Instruction Manual AVTM57J

for

Energized Winding
Resistance Tester
Catalog No. 577500 and 577500-1

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Figure 1: The Biddle Catalog No. 577500 Energized Winding Resistance Tester.

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SECTION A

INTRODUCTION

PURPOSE OF TESTER

The Biddle Catalog No. 577500 or 577500-1 ENERGIZED WINDING RESISTANCE TESTER is used for measuring the dc resistance of ac energized windings, thus enabling the determination of winding temperature rise while the windings are operated under actual load conditions. The Tester is suitable for measuring the winding resistance of transformers, chokes, induction coils, heater coils, generators and all types of motors where there are no brushes in series with the circuit being measured. Measurements are possible on either single phase or three phase, three wire equipment.

DESCRIPTION

The Tester is a modified Wheatstone bridge and is used as such on energized or deenergized samples. The Tester is completely self-contained and measurements are made by balancing the bridge by means of the measuring dials and the null detector. Resistance readings are taken directly from the Tester, no calculations or multipliers are necessary.

HIGH CURRENT ADAPTER

For measurements on windings of a higher current rating than that of the Tester, a HIGH CURRENT ADAPTER, Catalog No. 577510 is used to increase the Tester rating. The Adapter is connected to the Tester by means of a single cable and an MS type connector. Details of the ratings are given in the Specification Section.

SUMMARY

The Tester is a precision instrument and when used properly, can make measurements to determine actual temperature rise with an accuracy of better than one half degree centigrade. The use of the Tester for determining actual average winding temperature rises provides the most accurate results of any known method.

SECTION B

SAFETY PRECAUTIONS

SAFETY IS THE RESPONSIBILITY OF THE USER

The Biddle ENERGIZED WINDING RESISTANCE TESTER and the recommended operating procedures have been designed with careful attention to safety. Biddle has made formal safety reviews of the initial design and any subsequent changes. This procedure is followed for all new Biddle instruments and covers areas in addition to those included in ANSI C39.5. Regardless of these efforts, it is not possible to eliminate all hazards from electrical test equipment. For this reason, every effort has been made to point out in this instruction manual the proper procedures and precautions to be followed by the user in operating the Tester and to mark the Tester itself with precautionary warnings where appropriate. However, it is not possible to foresee every possible hazard which may occur in the great variety of applications of this Tester. It is therefore essential that the USER, in addition to following the safety rules in this manual, also carefully consider all safety aspects of the test before proceeding.

The purpose of the Tester is to measure the resistance of energized windings, and it is therefore necessary to connect the Tester to a source of High Voltage electrical energy and to an energized winding. High voltage is thus present at the terminals of the Tester and inside the case during operation. To insure safe use of the Tester, do not treat it casually. Read and understand these instructions and follow the safety rules given, paying special attention to the following items:

1. Deenergize the line and load leads and make sure the BRIDGE PWR switch is in the OFF position before connecting to or disconnecting from the Tester.

2. Strip back the insulation from the line and load leads no more than 1/2" (13 mm) from the ends, then insert the leads into the terminals so that no part of the conductor protrudes from the connector.

3. Always use an insulated screwdriver (600V class insulation) when making connection to the Tester.

4. Never remove the battery compartment covers nor try to change the batteries when the line and load leads are connected.

5. When using the HIGH CURRENT ADAPTER, always make connection between the Tester and the Adapter before connecting the line and load leads.

6. The ground terminals on the Tester are connected to the metal front panel and all exposed metal hardware. For safety in the event of insulation failure in the Tester, make sure that one of the ground terminals is connected to a safety earth ground.

7. The red terminal covers have been provided to prevent the operator from coming into accidental contact with the live terminals. They do not, however, provide a complete barrier between the operator and high voltage. Under no circumstance should these covers be removed. As a routine safety precaution some users require that rubber gloves be worn, not only in making connections to the high voltage terminals, but in manipulating controls. Biddle considers this an excellent safety practice.

Because there are dangerous voltages inside the case, the Tester must never be operated with the case removed. Repairs to the Tester should be made in accordance with the precautions noted in Section I, TROUBLESHOOTING AND REPAIR, and only by qualified personnel.

SECTION C

RECEIVING INSTRUCTIONS

When your Biddle instrument arrives, check the equipment received against the packing list to ensure that all materials are included. Notify Biddle Instruments, Blue Bell, PA of any shortage of materials.

Examine the instrument for damage received in transit. If any damage is discovered, file a claim with the carrier at once and notify Biddle. Be sure to give a detailed description of the damage observed.

This instrument has been thoroughly tested and inspected to meet rigid inspection specifications before being shipped. It is ready for use when set up as indicated in Section F.

SECTION D

SPECIFICATIONS

Dimensions: Tester and High Current Adapter, each 10" (254 mm) high x 13 1/2" (343 mm) long x 10" (254 mm) wide.

Weight: Tester, 32 lbs. (14.5 kg), Adapter, 24 lbs. (10.9 kg), including adjustable shoulder strap.

Operating Temperature: 41°F (5°C) to 113°F (45°C).

Storage Temperature: -22°F (-30°C) to 131°F (55°C).

Humidity: Operation and storage limits, 5 to 95 R.H. non-condensing.

Climate: Operation prohibited in direct rain or snow for safety reasons.

RATINGS

Tester Only: 600V 3-phase, 3-wire 50-400 Hz 20 Amp.
600V single phase 50-400 Hz 40 Amp.
(for currents above 20 amps single phase, the single-phase jumpers must be used, see SECTION F OPERATION for details.

With High Current Adapter: 600V, single-phase or 3-phase, 3-wire 50-400 Hz 100 Amp.

All ratings are for continuous duty. The Tester can be used at frequencies down to 25 Hz, but both voltage and current limits must be derated by multiplying these limits by the ratio of the test frequency to 50 Hz.

RATINGS OF ITEMS TESTED

Because of the many different motor types having a wide range of efficiencies, it is not possible to assign a maximum horsepower rating to the Tester load. As an approximation, tables 430-148 thru 430-150 of the National Electric Code can be used, however, the maximum steady-state line current taken by the motor should be determined to be sure not to exceed the Tester ratings.

The Tester has been designed to withstand the usual starting currents related to the majority of motors and loads. In order to protect against excessive starting currents, overcurrent devices rated or set in accordance with table 430-152 of the N.E.C. should be connected to the LINE side terminals of the Tester. Under no circumstances however, should these devices be set to greater than 400% of the Tester rating.

RESISTANCE RANGES

	CAT. NO. 577500	CAT. NO. 577500-1
Low Range:		
Maximum	111.11Ω	11.111Ω
Resolution	0.001Ω	0.0001Ω
Limit of Error @ 25°C	±(0.1% of reading + 0.002Ω)	±(0.1% of reading + 0.0002Ω)
High Range:		
Maximum	1111.1Ω	111.11Ω
Resolution	0.01Ω	0.001Ω
Limit of Error @ 25°C	±(0.05% of reading + 0.02Ω)	±(0.1% of reading + 0.002Ω)

BATTERIES

Bridge Power: Six 1 1/2 volt AA cells, Alkaline (NEDA 15A) (IEC LR6).

Detector: Two 9 volt general purpose (NEDA 1604) (IEC 6F22).

SECTION E

DESCRIPTION

PRINCIPLE OF OPERATION

Refer to Figure 2 for the basic schematic of the Tester.

The Tester operates as a Wheatstone Bridge with the following modifications. Resistors R1, R2, the resistance of the choke L5 and the resistance connected to terminals 2 and 3 form the arms of the dc Wheatstone Bridge circuit. Resistor R1 is varied to obtain a balance as indicated by the detector.

