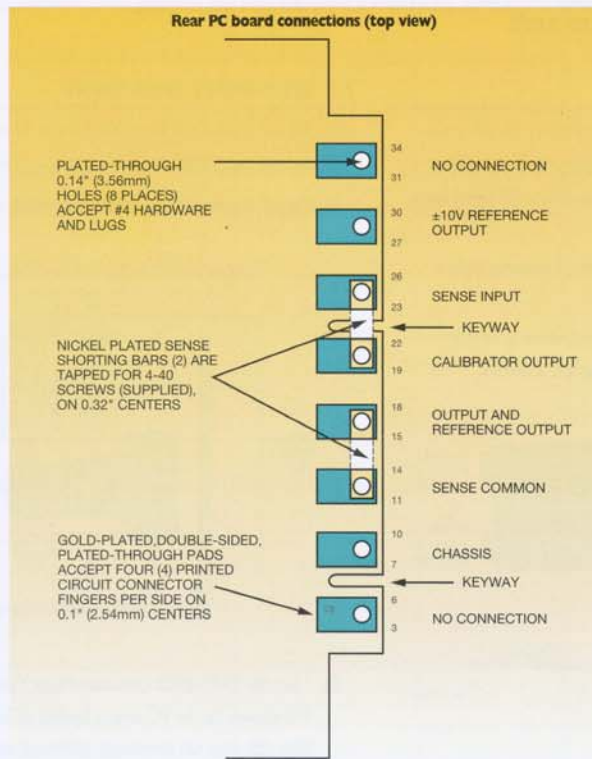
<b>REQUIREMENT DVC-8500A</b>	115 VAC, $\pm 10\%$ , @ 47-440 Hz, 10 watts (includes US-style, 3-prong line cord)
<b>DVC-8500E</b>	230 VAC, $\pm 10\%$ , @ 47-440 Hz, 10 watts (includes US-style, 3-prong line cord)
<b>DVC-8500J</b>	100 VAC, $\pm 10\%$ , @ 47-440 Hz, 10 watts (includes US-style, 3-prong line cord)
<b>GROUNDING</b>	Ground wire to case, but transformer-isolated $\pm 300$ VRMS from output common.
<b>FUSES: DVC-8500A</b>	0.15 A AGC SLO-BLO
<b>DVC-8500E</b>	0.1A AGC SLO-BLO
<b>DVC-8500J</b>	0.15 A AGC SLO-BLO

### MECHANICAL DIMENSIONS

<b>CASE</b>	5.59"W x 2.11"H x 5.78"D (142.0 x 53.6 x 146.8 mm) (Bench-top stand retracted)
<b>BEZEL</b>	5.86"W x 2.25"H x 0.50" THK (148.7 x 57.0 x 12.7 mm)
<b>SERVICING</b>	Bezel, front panel and mother board are removable from front while unit remains secured in panel. Bezel is lifted off by removing the two 0.050-inch (4-40) Allen hex key set screws on the bottom side edges. PC board may be removed by loosening the PC board guide track retaining screws on the lowest position of the panel mounting seats.
<b>WEIGHT</b>	2.25 pounds (1.0 Kg)
<b>CUTOUT</b>	5.62" x 2.16" (142.7 x 54.8 mm)

Warranty will be void if panels are removed.





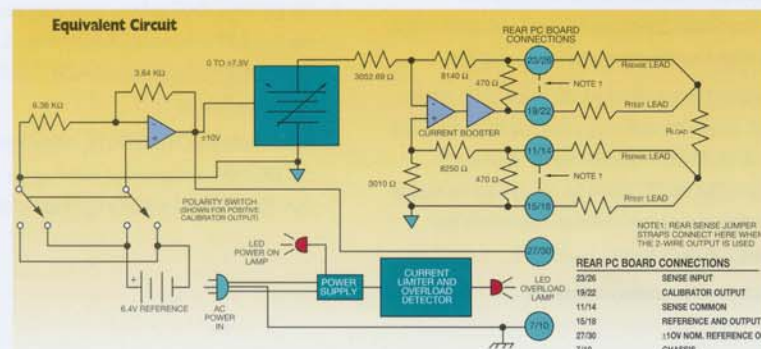
## REMOTE SENSING

Use remote sensing for applications with long leads, high currents, or voltage drop output errors. Referring to the equivalent circuit shown, note that four leads are connected to a remote load. Two of these leads carry the calibrators output while the other two leads are sense inputs to correct for voltage drop errors.

