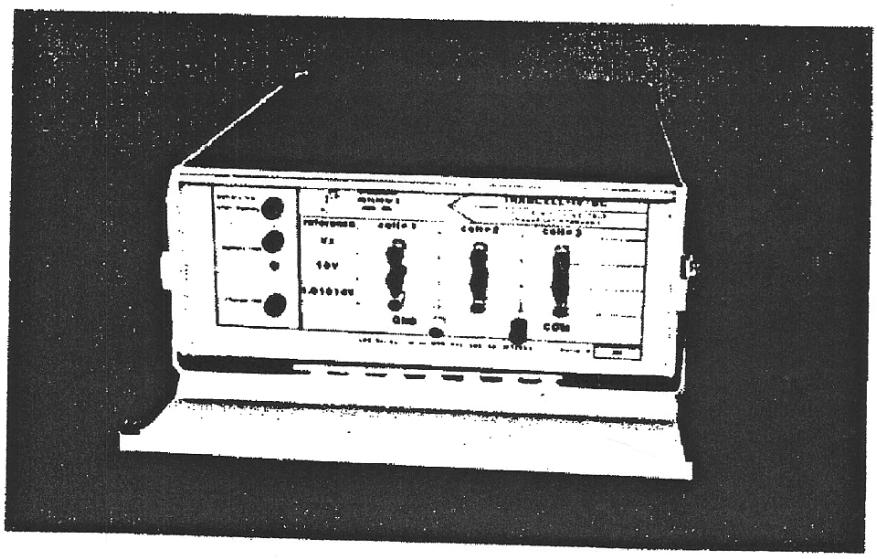
INSTRUCTIONS FOR OPERATION AND USE

VTS4007

TRANCELL-IV/SC

SOLID STATE DC VOLTAGE

TRANSPORT STANDARD



STANDARD REFERENCE LABS, INC.

STANDARDS FOR REAL-WORLD USE

SECTION 1. DESCRIPTION

A. GENERAL

The EPS Series TRANCELL-IV/SC is a transportable precision solid state dc voltage reference standard with either 1, 2, 3, or 4 diode-cells. Each diode-cell provides reference outputs of Vz (6.35V nom.), 10V, and 1.01814V. Of the three, the highest degree of precision is obtained from the reference diode (Vz) voltage output level. Its exact value is stated on the certificate of traceability. The more convenient 10 volt buffered working level and a 1.01814 volt auxiliary level are also provided. The buffered output level may be loaded with up to 2 ma without introducing significant output voltage error.

Additional Auxiliary Fixed Ratio Dividers are available that produce more reference voltage outputs between 10mv and 10 volts. These dividers are available both as the internally mounted types and as the PVD Series plug-ins (plug into the 10 volt buffered output terminals.)

The TRANCELL-IV/SC is designed to operate either on its own self-contained rechargeable batteries (DC operating mode) or on an AC line. However, its more precise performance is obtained in its DC operating mode when both the advantages of battery filtering and complete isolation from the AC line are realized. (Refer to the Operating Instructions for time limitations associated with DC operation.) The AC mode of operation provides a continual float charge on the internal batteries to keep them ready for use when an AC source is not available or when the most precise DC reference level is required.

NOTE

The unit will function within specifications on AC when a clean AC line is used to power the instrument.

To reduce the effects of ambient temperature changes, the TRANCELL-IV/SC is equipped with an internal oven and automatic oven temperature controls. An auxiliary thermistor (mounted within the module chamber) is also used as a back-up temperature monitor, so that if the temperature control circuitry fails, the average temperature within the chamber can be sensed and applicable corrections may be applied to the reference output levels. Pin jacks are located on the rear panel to provide access for measuring the resistance value of the thermistor. A graph showing the resistance of the thermistor as a function of the temperature is shown in Fig. 1-1.

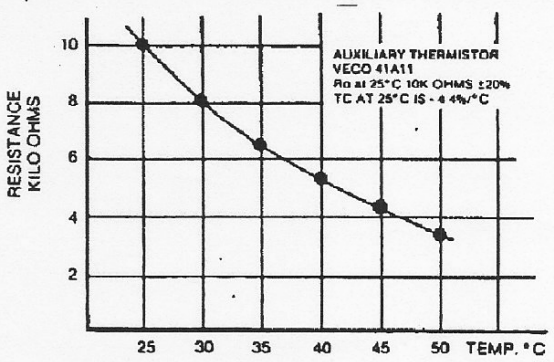


FIGURE 1-1. TEMPERATURE-RESISTANCE CURVE.