Capacitor banks C1 and C2 provide blocking to the dc supplied by battery BT3, so that the resistance of the power supply does not shunt the winding to be tested, thereby causing inaccuracies in the measurement.

Choke L5 is a combination high impedance choke/precision resistor. It serves as one arm of the dc bridge and also prevents a high ac voltage from appearing across battery BT3.

Capacitor C3 shunts battery BT3, providing a low impedance path for diverting ac current around the battery.

Diode D1 ensures against the possibility of current reversal in battery BT3.

Choke L4, in series with the detector, provides line voltage rejection for the detector circuit.

CONTROL AND CONNECTOR IDENTIFICATION

The location of controls and connectors are illustrated in Figure 3, together with the schematic reference number of the various components.

DS1 AND DS2: LED DECIMAL POINTS

These indicators are lit only when both the Bridge PWR switch and the DET switch are in the ON positions. Only one indicator can be lit at any one time depending on the position of the RANGE switch.

M1: NULL DETECTOR

This meter is a zero center taut band meter and indicates whether the bridge is balanced or not. The meter also serves to indicate the condition of the bridge power battery BT3.

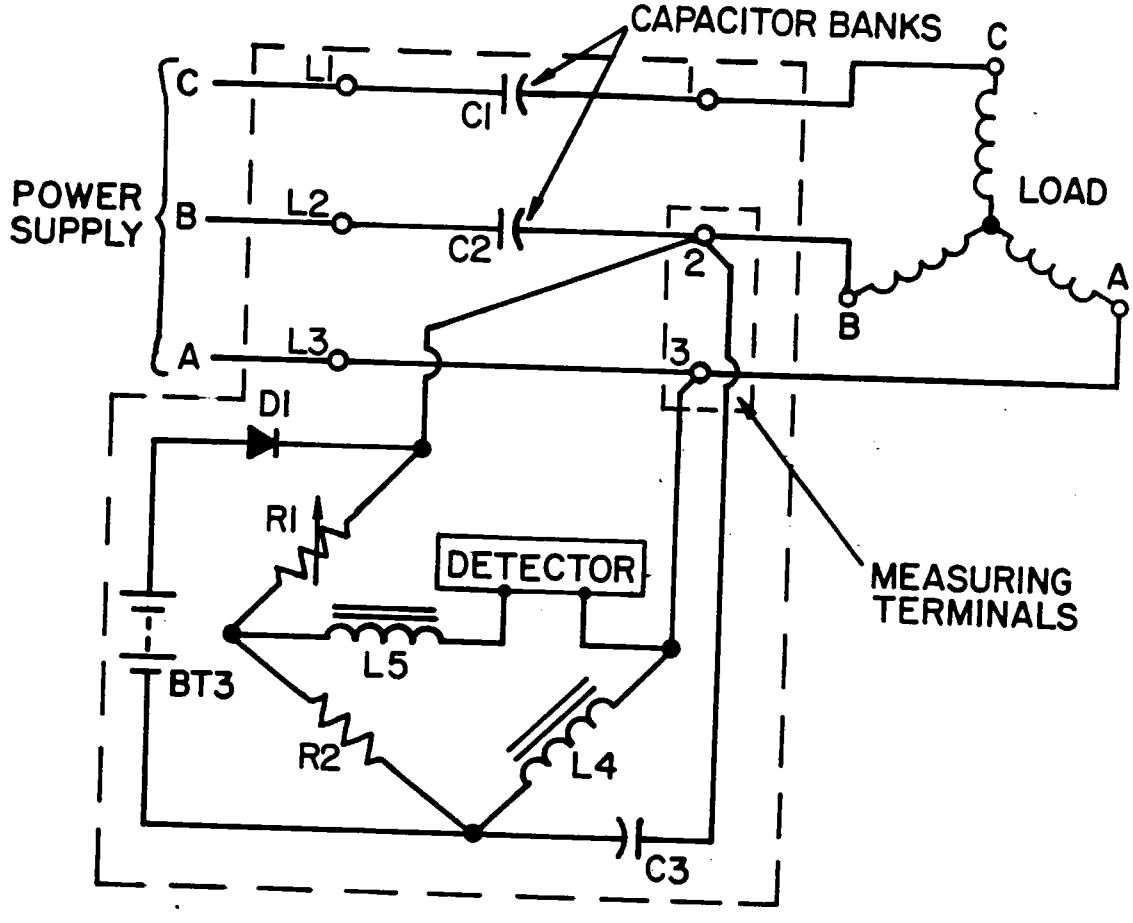


Figure 2: Basic Schematic showing connection to power supply and load.
Note: Reference designations shown here are for clarity of explanation only and may not correspond exactly with those on the instrument schematic.

R47: ZERO CONTROL

This potentiometer permits adjustment of the electrical zero for meter M1.

R48: SENSITIVITY CONTROL

This potentiometer controls the sensitivity of the detector circuit. It will give a sensitivity increase of approximately 20:1. The maximum sensitivity position is fully clockwise.

S1, S2, S3, S4 and S5: RESISTANCE DECADE SWITCHES

These switches control the resistance of the bridge arm indicated as R1 in the basic schematic.

S6: RANGE SWITCH

This switch automatically positions the LED decimal point.

S7: BRIDGE POWER SWITCH

This switch in the ON position, applies 9 volts to the bridge circuit via battery BT3. It also activates the detector circuit by switching in batteries BT1 & BT2. In the BAT CHK position, the condition of the bridge power battery BT3 is monitored.

S8: FILTER SWITCH

This switch allows for a filter to be switched into the detector circuit to provide additional damping of the null detector.

S9: DETECTOR SWITCH

This switch is a Momentary/Continuous ON switch for connecting the detector to the bridge arms.

TB1 & TB2: LINE AND LOAD TERMINAL BLOCKS

These terminal blocks accept either single phase or three phase, three wire power of up to 600 volts, 100 amps. The terminal blocks will accept either copper or aluminum cables in the range 14 AWG to 2 AWG. A ground terminal is also provided on each terminal block.

Three removable covers are at the rear of the Tester. (Fig. 4).

The top cover gives access to two 9V transistor batteries (BT1 & BT2). These batteries provide the power for the detector circuit.

The bottom cover gives access to six 1 1/2V AA batteries (BT3). This pack provides the 9V required for bridge power.

The center cover gives access to the HIGH CURRENT ADAPTER jack J3.

WARNING: THE TOP AND BOTTOM COVERS MUST BE FASTENED IN POSITION AND THE CENTER COVER MUST BE IN POSITION OR THE HIGH CURRENT ADAPTER CONNECTED, WHILE THE TESTER IS IN USE.

