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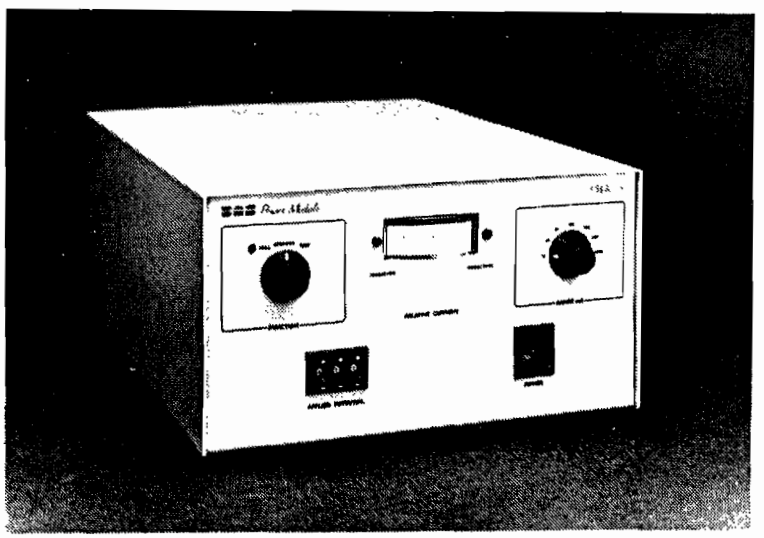
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Find the *Bioanalytical Systems PWR-3* at our website: ***Click HERE***

Installation/Operation Manual

for

PWR-3 Power Module/Potentiostat



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BAS Manual p/n MF-9052 1/19/89

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THE BAS PWR-3 POWER MODULE/POTENTIOSTAT CAN SUPPLY DC CURRENT IN EXCESS OF 1 AMPERE AT OVER 80 VOLTS. IMPROPER CONNECTION MAY RESULT IN SEVERE SHOCK. READ THE MANUAL!

THIS INSTRUMENT HAS MANY CAPABILITIES. READ THE MANUAL!

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1.0 GENERAL INFORMATION

1.1 Introduction to PWR-3 Power Module/Potentiostat

The BAS PWR-3 Power Module/Potentiostat is a high current (± 1 Ampere), high compliance voltage (± 80 V) potentiostat designed for medium scale synthetic work, corrosion studies or for any electrochemical experiment that would require these capabilities. Seven current ranges from 10 mA to 1.0 Amp full scale provide a wide dynamic range. A panel meter provides a quick, convenient measure of the current. A current signal is available through rear panel jacks for connection to an analog X-Y recorder, to the BAS CV-27 Voltammograph or to the BAS100A Electrochemical Analyzer.

The PWR-3 can be driven with an external signal generator such as BAS CV-27 Voltammograph or the BAS100A Electrochemical Analyzer. A test circuit is provided for rapid electronic troubleshooting.

1.2 Unpacking and Inspection of Shipment

Carefully unpack your shipment and inspect each piece for damage. Before leaving the factory, all Bioanalytical Systems Inc. (BAS) products are carefully checked and inspected for flaws in workmanship and operation. If the shipment is not delivered in good order and as specified on the packing slip, have the damage or shortage noted by the carrier at the time of delivery and file a claim with the carrier as soon as possible. Please contact BAS for written authorization prior to returning any shipment under such circumstances.

1.3 Warranty and Service Information

Bioanalytical Systems Inc. products are fully warranted against defects in materials and workmanship. The PWR-3 Power Module instrument is unconditionally guaranteed for 90 (ninty) days except when failure is due to:

(1) Obvious abuse or negligence

(2) Tampering in any manner not specifically prescribed in this manual or authorized by Bioanalytical Systems Inc., or

(3) Improper connection of the PWR-3 to the electrochemical cell.