B. SYSTEM DIAGRAMS.

A simplified system block diagram is shown in Figure 1-2. The AC line drives the external Recharger/Converter which in turn provides a continuous charge to the Trancell's self-contained rechargeable batteries. The battery output level is regulated and drives the reference module(s). Rechargeable batteries are also used to power the internal oven heaters and control circuits.

A simplified circuit diagram of the module is shown in Figure 1-3. Note that the 10-volt feedback loop is closed at the output binding posts (B.P.).

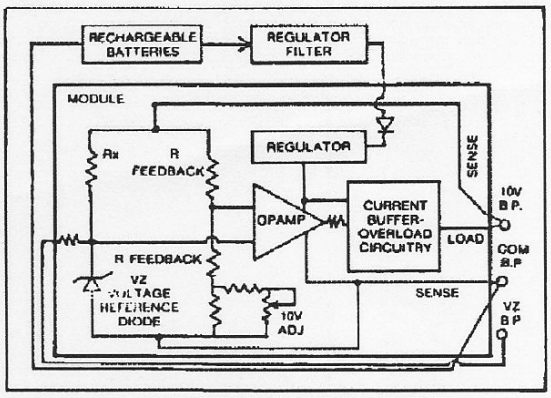


FIGURE 1-3. SIMPLIFIED MODULE CIRCUIT.

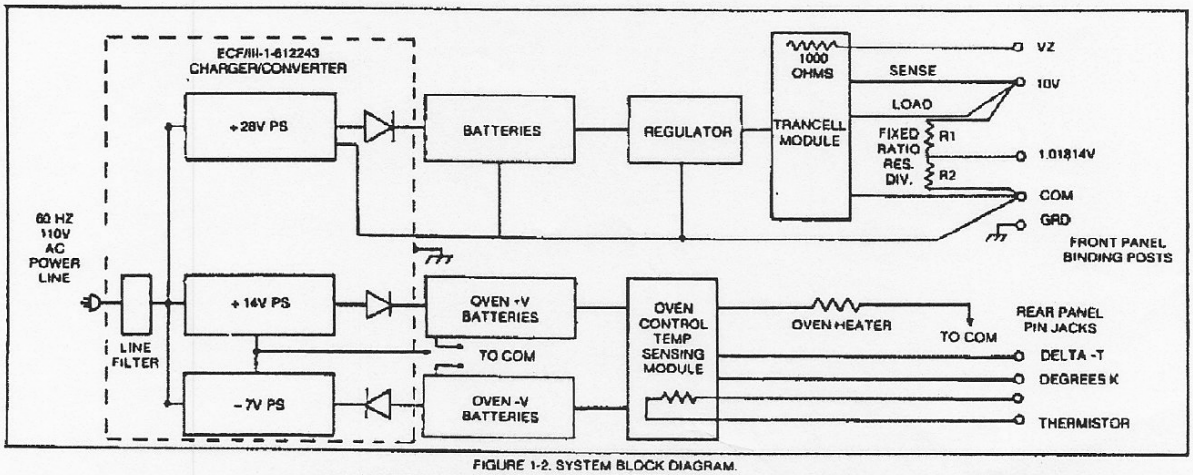


FIGURE 1-2. SYSTEM BLOCK DIAGRAM.

C. BATTERY COMPLEMENT.

The reference module is driven by two (2) 12V, Type 1 batteries in series on multiple, diode-cell units and two 12V, Type 2 batteries in series on single diode-cell units. The reference module battery complement generates about 27 volts at the float charge level. Typical operating voltages range from about 22 to 27 volts. These values may be monitored on the rear panel pin jacks (see Figure 3-2.) In case of emergency these terminals can also be used to connect external batteries in parallel with the internal batteries to extend the time in battery operating mode for long distant transport. The oven battery supply consists of two 12 V Type 1 batteries in parallel for the +V level and one 6V for the -V level. To protect against an accidental shorting of the batteries each supply has a 2 amp pigtail fuse connected in series with the battery positive output terminal. Refer to the Replacement Parts List for the battery part numbers.