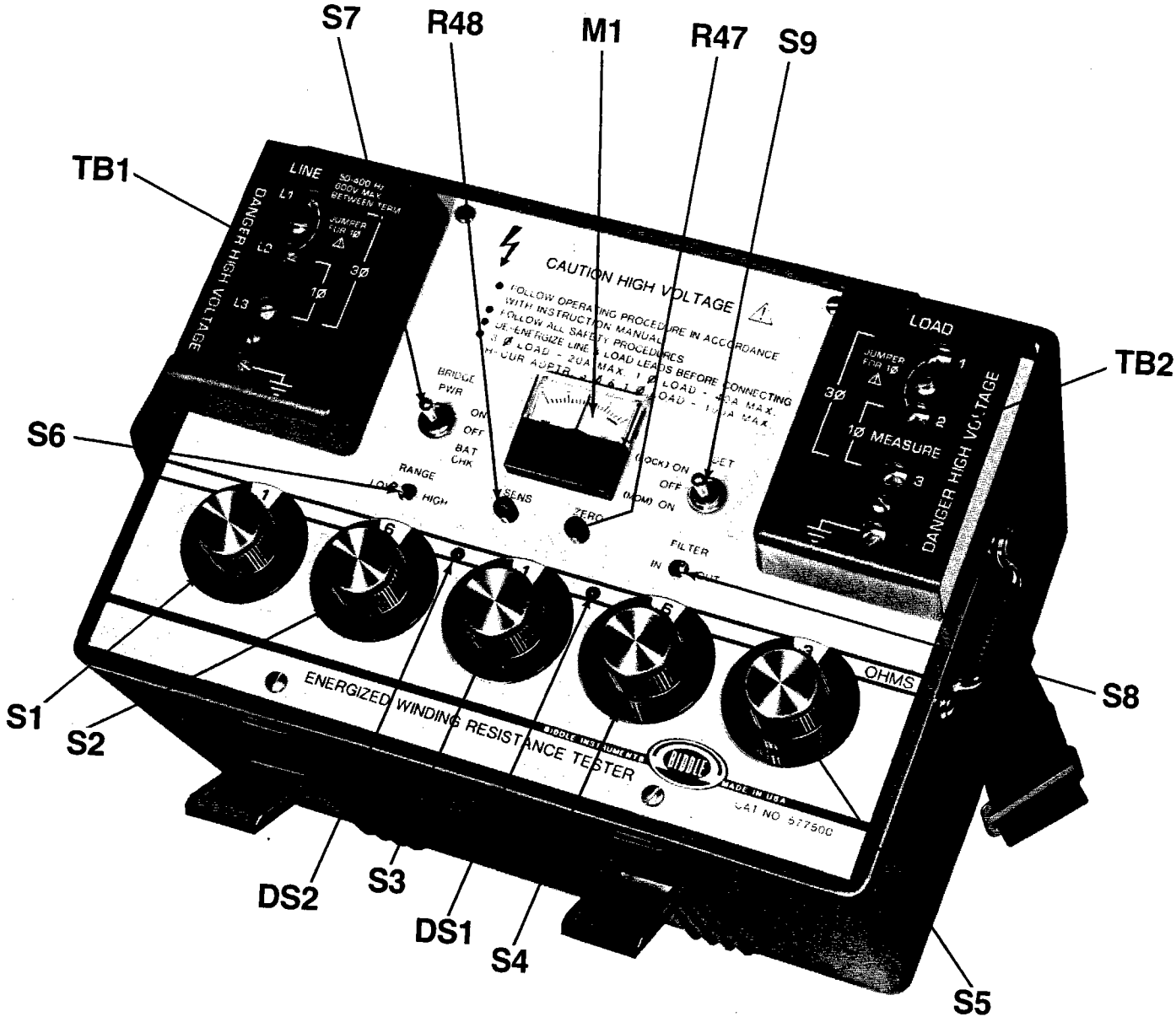


Figure 3: Control and Connector Identification.

SECTION F

OPERATION

SET UP

Refer to SECTION B, SAFETY PRECAUTIONS, for the method of connection to the Tester and High Current Adapter.

The Tester is suitable for either single-phase or three-phase operation. For three-phase operation, connect the line to terminals L1, L2 and L3 of the LINE terminal block (TB1) and the load to terminals 1, 2 and 3 of the LOAD terminal block (TB2). Do NOT make a neutral connection, the fourth terminal of each terminal block is for GROUND CONNECTIONS ONLY. Note that the resistance measured is that which is connected between terminals 2 and 3 of the LOAD terminal block (TB2).

For single-phase operation, connect the line to terminals L2 and L3 of the LINE terminal block (TB1) and the load to terminals 2 and 3 of the LOAD terminal block (TB2).

If the Tester is to be used for a single-phase load of between 20 amps and 40 amps, it will be necessary to use two jumper connections.

To make suitable jumper connections use 600V insulated wire capable of carrying 20 amps but not greater than #8 AWG. Cut the wire so that there are two lengths of approximately 6" each. Strip back the insulation 1/2" (13 mm) from each end.

Insert one jumper between terminals L1 and L2 of the LINE terminal block (TB1) and the other between terminals 1 and 2 of the LOAD terminal block (TB2). Make the single-phase line and load connections as before, making sure that both wires in terminal L2 and both wires in terminal 2 are securely connected.

Use a wire size suitable for the full load current of the device under test.

WARNING

MAKE SURE THAT THE TESTER IS CONNECTED TO A SAFETY EARTH GROUND, USING A WIRE SIZE OF AT LEAST AN EQUAL CROSS SECTION TO THE LINE AND LOAD LEADS.

IMPROPER GROUNDING MAY CAUSE A SHOCK HAZARD TO THE OPERATOR AND DAMAGE TO THE TESTER.

If voltmeters, ammeters and wattmeters are used, they should be connected on the LINE side of the Tester.

Make sure that a main power disconnect is connected on the LINE side of the Tester that the operator can reach.

Ambient temperature variations will affect the measurements of resistance to some degree. For best result, the Tester should be placed in a position free from drafts and where the temperature is stable. When testing motors or generators, make sure that the draft they produce is directed away from the tester. It is recommended that the Tester be exposed to the ambient conditions for several hours before testing.

Refer to SECTION D SPECIFICATIONS to determine allowable motor size and necessary overcurrent devices to be used.

OPERATING PROCEDURES

Before switching on the ac power perform the following:

1. Set the BRIDGE PWR and DET switches in the central OFF position.

2. Set the FILTER switch in the OUT position.

3. Set the RANGE switch to the most appropriate range for the device under test. (See SECTION D SPECIFICATIONS for details.)

4. Set the BRIDGE PWR switch to the ON position, rotate the SENS control fully clockwise and adjust zero on the null detector by means of the ZERO CONTROL.

5. Rotate the SENS control fully counterclockwise and set the BRIDGE PWR switch to the OFF position.

6. Actuate and hold the BRIDGE PWR switch to the BAT CHK position. The needle should deflect to the green section of the scale and be stable. If not, refer to SECTION I TROUBLESHOOTING AND REPAIR.

7. Set the BRIDGE PWR switch to the ON position and allow the Tester to sit for approximately 1/2 to 1 minute before continuing. This will ensure that the high impedance choke in the bridge circuit and the device under test are sufficiently magnetized so as not to effect the measurement.

8. Set the five decade switches (S1 through S5) to read zero.

NOTE: In order to avoid violent detector deflections caused by the unbalanced bridge settings, the following procedure should be performed as fast as possible.

9. Actuate the DET switch to the (MOM) ON position, observe the deflection of the needle and quickly release the switch back to the OFF position.

   With the decade switches set at zero the needle will deflect to the left.

10. Change the far left decade switch S1 one position at a time, repeating Step 9 each time until the needle deflects to the right.

11. Set switch S1 at the lower of the two values between which the deflection reversal occurs.

12. Repeat steps 10 and 11 with the remaining decades starting with switch S2.

When the deflection of the needle does not extend to the end of the scale, set the DET switch to the (LOCK) ON position.

When the deflection of the needle extends only one or two divisions of the scale, increase the sensitivity by a clockwise rotation of the SENS control until maximum deflection occurs. Continue this procedure until the SENS control is fully clockwise and the pointer is as close to the null position as possible.

The resistance now shown is the cold resistance of the device under test, plus that of the connecting leads.

If a balance cannot be attained by this method, change the RANGE switch setting to the HIGH position and repeat from Step 10 onwards.