The sense inputs have approximately 8K ohms input impedance, therefore use only low resistance sense leads.

To use the sense leads, detach the short sensing bars on the rear connector. Clip the sense leads directly at the load receiving calibrated voltage. Be sure to reinstall the shorting bars when not using the sense leads.

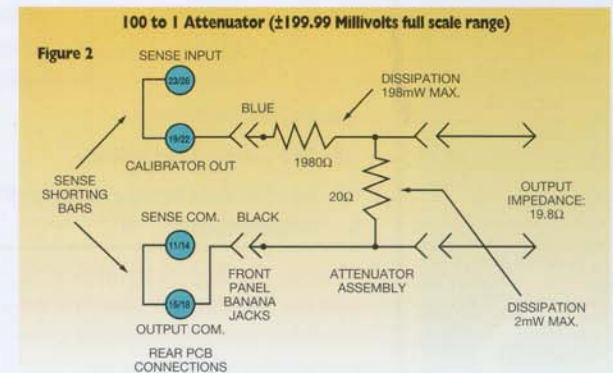
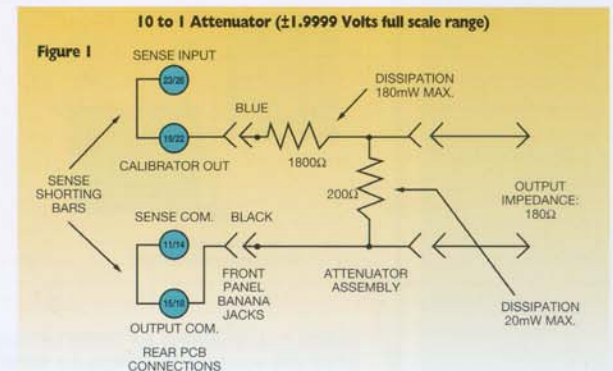
The two 470Ω resistors (shown across the calibrator outputs) prevent the output amplifier from being overdriven if the sense terminals are inadvertently left open. This protects sensitive loads from the output amplifier's full-scale voltage.



## OUTPUT ATTENUATION

By using the external voltage dividers shown in Figures 1 and 2, the DVC-8500 can be stepped in 100 or 10 micro-volt increments with full vernier control. While the circuits are simple, the resistors should be selected for low temperature drift to maintain the DCV-8500's rated accuracy.

Note the higher output impedance of these attenuators as compared to the buffered, unattenuated output. Use this output impedance to calculate errors due to significant output load current.



## REAR CONNECTIONS

Rear connections are dual 36-pin PC edgeboard connections on 0.1" centers. Individual connections consist of 4 gold-plated fingers on a common pad area in parallel with the 4-finger pad on the bottom. Each dual-pad (8 fingers total) is drilled and plated through for optional lug connection using 4-40 hardware. Shorting bars and 4-40 hardware are included to short sense and common connections if not used.

For rear connections, use a Viking #3VH36/IJN-5 or equivalent PC connector.

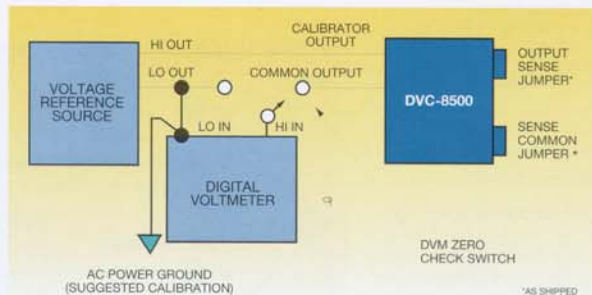


**IN LABORATORY, BENCHTOP ENVIRONMENTS, RECALIBRATION FOR THE DVC-8500 IS SUGGESTED EVERY 90 DAYS DUE TO NORMAL COMPONENT AGING. IN APPLICATIONS WITH TEMPERATURE CYCLING, EXCESSIVE VIBRATION OR POWER LINE VARIATIONS, RECALIBRATION MAY BE REQUIRED MORE OFTEN THAN 90 DAYS.**