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All service is done at the West Lafayette factory. If a service problem occurs, call or write BAS Customer Service and describe the problem. It may be solveable without having to return the instrument for repair. If the unit must be returned obtain a Return Authorization number from the Customer Service agent. There is a minimum service charge for all items not under warranty and no repair will be done until a purchase order is received to which the charges can be assigned.

All service correspondence and shipments should be sent to:

Bioanalytical Systems Inc.
Service Department
2701 Kent Avenue
West Lafayette, IN 47906
RA # _____

Please include a written description of the problem with the return shipment. BAS will repair, at our option and your expense, any equipment which has not been used under the terms and guidelines of this warranty.

2.0 INSTALLATION

2.1 Power Requirements

The PWR-3 may be operated on either 120 VAC or 240 VAC power and 50 or 60 Hz. Selection of the appropriate voltage is accomplished on the rear panel. To determine the voltage requirement of the instrument or to change the voltage, unplug the line cord and slide the plastic window to the left. The orientation of the small circuit board now exposed in this socket determines the voltage. If the voltage labelled on the outside edge is not that required, pull out the board and reinsert it such that the desired voltage is now visible along the outside edge. Note: Do not use the board with the 100/230 V side up. Figure 2.1 is a illustration of the main power connecter.

If the instrument is operated from a power outlet without a ground connection, an appropriate adapter must be used. the ground connector of this adapter must be securely fastened to an external ground to assure grounding which is to be maintained for safety under all circumstances. Whenever applying power make sure that the cell selection switch is set to STANDBY.

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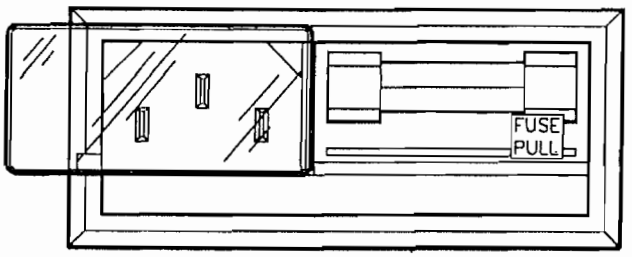
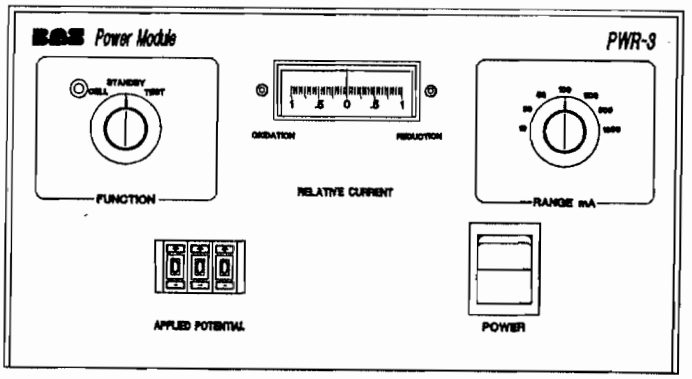


Figure 2.1 Power cord connector and voltage selector.

2.2 Identification of Controls

Refer to Figures 2.2 and 2.3 while the function of each control is briefly explained.

FRONT PANEL CONTROLS



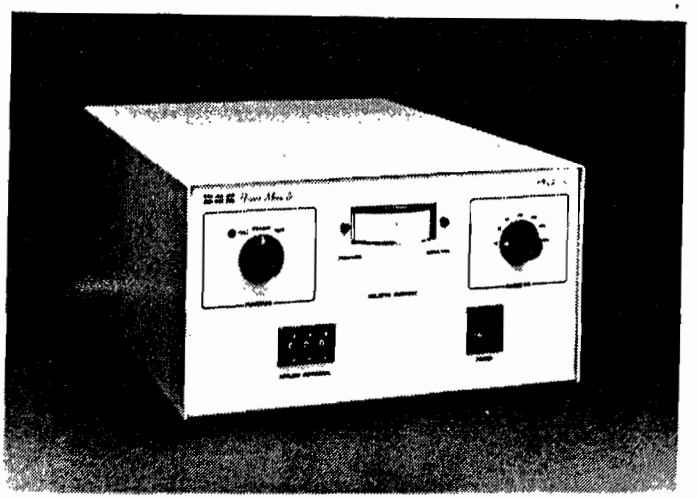


Figure 2.2 Front Panel Drawing and Photograph

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POWER

This switch applies the main electrical power to the PWR-3. The switch will be illuminated whenever power is on.