If a balance is still not possible, set all decade switches to the 10 position; if the needle deflects to the left the resistance of the device under test is greater than the maximum for the Tester and therefore cannot be tested.

If the deflection of the needle is to the right, the resistance of the device under test can be balanced using the same procedure as in Steps 10 and 11 except starting with all decade switches in the 10 position, and setting the individual decade switches to the higher of the two values between which a deflection reversal occurs.

13. Rotate the SENS control fully counterclockwise; set the DET switch to the OFF position.

14. Switch on the AC power by closing the main disconnect installed on the LINE side of the Tester and allow sufficient time for the device under test to reach steady state operating conditions.

WARNING

High voltage is now present at the terminals of the Tester. Refer to Section B, SAFETY PRECAUTIONS.

The Tester can now be used to monitor the resistance of the device under test under operating conditions.

The Tester can be left with the BRIDGE PWR switch set in the ON position throughout the test, however, if it is not necessary to observe the readings continuously, it is recommended, in order to conserve battery life, that the BRIDGE PWR switch be set only to the ON position approximately 1/2 to 1 minute before a reading is to be taken.

Whenever a reading has to be taken, make sure that the SENS control is fully counterclockwise before switching on the DET switch.

When the DET switch is switched to the ON position, choke L4 (Figure 2) is energized at full line voltage. A transient condition thus exists and can last for several seconds. During this time the null detector deflection will be more than it is in its steady state condition. Allow a few seconds before balancing the bridge.

After taking the reading make sure the SENS control is returned to the fully counterclockwise position before switching off the DET switch.

SECTION G

APPLICATION NOTES

1. It should be noted that capacitor banks C1 and C2 (see Figure 2) are in series with the lines L1 and L2 respectively, and as such there is a few volts drop across them at the full load capacity of these circuits. If it is required to apply a specific voltage at the terminals of the device under test, it will be necessary to measure the voltage on the LOAD side of the Tester rather than the LINE side. However, provisions should be made to disconnect the voltmeter, and any other meter connected on the load side, whenever resistance readings are to be taken so that the accuracy of the readings are not affected.

2. The Tester can be used for measuring the winding resistances of generators or supply transformers. To do this, the generator or supply transformer should be connected to the LOAD side of the Tester and the load to the LINE side. The Tester will always measure the resistance which is connected to terminals 2 and 3 of the LOAD terminal block (TB2).

3. The FILTER switch has been provided to give additional damping of the null detector. When the FILTER switch is set in the IN position, the response of the null detector is very sluggish. The filter should be switched to the IN position only after a balance has been reached, and is usually only necessary when testing motors under pulsating loads such as compressors.

4. The BRIDGE PWR switch can be activated to the BAT CHK position at any time and the bridge power battery (BT3) voltage monitored even with the Tester energized.

5. Special care should be taken when making heat runs on motors with disc-type thermal protectors. If the motor reaches a temperature near protector trip-out, the disc begins to move, causing high contact resistance. Where there is reason to believe a motor with disc type overload protection will run extremely hot, the protector should be shorted out to prevent error in resistance readings.

6. The average winding temperature rise of a winding in degrees C can be calculated using the following formula:

$$Tr = \frac{Rh}{Rc} (K+Tc)-(K+Th)$$

where:

Tr = Temperature rise in °C

Rh = Hot winding resistance in ohms

Rc = Cold winding resistance in ohms

Tc = Ambient temperature @ which Rc was measured in °C.

Th = Ambient temperature @ which Rh was measured in °C.

K = a constant = 234.5 for copper windings
= 226 for aluminum windings

NOTE

To convert TEMPERATURES from °C to °F, use the equation:

$$°F = °C \times 1.8 + 32$$

To convert TEMPERATURE RISES from °C to °F, use the equation:

$$°F = °C \times 1.8$$

7. The Tester can be used as a resistance measuring device for deenergized equipment. All that is required is to make connections of the object to be tested to terminals 2 and 3 of the LOAD side terminal block TB2.

SECTION H

MAINTENANCE

GENERAL

Certain routine checks are necessary to ensure safe and correct operation of the Tester. These checks are described below. Make all the following checks after repairs, and at regular scheduled intervals of at least once a year; more often if the Tester is in heavy use.

MECHANICAL INSPECTION (EXTERIOR)

1. Visually inspect the case, noting if hinges and case locks function properly. Check for cracks in the case or lid. Inspect the condition of the carrying strap and case feet. Check that the three cover plates at the rear of the Tester are in place and secure.

2. Clean the case, panel and terminal block covers.

3. Inspect the panel, noting if all knobs are secure on their shafts, that all controls operate smoothly without binding and all mounting screws are tight.

4. Check the terminal blocks, making sure that the set screws are not damaged and that they can be screwed in and out easily without binding.

5. Mechanically set the null detector to zero.

6. Repair any defects found.

MECHANICAL INSPECTION (INTERIOR)

DANGER

THE TESTER MUST BE DISCONNECTED FROM THE SUPPLY AND DEENERGIZED BEFORE REMOVING FROM CASE. DISCHARGE THE INTERNAL CAPACITORS BY CONNECTING A SHORTING WIRE BETWEEN TERMINAL L1 OF THE LINE TERMINAL BLOCK (TB1) AND TERMINAL 1 OF THE LOAD TERMINAL BLOCK (TB2), AND BETWEEN TERMINAL L2 OF THE LINE TERMINAL BLOCK (TB2) AND TERMINAL 2 OF THE LOAD TERMINAL BLOCK (TB2). KEEP THESE SHORTING WIRES IN PLACE WHENEVER THE TESTER IS OUT OF THE CASE.

1. Remove the panel assembly from the case as follows:

   a. Remove and set aside the front panel screws.
   b. Remove the two battery covers from the rear of the case and disconnect the batteries.
   c. Raise the panel assembly straight up, lifting by the terminal block covers, until it is clear of the case.
   d. Place the panel assembly on a clean dry surface.

2. Clean any accumulated dust from the interior of the case and panel assembly.

3. Visually inspect all components and leads for defects. Repair any defects found.

4. Ensure that the connections to the terminal blocks TB1 and TB2 and to capacitor banks C1 and C2 are tight.

5. Reinstall the panel assembly into its case, reconnect the batteries (See Figure 4 for proper location). Replace the battery covers and mounting screws.

ELECTRICAL INSPECTION

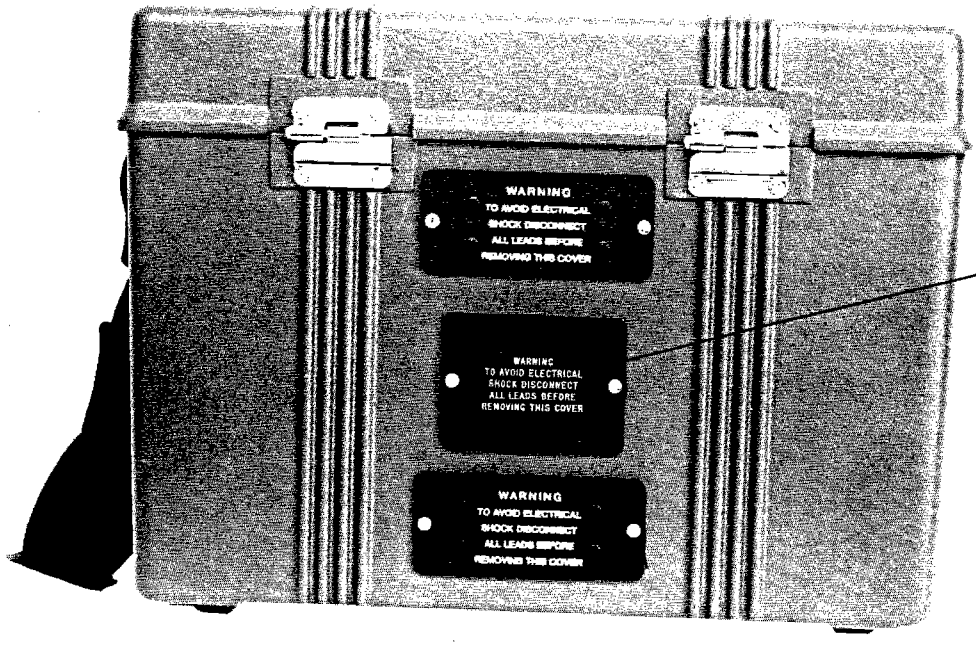
The electrical inspection should be performed only after the mechanical inspections have been completed.