SECTION II. PREPARATION FOR USE

A. GENERAL

All Trancell units are carefully packed in double strength cartons and shipped with instructions to guard against damage. Upon receipt of the unit, inspect the carton for evidence of accidental damage that may have occurred during transit. Notify the carrier immediately of any obvious damage.

Although solid state construction makes the unit fairly resistant to shock and fluctuations in temperature and humidity, it is recommended that care be exercized as with all precision electronic laboratory equipment.

CAUTION

Stability is adversely affected by interruption in power to the reference module. Consequently, the module is continuously driven by the internal rechargeable batteries. Immediately upon arrival plug the external charger into the AC line to fully recharge the Trancell batteries. Refer to the Table of specifications for time limitations associated with operation on internal batteries.

B. RECHARGER/CONVERTER

The Trancells may be operated continuously for limited periods of time on internal rechargeable batteries or while continuously connected to an AC line power (see Figure 3-1). When connected to the AC line, an external battery Recharger/-Converter is required for each unit to provide a continuous, safe trickle charge to the internal rechargeable batteries. All Trancell-IV/SC are equipped with a type 57-50140 quick connect plug for convenience.

C. TRANCELL CALIBRATION

Optimum stability is achieved on the VZ reference output level. For convenience, the buffered 10 volt working reference level is developed through the use of an operational amplifier, feedback resistors and overload protective components. These buffering components contribute errors in addition to the error inherent in the reference diode. The 1.01814 volt reference level is generated through the use of a precision resistive divider driven by the buffered 10 volt level.

To allow for periodic readjustment to nominal for the 10 volt and 1.01814 volt levels, all Trancell units are equipped with adjustable calibration pots. The following procedures using external Ratio Standards are recommended.

CALIBRATION NOTE 1

The external ratio standard used in the following procedures must have ratio errors that are small in comparison with the adjustment accuracy required. Note that for ratio devices whose accuracy ratings are given in terms of input of full scale, the error in terms of calibrated output value may be large. For example, a Kelvin-Varley divider rated at 1 PPM of full scale may introduce a 10 PPM error in output level when used to achieve a 10:1 ratio. Since the accuracy encountered in the Trancell series is very high, the ratio device must be extremely accurate. It is recommended that the ratio accuracy be at least four (4) times as accurate as the accuracy level of the calibrated output required. The FIELD-KOEP DC VOLTAGE RATIO CALIBRATOR (FKRC) provides accuracy well within the required limits for the calibration procedures.

1. PROCEDURE USING FKRC

Disconnect the Trancell from the AC line and wait approximately four (4) hours for the standard to settle. This will allow maximum repeatability and accuracy levels, better than 0.5ppm.

(a) Self Calibrate the FKRC using the Reference VZ as the external reference level.

(b) Connect the Trancell 10V binding posts to the calibrated FKRC input binding posts, as shown in Figure 2-1, and measure the value of the 10 volt working level.

(c) If the measured value in step (b) is not exactly 10.00000 volts, remove the Trancell case cover (as noted in Section IV) to gain access to the calibration adjustment pots.

(d) Adjust the 10V Calibration Pot until the measured value is exactly 10.00000 volts.

(e) Remove the lead from the Trancell 10V binding post and connect it to the 1.01814V binding post. Measure the value of the 1.01814 volt reference level.

(f) If the measured value in step (e) is NOT 1.01814 volts, adjust the 1V Calibration Pot until the measured value is exactly 1.01814 volts.

CALIBRATION NOTE 2

It is necessary to calibrate the 10V level to 10.000000 prior to calibrating the 1.01814V level because the 10V output level drives the resistive divider used to generate the 1.01814 volt level.