APPLIED POTENTIAL

This digital potentiometer fixes the potential applied to the cell in the absence of an external input. The polarity of this potential is set by the +/- APP. E (Applied Potential, E) switch on the rear panel (see below).

FUNCTION

This switch determines the status of the PWR-3. Three options are available. STANDBY disconnects the cell from the PWR-3 electronics, (no potential is applied). CELL closes the switches connected to the cell. TEST connects a dummy cell (a resistor) so the PWR-3 can be evaluated independently of the real cell. The TEST function is explained in section 3.4 of this manual.

RANGE mA

This switch determines the current sensitivity or the gain of the current-to-voltage converter. There are seven switch positions.

10, 20, 50, 100, 200, 500, and 1000 milliamperes per 1V Full Scale output.

RELATIVE CURRENT

This analog meter gives a rapid visual indication of the current being supplied and measured by the PWR-3. The value on the meter may be considered a multiplier; the actual current is the meter reading times the RANGE setting. An oxidation or reduction at the working electrode is indicated by the swing of the meter needle.

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REAR PANEL CONTROLS

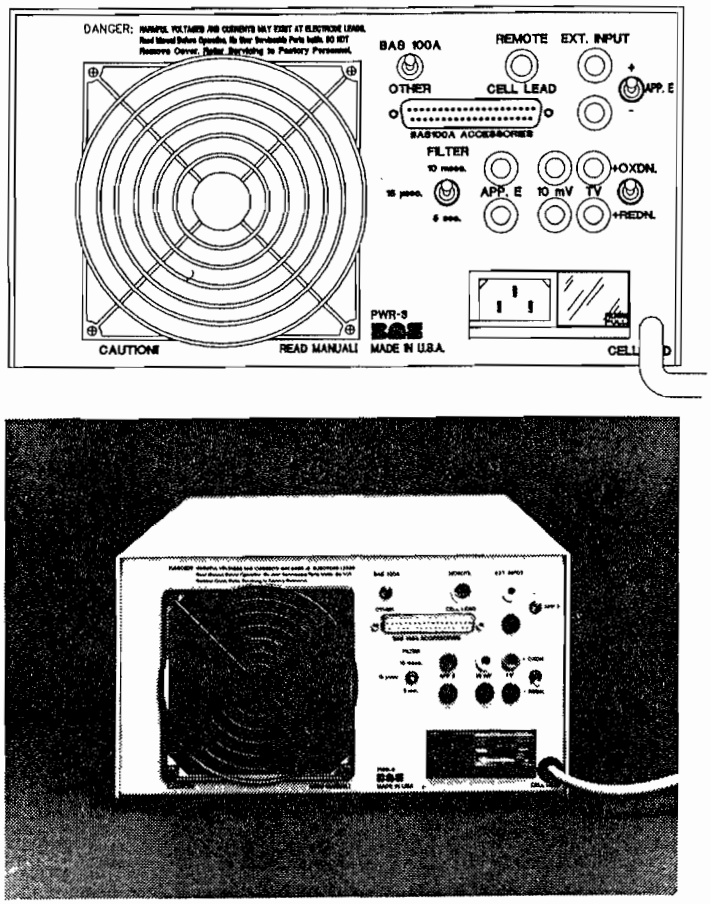


Figure 2.3 Rear Panel Drawing and Photograph

APP. E (Applied Potential, E switch)

This switch establishes the polarity of the APPLIED POTENTIAL to the cell whose value is given by the front panel digital potentiometer.