4

## 1. RECOMMENDED EQUIPMENT

- Voltage reference source with known overall accuracy of  $\pm 25$  ppm.
- Calibrated Digital Voltmeter with 100 microvolt or finer resolution. DC common mode rejection must be 92 dB minimum (25 ppm) with a common mode voltage range of  $\pm 20$  volts.
- All equipment should be warmed up for at least 15 minutes before proceeding.  
Do not recalibrate the instrument if present calibration is within tolerance. A suggested recalibration wiring diagram is shown.



## CHECK CALIBRATION AT THESE SETTINGS WITH THE VERNIER CONTROL AT ZERO:

+19.999V	-19.999V
+10.000V	-10.000V
+8.000V	-8.000V
+0.000V	-0.000V

Calibration is needed if:

- Zero is off more than  $\pm 100$   $\mu$ V.
- Any of the above non-zero readings is off by more than  $\pm 1$  millivolt.

## 2. READJUSTMENT\*

**\*Warning:** - Readjustment procedure should be performed only if "zero reading" is off by more than 200mV and "non-zero reading" is off by more than 400mV. Warranty will be voided if this procedure is exercised. Proceed to Step 3 (Zero Offset Adjustment).

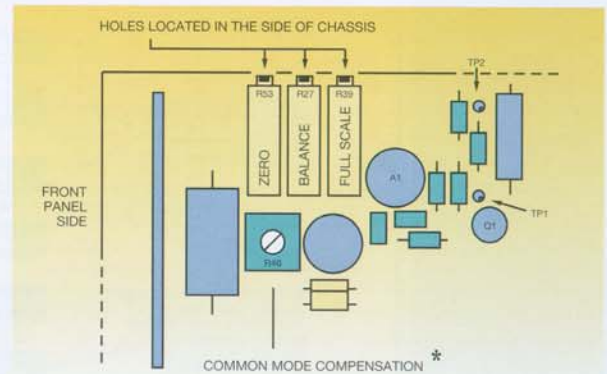
The Internal PC board must be partially removed for access to the calibration adjustments.

- Disconnect the power plug from the AC outlet. Leave sense shorting bars attached if installed. If the rear PC connector is used, remove it and reestablish sense connections after opening the case.
- Loosen the two .050 inch Allen-head hex key set-screws on the lower side edges of the front bezel. Swing the bezel out and up from the bottom, lifting the bezel off the two engaging pins of the case top.
- Loosen the PC board retaining screws blocking the board guide tracks. Locate the cluster of four screws on each case panel mounting seat. The bottom screws on both sides should be backed out to allow the PC board to slide out the front. Pull the PC board far enough out to expose the trim potentiometers behind the lever switches. Reestablish the sense connections by using the shorting bars or jumpers.

**CAUTION!** AC Line voltage will be present in the case.

## 3. ZERO OFFSET ADJUSTMENT

- Set the DVC-8500 lever switches to +00000 volts.
- Set the DVC-8500 Vernier control to zero.
- Detach any external load from the output terminals and turn on AC power.



- \* Set the DVC-8500 Common Mode Compensation (Potentiometer R46 shown on the PC board layout) to half rotation (centered). **Skip this step** for previously calibrated units which are within reasonable calibration.
- Adjust the ZERO Offset Control (R53) until the DVC-8500 output is zero volts.
- Switch the DVC-8500 polarity lever switch to - 00000. If the output voltage changes, readjust R46 for a zero volt output.
- Reset the polarity to +00000. Repeat steps E, F and G until both +00000 and -00000 settings both give zero outputs.