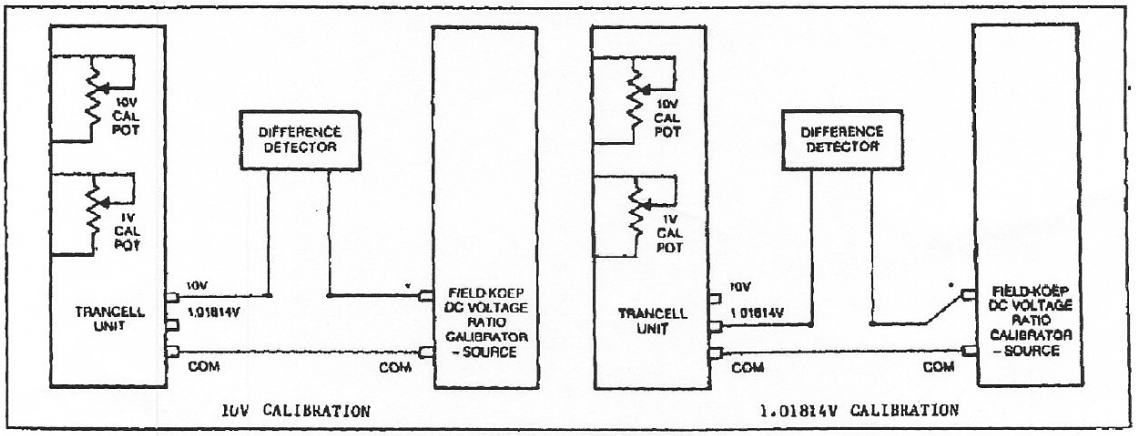


FIGURE 2-1 CALIBRATION CIRCUIT.

2. ALTERNATE RATIO-DIVIDER PROCEDURE

Calibration notes 1 and 2 apply to this procedure.

(a) Connect the Trancell into the circuit as illustrated in figure 2-2 using a seven (7) decade Kelvin-Varley divider with a 0.1 PPM of full scale ratio accuracy.

(b) Set the Vz value given on the Trancell's Certificate of Traceability on the Ratio Divider.

(c) Adjust the 10 V Calibration Pot until the Difference Detector indicates zero. Reverse the polarity and note the Difference Detector indication. Adjust the 10V Calibration Pot until the average reading is zero.

(d) After the 10V level has been adjusted, remove lead A from the Vz terminal.

(e) Set the Ratio Divider to 1.018140.

(f) Connect lead A to the 1.01814 terminal.

(g) Adjust the 1V calibration pot until the Difference Detector indicates zero. Reverse the polarity and note the Difference Detector indication. Adjust the 1V calibration pot until the average reading is zero.

(h) Repeat the procedure for each cell.

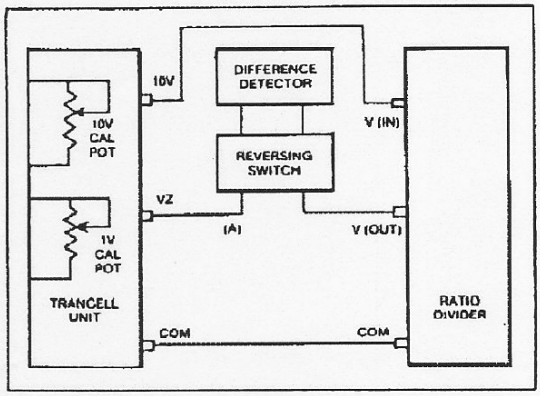


FIGURE 2-2 ALTERNATE CALIBRATION CIRCUIT.

SECTION III. OPERATION AND USE

A. GENERAL

The Trancell unit provides a precision DC Voltage source for both laboratory and field use. It may be operated for limited periods of time on the internal rechargeable batteries or continuously while connected to AC power through the Recharger/ Converter.

Optimum precision and stability are achieved on the VZ reference output level. However, once calibrated the buffered 10V and the 1.01814V levels provide more convenient output working levels. All outputs may be used simultaneously. For example, one 10 volt buffered output may be used to drive a voltmeter calibration circuit while the second is used to drive a Kelvin-Varley voltage divider.

B. DC OPERATING MODE

Due to possible introduction of minor noise in the reference outputs while operating on AC line power, optimum performance of this Trancell Standard is achieved while operating in the DC mode (on internal batteries). Consequently, the time limitation associated with DC operation is critical. Exceeding the time limits given in the Table of Specifications could cause power interruption to the internal reference module resulting in significant (ppm) retrace errors.

NOTE

All specifications and guarantees are valid only as long as power to the internal reference module is uninterrupted.