Perform the electrical inspection as follows:

Equipment needed: 1 - 100Ω resistance decade box with minimum resolution of 0.01Ω (such as Biddle Cat. No. 724328-9).

1. Activate and hold the BRIDGE PWR switch to the BAT CHK position. The needle should deflect to the green section of the scale and be stable.

2. Set the BRIDGE PWR switch to the ON position, DET switch to the OFF position. Rotate the ZERO control fully counterclockwise, rotate the SENS control until approximate full-scale deflection on the null detector is achieved. Rotate the ZERO control fully clockwise, the needle should deflect to the right approximately full scale. Return the needle to the zero position.



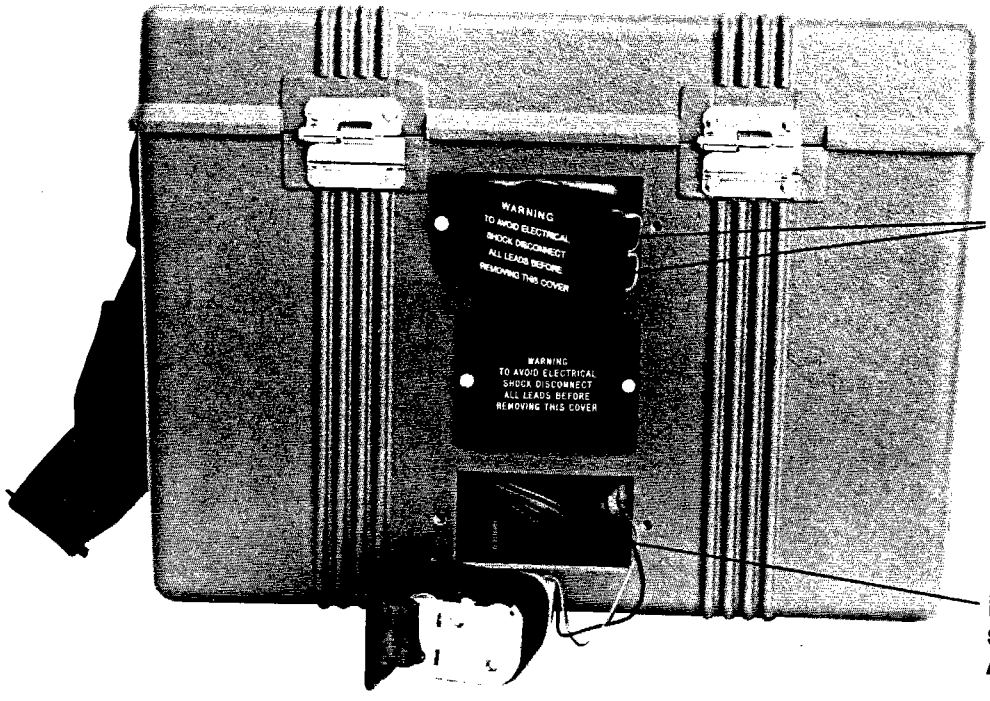


Figure 4: Battery Location.

3. a. Connect the 100Ω resistance decade box to the measurement terminals (2 and 3) of the LOAD terminal block TB2.

   b. Set the decade box to 100Ω for Cat. No. 577500 or 10Ω for Cat. No. 577500-1.

   c. Set the RANGE switch on LOW.

   d. Set switches S1, S2, S3 and S4 to "9", and switch S5 to "10".

   e. Set the SENS switch fully counterclockwise.

   f. Set the BRIDGE PWR and DET switches to the ON position.

   g. Adjust the decade box so that the needle of the null detector reads zero when the SENS control is in the fully clockwise position.

   h. Before performing each of the following steps, set the DET switch to the OFF position.

      I. Turn S5 to "0" and S4 to "10", check the bridge balance.

      II. Turn S4 to "0" and S3 to "10", check the bridge balance.

      III. Turn S3 to "0" and S2 to "10", check the bridge balance.

      IV. Turn S2 to "0" and S1 to "10", check the bridge balance.

For each of the above four steps the detector needle should not have deflected more than 1 division.

   i. Set the DET switch to the OFF position.

   j. Set the RANGE switch to the HIGH position.

   k. Balance the bridge. The reading should be between: 99.93 and 100.07Ω for Cat. No. 577500 and 9.988 and 10.012Ω for Cat. No. 577500-1.

   l. Set the DET switch to OFF.

4. a. Connect a clip lead between terminals 1 and 2 of the LOAD terminal block and between L2 and L3 of the LINE terminal block.

   b. Wait approximately 1 minute, then set the DET switch to the ON position. The needle should not deflect more than 1 or 2 divisions from zero.

   c. Set the DET switch to OFF, then remove the clip lead from L2 and L3 and move it to L1 and L3 of the LINE terminal block. Repeat Step (4b).

Refer to SECTION I TROUBLESHOOTING AND REPAIR if anything other than the desired results occur in any of the above procedures.

CALIBRATION

Requirements

Resistance decade box, total resistance 1111.1 , resolution 0.01 Ω , accuracy at least ±.05%. (Biddle Cat. No. 724328-9 is suitable for this purpose). Perform the calibration at 25°C.

1. Remove the panel assembly from the case as described earlier in this section. Reconnect the batteries.

2. Set the BRIDGE PWR switch in the ON position and the DET switch in the OFF position.

3. Set the ZERO control to its approximate mid position.

4. Set the SENS control to maximum sensitivity (fully clockwise).

5. On the PC board at the rear of the panel assembly, adjust the lower potentiometer R44 (marked ZERO) until the needle of the null detector is on zero.

6. Return the SENS control back to minimum sensitivity and switch off the DET switch, then the BRIDGE PWR switch.

7. Connect the resistance decade box to terminals 2 and 3 of the LOAD terminal block (TB2) with leads having a combined resistance of less than 10 mΩ.

8. Set the decade box to 100.00Ω for Cat. No. 577500, 10.00Ω for Cat. No. 577500-1 and the Tester to the LOW range. Set decade switches S1, S2, S3 and S4 to 9 and S5 to 10.

9. Set the BRIDGE PWR switch to ON and the DET switch to ON.

10. On the PC board at the rear of the panel assembly, adjust the upper potentiometer R33 (marked CAL) until the needle of the null detector is on zero when the SENS control is at maximum sensitivity.

11. Return the SENS control back to minimum sensitivity and switch off the DET switch.

12. Set the decade box to 1000.00 for Cat. No. 577500 and 100.00 for Cat. No. 577500-1 and the Tester to the HIGH range.

13. Set the DET switch to the ON position.

14. Increase the SENS control to the fully clockwise position, the meter deflection will remain on scale.

15. Readjust potentiometer R33 such that the meter needle is half way between its present position and zero.

16. Reinstall the panel assembly into its case and secure all mounting screws and covers.

This procedure splits the error between the HIGH and LOW ranges.