## 4. FULL SCALE ADJUSTMENT

- Set the Balance Control (R27) and Full Scale Adjust Control (R39) to half rotation (centered). Skip this step for previously calibrated units which are within reasonable calibration.
- Leave the Load Resistance at open circuit, and Vernier control at zero.
- Set the DVC-8500 lever switches to +19000.
- Set the external Voltage Reference Source at +19.000 Volts. Connect the DVM between the Reference Source and the DVC-8500. Adjust R39 until the DVM indicates a zero null.
- Set the DVC-8500 and the reference Source to -19.000 Volts. Readjust R27 to null the DVM.
- Set the DVC-8500 and the Reference Source to +19.000 Volts and readjust R39 if necessary. Repeat steps, E, F and G to produce +19.000V and -19.000V outputs from the DVC-8500 which track those of the Reference Source.
- Reassemble the DVC-8500 PC board into its case, turn on the power and allow the instrument to warm up for 15 minutes. Recheck calibration. There should not be a significant change.

## OPTIONAL FRONT PANEL MOUNTING

Standard DVC-8500 calibrators are designed for benchtop use and have a built-in stand and rubber feet. The DVC-8500 may be panel mounted using an optional mounting kit, part number 38-8193022. The user would cut a hole in their panel according to the dimensions shown in Figure 1. After removing the tilt-up stand and rubber feet, simply attach the two U-shaped straps to the rear of the DVC-8500 with the two screws provided.

## ACCESSORY KIT (PART # 38-8193022)

Includes: Two U-Strap Case Supports  
One 36-Pin Edge Connector  
Four 18-8 Screws  
Four Lock Washers #4  
Two Flat Washers #4

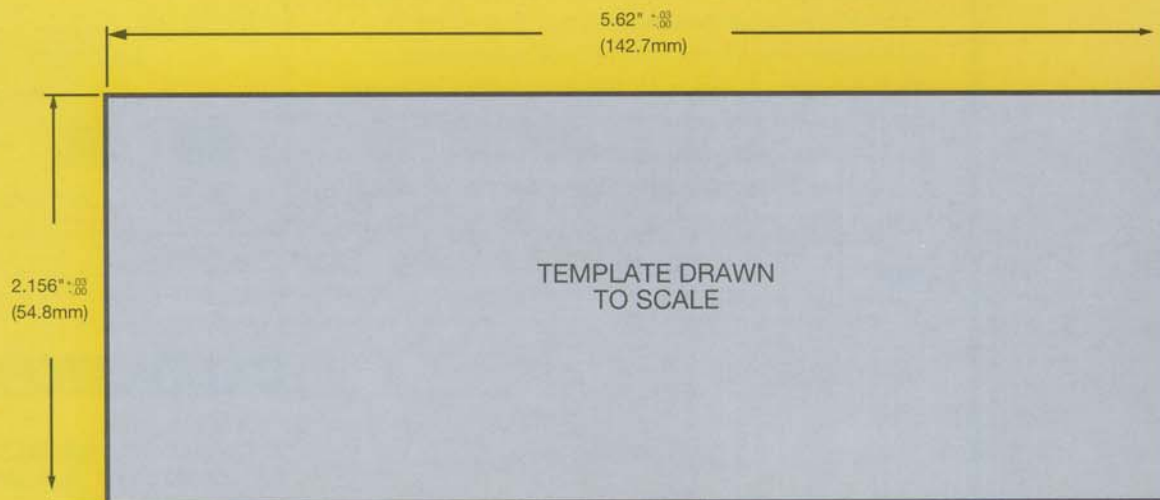
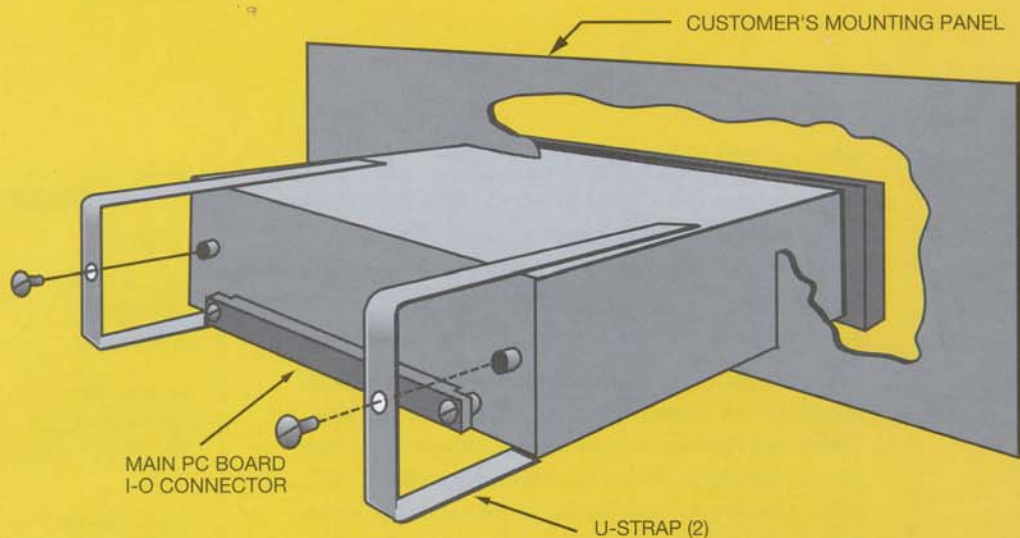