EXT. INPUT (External Input)

This set of jacks allows an external function generator signal to be added to the fixed D.C. potential of the PWR-3. The total applied potential is the sum of the D.C. potential as adjusted using the front panel applied potential potentiometer and the potential to this jack.

BAS100A ACCESSORY

This 37 pin connector is for the control cable from the BAS100A. Through this connector, current sensitivity (gain) and cell on-off are remotely controlled.

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BAS 100A/OTHER

This switch determines the amount of current that will be allowed through the REMOTE CELL LEAD connector. This current is proportional to the actual current through the PWR-3. At present (5/1/88) this switch is redundant; either position will give 0 to 1 milliampere. (Editors Note: it is not worth a long discussion to explain the reason it is even present except to say it was needed at one time during development and the switch was not erased during production).

REMOTE CELL LEAD

This special connector is for receiving external potential waveforms and for sending a current signal to the BAS CV-27 Voltammograph or BAS 100A Electrochemical Analyzer.

FILTER

This switch establishes the effective time constant applied to the output. Available settings: 5 sec, 10 msec and 15 usec.

APP. E (Applied Potential Jack)

The voltage measured or recorded from this jack is the actual potential applied to the cell, reflecting both the front panel D.C. potential and the external input, if any. The output jacks are provided to drive a suitable recorder.

10 mV

These 10 mV jacks provide a linear output of 0-10 mV for 0 to 100% of the mA RANGE selected on the front panel. For example, a measured current of 350 mA with the mA RANGE rotary switch adjusted to 500 would yield an output of 7 mV.

1 V

These 1V jacks provide a linear outpot of 0 to 1V for 0 to 100% of the mA RANGE selected on the front panel.
+OXDN/+REDN (Positive for an oxidation/Positive for a reduction).

This switch fixes the polarity of the signal at the 10 mV and 1V output jacks. Thus choice of polarity is available for recorder display.

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2.3 Rear Panel Connections

Electrochemical Cell. A gray, shielded cable terminating in three, color-coded alligator clips is used for connection to the cell. The color code for a three electrode cell is:

BLACK	Working electrode
RED	Auxiliary electrode
WHITE	Reference electrode

Turn the FUNCTION switch (front panel) to STANDBY whenever disconnecting or connecting the cell leads. Avoid possible short circuits by providing a mechanically stable point of attachment for the cable near the cell.

Output. The PWR-3 offers several options for outputs to an XY recorder or other suitable recorder device.

The potential applied to the cell at any point in time is available at the red and black APP. E banana jacks. The +OXDN./+REDN. provides a positive output to the recorder regardless of the direction of current. Both 10 mV and 1V full scale output ranges are available at the respectively labelled jacks.

For simple chronoamperometry, select the appropriate filter and direct the output to a time base recorder or oscilloscope. For a 1 volt full scale recorder, use the green and black banana jacks labelled "1V', and attach green to "+" and black to "-". For a 10 mV full scale recorder, use the blue and black banana jacks marked "10mV".

For simultaneous current-potential measurement, an XY recorder is used. Drive the X-axis from the red and black jacks marked APP.E. Drive the Y axis with the 10 mV or 1 V jacks as described above.

Present electrochemical convention is positive (up on a recorder) for a reduction current and the applied potential positive going to the left. To implement this convention using the PWR-3 and a standard, differential input XY recorder, do the following:

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Y AXIS

1. Flip to + REDN

2. Assuming 1 V full scale output, connect the green and black "1V" jacks to the "+" and "-" terminals respectively for the Y axis on the recorder.

X AXIS

1. Connect the red and black APP. E jacks to the "-" and "+" terminals, respectively, for the X axis. Note: A differential recorder is required for connection of the black App. E jack to the "+" recorder terminal.