SECTION I

TROUBLESHOOTING AND REPAIR

REPAIR POLICY

Biddle maintains a complete instrument repair service. Should this Tester ever require repair, we recommend it be returned to the factory for repair by our instrument specialists.

When returning instruments for repair, either in or out of warranty, they should be shipped Prepaid and Insured, and marked for the attention of the Instrument Service Manager.

TROUBLESHOOTING GUIDE

Repairs should be made only by qualified personnel and only after reading this entire manual. The Tester should be completely checked for proper operation as described in SECTION H MAINTENANCE, before troubleshooting is attempted.

SECTION J REPLACEABLE PARTS LIST identifies all replaceable parts of the Tester and HIGH CURRENT ADAPTER, and gives the Biddle part number for each component. We recommend, that for safety and correct operation, only Biddle replacement parts be used when making repairs. Refer to the Tester schematic (Figure 5) for any required circuit details. If major problems are encountered or assistance required, contact the factory.

After repairs always perform a complete inspection of the Tester as detailed in SECTION H MAINTENANCE.

BATTERY REPLACEMENT

Refer to Figure 4 for the correct location of the batteries.

Batteries BT1 and BT2 are general purpose 9 volt transistor batteries (NEDA 1604) (IEC 6F22). These batteries need replacement when it is no longer possible to achieve a full scale deflection (both directions) on the null detector, by rotation of the ZERO control. Make sure that the BRIDGE PWR switch is ON and the SENS control is fully clockwise. Always replace both batteries.

Battery BT3 is composed of six 1 1/2 volt AA cells (NEDA 15A) (IEC LR6). Use only Alkaline type batteries. These batteries need replacement if the needle of the null detector does not deflect to the green section of the scale or, if the reading is not stable, when the BRIDGE PWR switch is held in the BAT CHK position. Always replace all six batteries when battery replacement is indicated. Note that the Tester will still operate under poor battery conditions but the sensitivity of deflection is decreased, thereby reducing the accuracy of readings.

Sub-section (3) of the Electrical Inspection part of SECTION H, MAINTENANCE checks the decade switches S1 through S5 and the range arm resistors R31 and R32. If the expected results do not occur during these checks, it will be necessary to check the above decade switches and resistors for correct operation and value; contact the factory for replacement parts.

Sub-section (4) of the Electrical Inspection part of SECTION H, MAINTENANCE, checks the capacitor banks C1 and C2. If the expected results do not occur during these checks, contact the factory for further information.

SECTION J

REPLACEABLE PARTS LIST

SYMBOL	DESCRIPTION	BIDDLE P/N		MFG P/N
	Cat. No.	577500	577500-1	
A1	Bridge Circuits PCB	23717	23717-1	BIDDLE
A2	Bridge Circuits Aux PCB	23719	23719-1	BIDDLE
A3	LED PCB	-	26317	BIDDLE
BT1 & BT2	Battery 9V (NEDA 1604, IEC 6F22	1482		DURACELL M1604
BT3	Battery (6) 1.5V (NEDA 15A, IEC LR6)	23415		DURACELL MN-1500
C10-C15	Capacitor 4000 µF/15 Vac	22781		BIDDLE
L4	Choke, 25 H/600 V	22647		BIDDLE
L5	Choke, 1000 H/600 V	22648		BIDDLE
M1	Null Meter 100 µA	11874		BIDDLE
S1	Decade Switch 100Ω	13350-5		BIDDLE
S2	Decade Switch 10Ω	13350-3		BIDDLE
S3	Decade Switch 1Ω	13350-1		BIDDLE
S4	Decade Switch 0.1Ω	11946-5		BIDDLE
S5	Decade Switch 0.01Ω	11946-6		BIDDLE
S6	Toggle Switch DPDT	12119-27		AMERICAN UL21KMZQ/A117
S7	Toggle Switch 3PDT (One Momentary POS)	8406-6		CUTLER-HAMMER 7704-K3
S8	Toggle Switch SPDT	12119-26		AMERICAN UL11KMZQ/A117

REPLACEABLE PARTS LIST (cont'd)

SYMBOL	DESCRIPTION	BIDDLE P/N	MFGR P/N
S9	Toggle Switch DPDT (One Momentary POS)	8406-5	CUTLER HAMMER 8946-K400
-	Battery Term Cable Assy	23958	BIDDLE
-	HI-CUR ADPTR Cable Assy	23729	BIDDLE
-	Term Blk Sect (2 Long)	23714	BIDDLE
-	Load Term Cover	23711-1	BIDDLE
-	Line Term Cover	23711-2	BIDDLE
-	Bridge Control Knobs	11868	BIDDLE
-	Decade Switch Knob	23027	BIDDLE
-	Case	23724	BIDDLE
-	Carrying Strap	6580-1	BIDDLE
-	Battery Cover Assy	22920	BIDDLE
-	6 Cell Battery Holder	22929	SHOYGO INTNL BH-58
-	Receptacle Cover	23720	BIDDLE

EWRT HIGH CURRENT ADAPTER

SYMBOL	DESCRIPTION	BIDDLE P/N	MFGR P/N
C1-C24	Capacitor 4000 µF/15Vac	22781	BIDDLE
-	Connecting Cable Assy		BIDDLE
-	Case		BIDDLE