Figure 1. FRONT PANEL CUTOUT (copy and use for template)



**WARRANTY**

Calibrators Inc. warrants that all of its products are free from defects in material or workmanship under normal use and service for a period of 18 months from the date of shipment. Calibrators Inc. obligations under this warranty are limited to replacing or repairing, at our option, at our factory or facility, any of the products which within the application period after shipment be returned to us, transportation charges prepaid, and which are, after examination, disclosed to the satisfaction of Calibrators Inc. to be thus defective. The warranty does not apply to any products or equipment which have been repaired or altered, except by Calibrators Inc., or which have been subjected to misuse, negligence or accident. Under no circumstances shall Calibrators Inc. liability exceed the original purchase price.

**GENERAL DISCLAIMER**

In accordance with our policy of continuous product improvement, Calibrators Inc. reserves the right to make changes/improvements to our products and/or their specifications at any time without prior notice to anyone. Prices are also subject to change without notice.

Calibrators Inc. makes every attempt to ensure information provided in our technical literature is accurate and reliable. We can not, however, assume responsibility for inadvertent errors, inaccuracies, omissions or subsequent changes. We similarly assume no responsibility for the use of this information, and any and all such use of this information shall be entirely at the user's own risk.

No patent rights or licenses applicable to any of the circuits or Calibrators Inc. intellectual-property described herein are granted to any third party, either directly, by implication or any other means. Furthermore, despite our efforts to ensure otherwise, we can make no representation of any kind that the information and/or circuitry described herein is free of infringement of any intellectual-property rights or any other rights of third parties.

**LIMITATIONS ON THE USE OF CALIBRATORS INC. PRODUCTS**

Calibrators Inc. products are not designed for and should not be used, without the specific prior written consent of Calibrators Inc., in any life-support systems, nuclear-facility applications, aircraft-control applications or any other applications in which failure of the product, in any way, could reasonably result in harm to life, property or the environment.

A life-support system is defined as a product or system intended to support or sustain life and whose failure can be reasonably expected to result in significant personal injury or death. Nuclear-facility applications are defined as any application involving a nuclear reactor or the handling and processing of radioactive materials in which the failure of equipment, in any way, could reasonably result in harm to life, property or the environment.

**ORDERING GUIDE****MODEL****DESCRIPTION**

DVC-8500A

Calibrator, 115 VAC

DVC-8500E

Calibrator, 230 VAC

DVC-8500J

Calibrator, 100 VAC

**Accessories:**Panel-Mount Kit  
P/N 38-8193022Consists of (2) U-straps,  
rear PC board connector  
and hardwareTest Lead Set,  
P/N38-8193902Consists of (2)  
3-foot, 20 gauge leads,  
red and black. Stackable  
banana plugs and retracting  
hook clips**PAYMENT METHODS:**

Net 30 \*

**C.O.D.**

\* Pending credit approval

**CALIBRATORS INC.**

26 Oxford Road, Mansfield, MA 02048  
TEL 508.337.3001 FAX 508.337.6488  
EMAIL calinc@ici.net