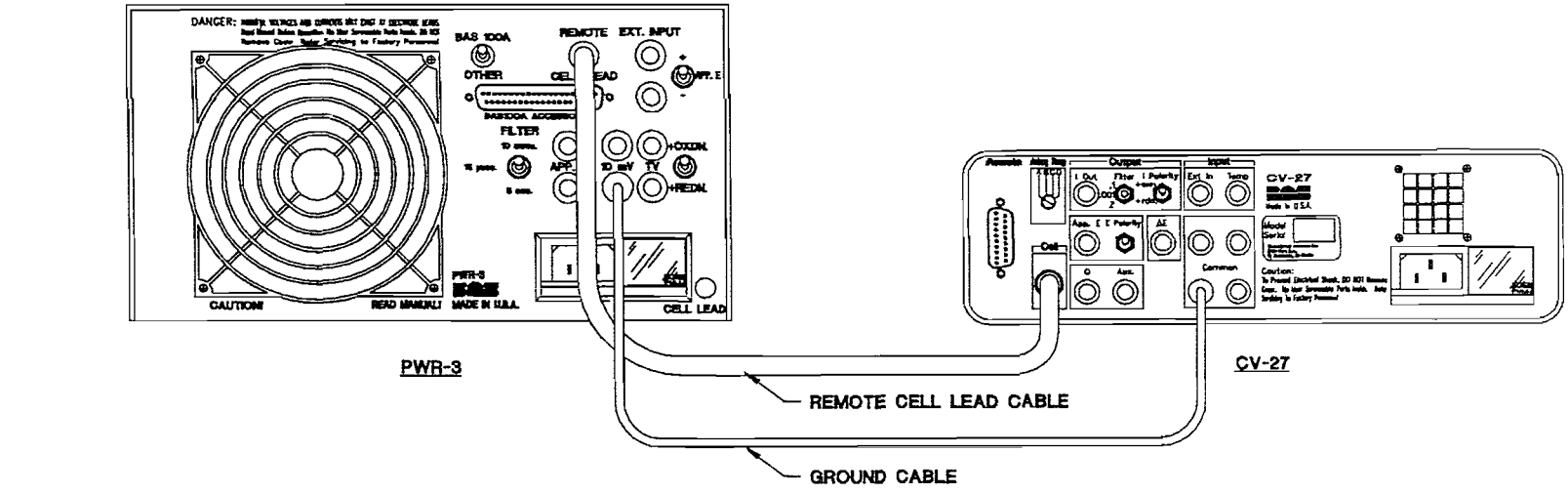
External Input. An optional external input waveform may be applied at the yellow and black jacks on the rear panel. Remember that the potential applied to the cell at any time is given by the following:

E = (Polarity) X (Applied D.C. potential on the front panel) + (External input).

BAS100A Accessory (BAS 100A Digital Connection)

A 37 pin ribbon cable allows the BAS100A Electrochemical Analyzer to control the PWR-3. This plugs into the appropriately labelled accessory jacks on both units; see Figure 2.4. The pin line assignments are shown in Figure 2.5.