SECTION K

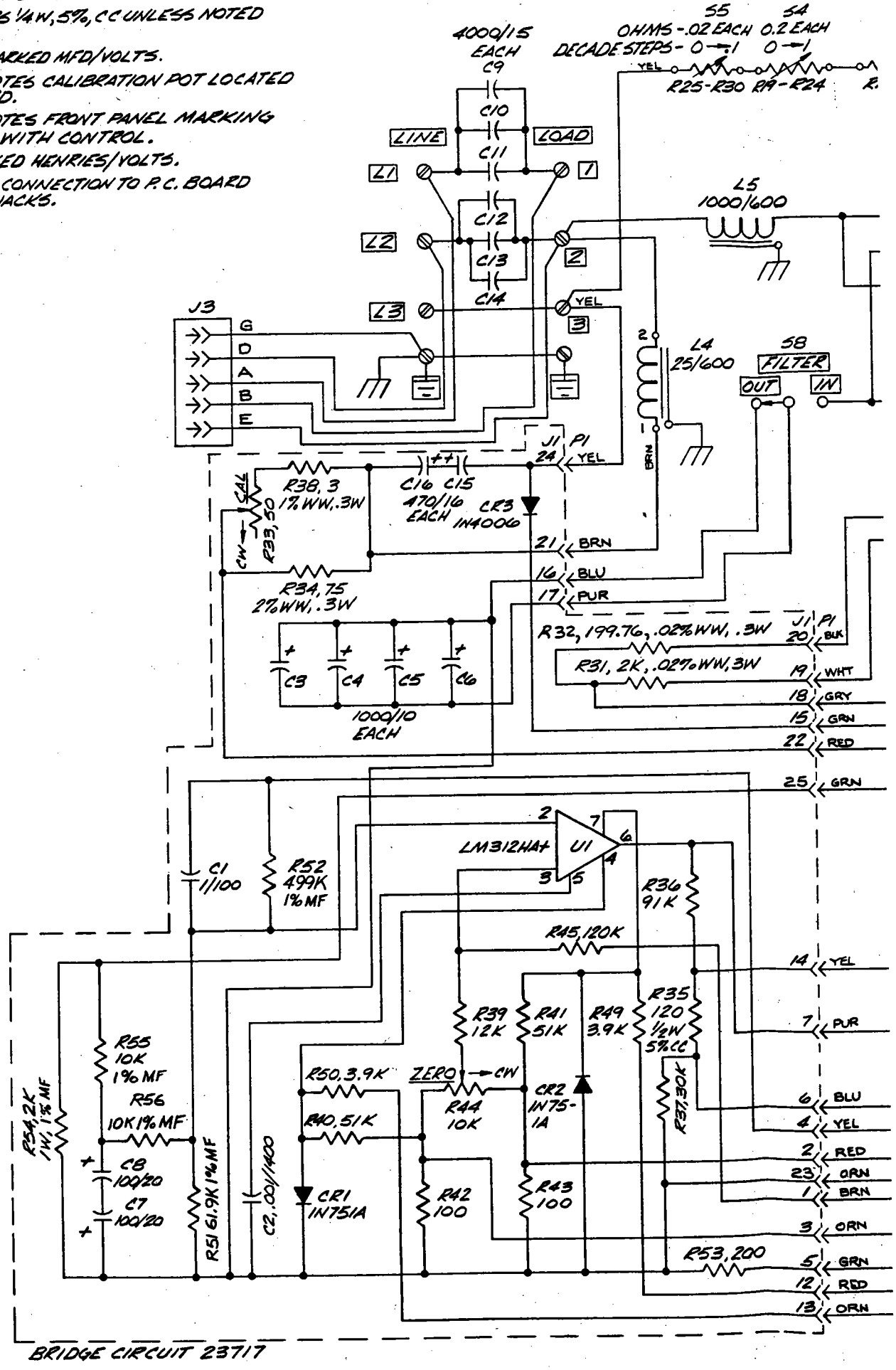
WARRANTY AND REPAIR

All products supplied by Biddle Instruments are warranted against all defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing, at our option, defective equipment. Equipment returned to the factory for repair will be shipped Prepaid and Insured. The warranty does not include batteries or where the original manufacturer's warranty shall apply. WE MAKE NO OTHER WARRANTY.

The warranty is void in the event of abuse or failure by the customer to perform specified maintenance as indicated in this manual.

NOTES:

1. ---- DENOTES PRINTED CIRCUIT BOARD.
2. ALL RESISTORS 1/4W, 5%, CC UNLESS NOTED OTHERWISE.
3. CAPACITORS MARKED MFD/VOLTS.
4. XXXXX DENOTES CALIBRATION POT LOCATED ON P.C. BOARD.
5. [XXXXX] DENOTES FRONT PANEL MARKING ASSOCIATED WITH CONTROL.
6. CHOKES MARKED HENRIES/VOLTS.
7. →)— DENOTES CONNECTION TO P.C. BOARD VIA PLUGS & JACKS.



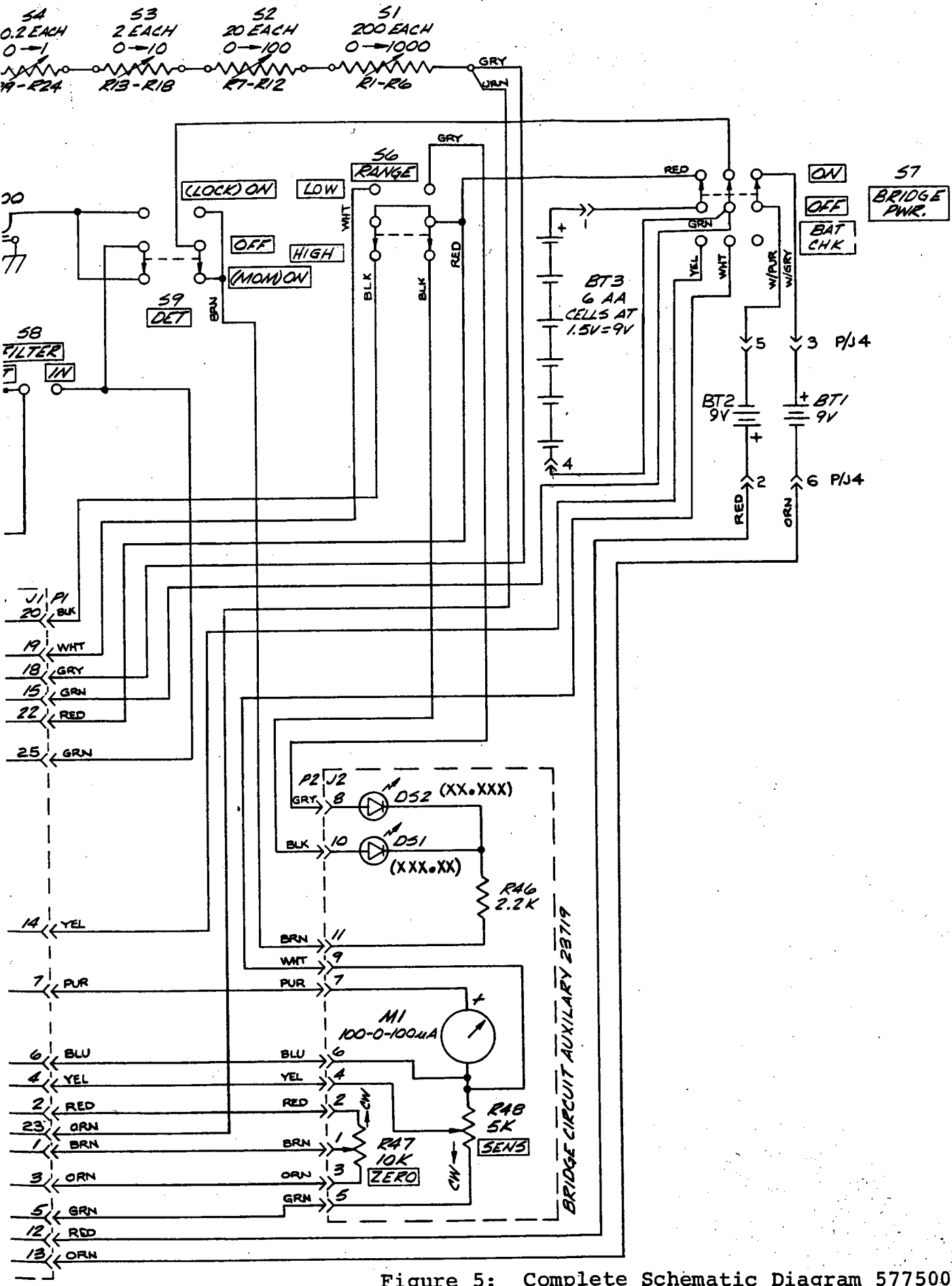
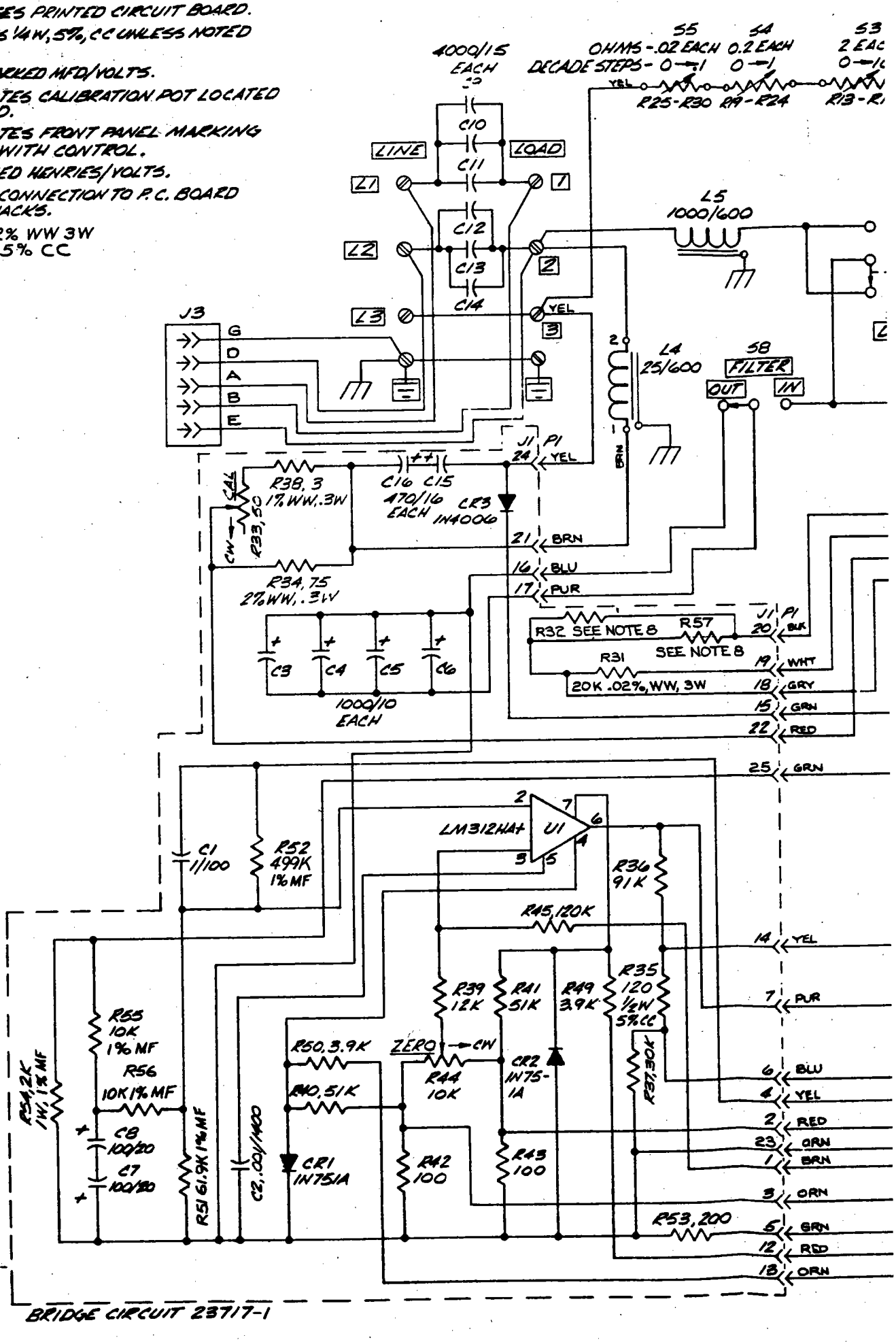