Prior to use in the DC mode the unit should be energized by the Recharger/Converter for a period of at least 24 hours. If the unit is exposed to a significant temperature differential, it must be allowed to stabilize at the new ambient temperature for 24 hours prior to use.

CAUTION

The GND Terminal located on the front panel should normally be tied to circuit ground or guard when unit is operating solely on the internal batteries. This grounding terminal is automatically tied to ground via the AC plug when being energised by the external Recharger/Converter.

C. BATTERY INDICATOR LIGHTS

To help prevent power interruption caused by low battery charge the Standard is equipped with battery indicator lights located on the left side of the front panel. The top light flashes when the batteries are at a low charge level indicating that the unit should be connected to the Recharger/Converter for a battery recharge.

NOTE

The light will start to flash about 8 hours before the batteries reach a level that will cause power interruption to to the module.

The center light and push button switch are used to indicate the condition of the batteries if the top light is not flashing, as the top light will not flash after the batteries are dead. When the switch is pressed, the light will light if the batteries are still charged. A separate light will light when the Recharger/Converter is connected to the standard and the batteries are being charged.

D. AC OPERATION

When plugged into AC line power, the Recharger/Converter continuously trickle charges the internal batteries. A typical application hook-up circuit is shown in Figure 3-1 for AC operation.

E. ADDITIONAL OUTPUT LEVELS

For added convenience, a highly accurate external plug-in style Fixed Ratio Resistive Divider is available as an accessory to provide reference outputs from 10 millivolts to 10 volts. All "PVD" plug-in dividers are provided with a self-contained calibration adjustment pot which may be used to the desired nominal value.

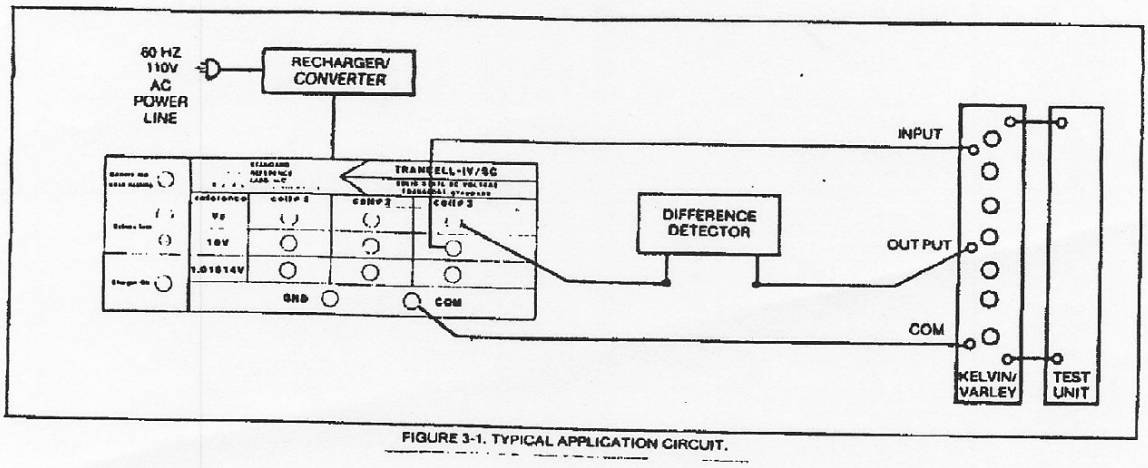


FIGURE 3-1. TYPICAL APPLICATION CIRCUIT.

F. TEMPERATURE AND RESISTANCE MONITORING

Each Trancell unit is provided with pin jacks, located on the rear panel, to monitor the battery supply levels, the auxiliary thermistor resistance, and the oven Delta T and Degrees K temperature levels. Figure 3-2 shows the location of these jacks on the rear panels. Thermistor jacks are used to gain access to the resistance value of the thermistor, the value of which changes with temperature changes.

Pinjacks Oven + and COM-1, OVEN - and COM-1, and REFERENCE COM-2 and+ are provided to monitor the battery operating voltages. These values should be approximately 11 to 14 volts for the OVEN +, 22-28 volts for the main power (REFERENCE), and 5.5 to 7 volts for the OVEN -.