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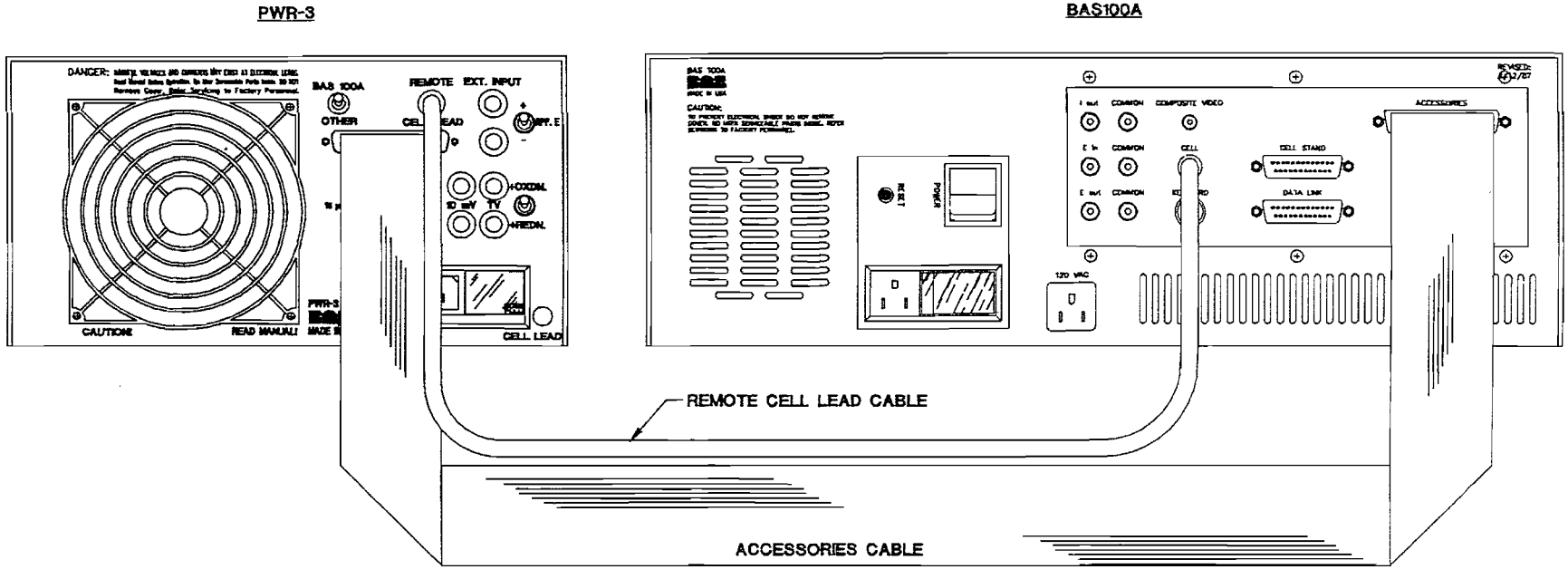


FIGURE 2.4. CONNECTION OF THE PWR-3 TO THE BAS100A or CV-27.

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BAS-100A
37 pin "D" Back Panel

Connector	Function
1	Data 7
20	Data 6
2	Data 5
21	Data 4
3	Data 3
22	Data 2
4	Data 1
23	Data 0
5	Data 15
24	Data 14
6	Data 13
25	Data 12
7	Data 11
26	Data 10
8	Data 9
27	Data 8
9	Read Not
28	Write Not
10	Address 5
29	Address 4
11	Address 3
30	Address 2
12	Address 1
31	Address 0
13	+5 V
32	+5 V
14	Digital Ground
33	Digital Ground
15	+15 V
34	+15 V
16	Analog Ground
35	Analog Ground
17	-15 V
36	-15 V
18	NC
37	NC
19	NC

Figure 2.5 Pin Out for Accessories Connector

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REMOTE CELL LEAD (BAS 100A/CV-27 Analog Connection)

The PWR-3 receives the potential waveform and sends a current proportional to the total current through this connector to the BAS 100A Electrochemical Analyzer or CV-27 Voltammograph. The cable has the male connector on both ends and plugs into the labelled CELL LEAD jacks on the BAS 100A or CV-27. This is illustrated in figure 2.4

GROUND CABLE

A ground cable (black cable with a banana plug on each end) between the black PWR-3 common jack and black CV-27 common jack is recommended with a differential XY or XYT recorder, such as the BAS recorders. If the recorder employed is earth grounded, then the ground cable should not be connected because it may create a ground loop causing excess noise.

FILTER

There are three switch positions available to govern the amount of passive (RC) filtering applied to the output signal. The choices are: 15 usec(15 KHz bandwidth), 10 msec (20 Hz band width), and 5 sec.

3.0 OPERATION OF THE PWR-3

3.1 Potentiostatic Operation

To operate the PWR-3 at a fixed potential:

(a) Make sure the FUNCTION switch is in the STANDBY position.

(b) Adjust APPLIED POTENTIAL potentiometer to the desired value and flip the rear panel +/- APP.E switch to desired polarity.