Figure 5: Complete Schematic Diagram 577500.

NOTES:

1. ---- DENOTES PRINTED CIRCUIT BOARD.
2. ALL RESISTORS 1/4 W, 5%, CC UNLESS NOTED OTHERWISE.
3. CAPACITORS MARKED MFD/VOLTS.
4. ⟨XXXXX⟩ DENOTES CALIBRATION POT LOCATED ON P.C. BOARD.
5. [XXXXXX] DENOTES FRONT PANEL MARKING ASSOCIATED WITH CONTROL.
6. CHOKES MARKED HENRIES/VOLTS.
7. →)— DENOTES CONNECTION TO P.C. BOARD VIA PLUGS & JACKS.
8. R32 IS 2K .02% WW 3W
   R57 IS 20M 5% CC



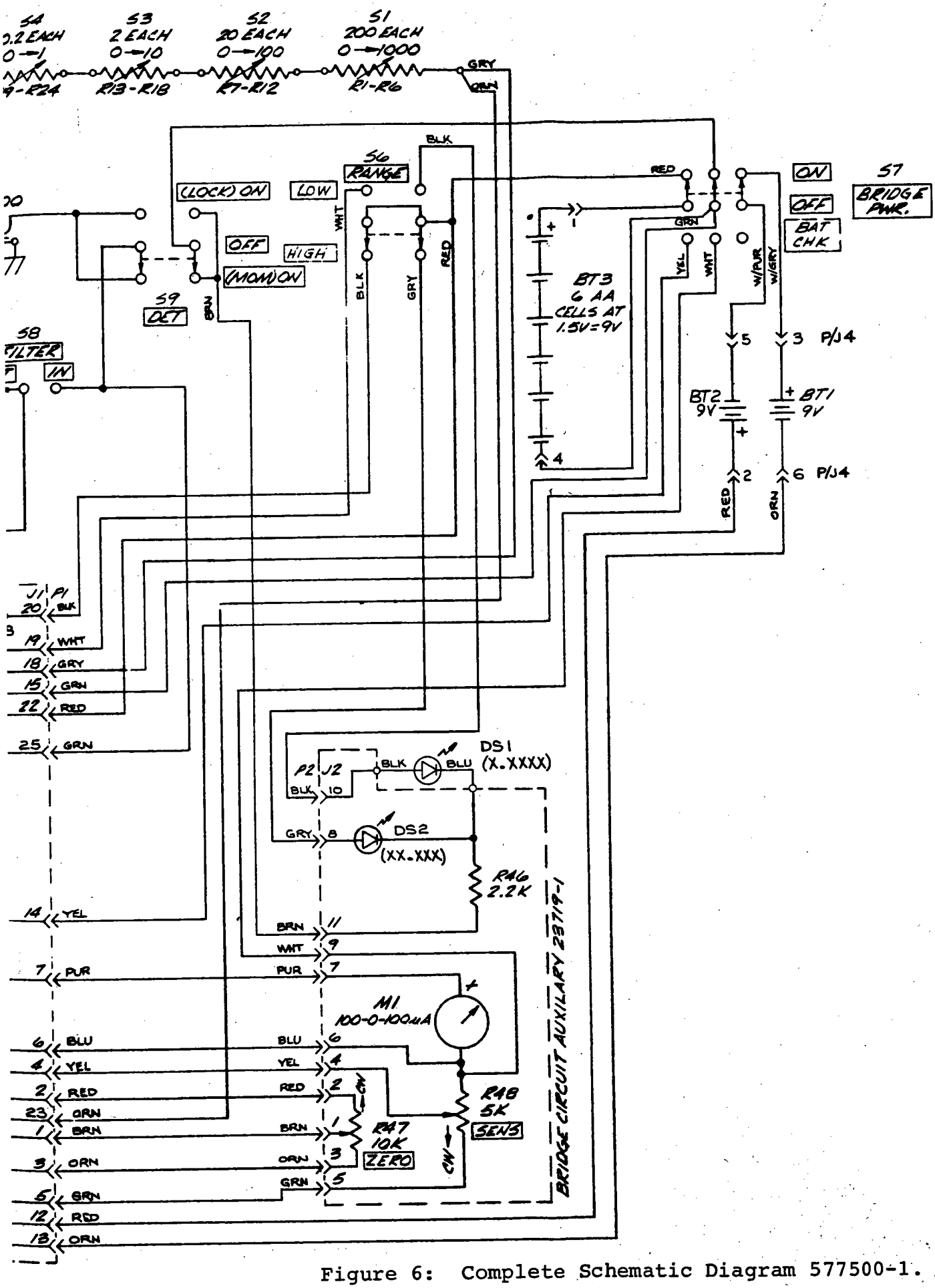


Figure 6: Complete Schematic Diagram 577500-1.