The Degrees K jacks are provided to monitor the oven temperature. Internal circuitry is such that at 25 C the output generated is 2.98 volts. The signal changes with temperature changes so that at 43 C, the output increases to 3.16 volts. The formula used to determine this output is

$$(273 + Y)/100$$

Where Y= oven temperature in Degrees C.

To monitor small changes in the oven temperature, a differential bridge signal is fed into a fixed gain differential amplifier which results in the Delta T signal of about 1000 mv/C. This signal is obtained from the Delta T jacks.

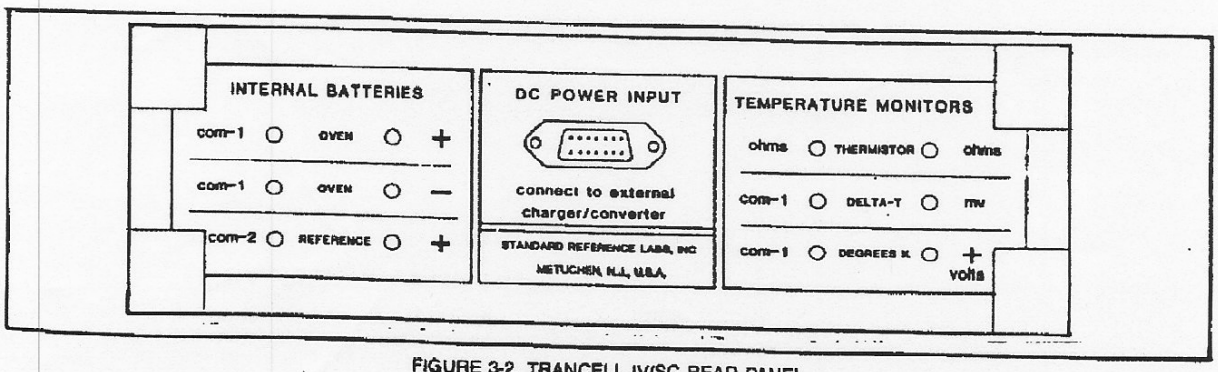


FIGURE 3-2. TRANCELL IV/SC REAR PANEL.

SECTION IV

MAINTENANCE AND REPAIR

A. GENERAL

The only maintenance required is the continual charge of the self-contained batteries. The batteries are rated to accept several hundred charge/recharge cycles under normal operating conditions. However, the batteries, unit reference module and divider boards are functional electrical items subject to normal failure and are so designed for field replacement. Adhere to the following procedures should it become necessary to replace these items.

CAUTION

Always disconnect all AC line power to the unit before removing any part of the unit cabinet. Plan to complete the replacement within 30 minutes to avoid any possible retrace errors.

B. BATTERY REPLACEMENT

1. Remove two top panel mounting screws and top panel.

2. Unsnap and remove the Recharger/Converter "power input" connector from rear panel.

3. Remove three front panel dust cover screws and dust cover.

4. Remove two bottom panel mounting screws (at rear panel) and slide bottom panel back about two inches.

5. Remove four rear panel mounting screws and pull rear panel away from chassis being careful not to damage wiring to panel.

6. The small 6 volt battery with fuse is held in place by the rear panel and now may be removed from the chassis.

7. Note position of batteries and wiring to allow for proper installation of replacement batteries. From the front panel, the two 12 volt batteries on the left side are wired in series (to obtain 24 volts) while the two 12 volt batteries on the right side are wired in parallel.

NOTE

Each power supply has a 2 amp pigtail fuse located in series with the "+" terminal to protect against accidental shorting of batteries. Be careful not to damage the fuse during this procedure.

8. Remove screws, nuts, and battery mounting "L" brackets. Note location of yellow grounding wire on bracket. Also, the bracket mounting screw holes are thread tapped making it necessary to unscrew the screws all the way out.

9. Slide batteries out of the case and unsolder battery and fuse leads at terminals. Rewire the fuse to the new fully charged 12 volt batteries. Rewire batteries.

10. Slide batteries back in case, replace mounting bracket and hardware (including yellow grounding wire).

11. Reverse steps 1 to 6 to reassemble the unit. Note that the small "L" bracket on the rear panel is in the proper position to secure the small 6 volt battery.