(c) Select the appropriate FILTER position on rear panel.

(d) Make sure the FUNCTION switch is in the STANDBY position. Push the POWER switch to the on position.

(e) Select an anticipated full scale RANGE mA.

(f) Make sure the electrode leads are property connected to the cell. Turn the FUNCTION switch to CELL. The red indicator light should be illuminated.

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(g) Select a RANGE mA setting to place the RELATIVE CURRENT needle at a midrange position.

CAUTION: Before disconnecting the cell, return the FUNCTION switch to STANDBY.

3.2 Potentiodynamic Operation

To use the PWR-3 in potentiodynamic operation, it is necessary to drive the PWR-3 with an appropriate signal generator such as the BAS CV-27 or BAS100A instruments. For generators other than the BAS CV-27 or BAS100A, the signal is fed into the yellow and black jacks marked EXT. INPUT on the rear panel. The potential applied to the cell at any point in time is the algebraic sum of the EXT. INPUT and the PWR-3's APPLIED POTENTIAL value.

To drive the PWR-3 with either the CV-27 or BAS100A, connect the CELL LEAD outputs with the special cable; see figure 2.4. To use the PWR-3 with the BAS100A, the 37 pin control cable must also be connected; see Figure 2.4

The current or charge on the display of the CV-27 when it is connected to the PWR-3 must be multiplied by a conversion factor of 1 ampere/milliampere or 1 coulomb/1 millicoulomb. The range switch setting on the PWR-3 will not affect the conversion factor.

3.3 Electronic Troubleshooting

This section contains two subsections:

(1) a test procedure for assessing electronic controller performance, and

(2) service procedures from BAS.

Diagnostic Self-check Procedure for the PWR-3 Potentiostat

This procedure isolates PWR-3 from the cell and therefore checks it independently of other components. The values quoted below are guidelines; if the electronics are faulty, the output in a defective unit is usually wildly different from them.

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Equipment Required:

digital voltmeter (4 digit, ± 10.00 V)

Test Procedure

1. Turn the FUNCTION switch to STANDBY.

2. Plug the voltmeter into the rear panel jacks labelled APP.E. Select various values of APPLIED POTENTIAL using the front panel push buttons. Test the polarity using the +/- APPLIED POTENTIAL switch on the rear panel.

   Values should be ± 3 mV.

3. Plug the voltmeter into the green and black output jacks. Set the APPLIED POTENTIAL AT +1.00 V. Set RANGE mA at 50 mA. Flip to + OXDN on rear panel.

(4) Switch the FUNCTION switch to TEST. Allow the output to assume a steady state value (time delay, if any, is due to FILTER selection on rear panel).

The output should be + 1.00 V. Other combinations of APPLIED POTENTIAL and RANGE mA to be tested, with the expected OUTPUT, are listed below.

APPLIED POTENTIAL	RANGE mA	OUTPUT (1V)
-1.0V	50	-1.00
+0.50	50	+0.50
+0.50	100	+0.25
+0.50	200	+0.125
-9.99V	500	+1.0

The above OUTPUT values should agree with the calculated to within ± 2%.

(5) This completes user tests. PWR-3 Potentiostats passing the above tests are fully operational and any system malfunction must be due to the cell.

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Service Procedure

Deficiencies in the PWR-3 during the self test procedure should be referred to Bioanalytical Systems service staff. Call 317-463-4527, ask for Customer Service and identify the and identify the problem as being electronic. Technical personnel will offer further guidance.

If a return is deemed necessary, a return authorization number (RA#) must be procured by the user. The RA# identifies the user, the problem, and the BAS representative responsible for handling your problem. Materials returned to BAS without an RA# will be refused. Shipments should be sent prepaid to:

Bioanalytical Systems, Inc.
Service Department
2701 Kent Avenue
W. Lafayette, IN 47906

The RA# should be clearly marked on the outside of the shipping container.

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