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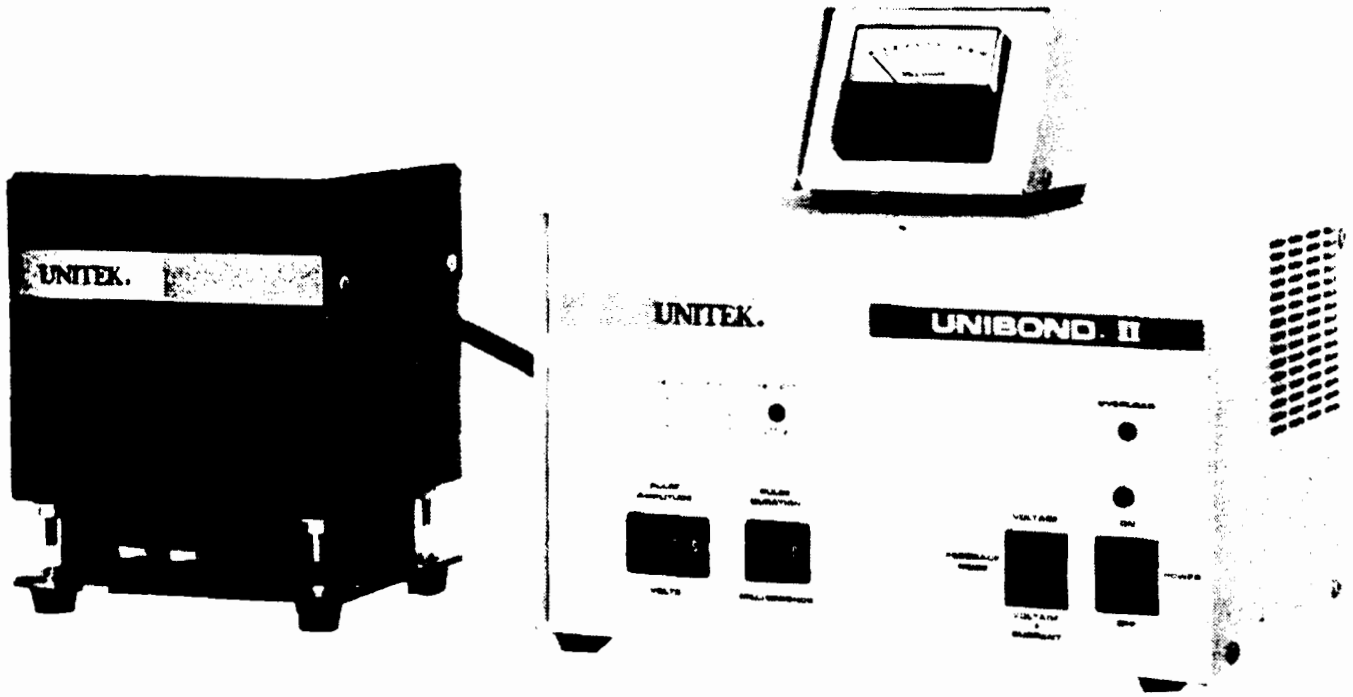
Find the *Amada Miyachi / Unitek Miyachi Unibond II* at our website: ***Click HERE***

USERS'S MANUAL
No. 990-1-050

UNITEK EQUIPMENT INC.

UNIBOND II

Constant Power/Constant Voltage Power Supply And Meter Accessory



Model UB2	Stock No. 1-191-01
Model UB2/100	Stock No. 1-191-01-01
Model UB2/230	Stock No. 1-191-01-04
Model UBM	Stock No. 10-266-01

WARNNING

Contact with voltages present in this power supply may cause serious or fatal injuries.
Read manual completely before attempting to install or operate.

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Equipment sold by UNITEK EQUIPMENT INC. (hereafter called UNITEK EQUIPMENT) is warranted as stated below. Subject to the exceptions and upon the conditions specified below UNITEK EQUIPMENT agrees to correct, either by repair, or at its election, by replacement, any defect of material or workmanship which develops within ONE (1) YEAR after delivery of the equipment (parts) to the original PURCHASER by UNITEK EQUIPMENT or by an authorized representative of UNITEK EQUIPMENT, provided that investigation and inspection by UNITEK EQUIPMENT discloses that such defect developed under normal and proper use. In no case shall UNITEK EQUIPMENT's liability exceed the price of the equipment. The following conditions apply to this warranty:

(A) All equipment claimed defective must be returned to UNITEK EQUIPMENT, TRANSPORTATION CHARGES PREPAID, and will subsequently be returned to the PURCHASER with the transportation charges prepaid.

(B) UNITEK EQUIPMENT makes no warranty concerning components or accessories not manufactured by it, such as transistors, fuses, optics, batteries, etc. However, in the event of the failure of any component or accessory not manufactured by UNITEK EQUIPMENT, UNITEK EQUIPMENT will assist the PURCHASER in obtaining, from the respective manufacturer, whatever adjustment is reasonable in light of that manufacturer's warranty.

(C) All expendables, such as electrodes, are warranted only for defects in material or workmanship which are apparent upon receipt by the customer. The warranty is negated after the initial use.

(D) UNITEK EQUIPMENT shall be released from all obligations under its warranty in the event repairs or modifications are made by persons other than its own service personnel, or an authorized representative's personnel, unless such repairs are made with the written consent of UNITEK EQUIPMENT in accordance with procedures outlined by UNITEK EQUIPMENT.

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(G) This Warranty shall be governed by the Laws of the State of California. Claims for damage in shipment must be filed promptly with the transportation company.

UNITEK MIYACHI CORPORATION

ERRATA
996-050, Rev A

Unibond II User's Manual	990-050	Unknown	A	8/96
Manual Title	**Manual Part No.**	**Date**	**Rev**	**Addendum Date**

REVISION RECORD

Revision	EO	Date	Basis of Revision
A	16701	8/96	Correct the calibration procedure.

IS:

Page 27, Paragraph 8.02.05, Voltage Listing:

+14.25 to +15.57 volts at (+) side of C24.

-14.40 to -15.60 volts at (-) side of C23.

+16.75 to +19.25 volts at (+) side of C27.

+85.00 to +95.00 volts on collector (case) of Q16 - Q22.

Page 27, Paragraph 8.02. Last sub-paragraph is 8.02.05.

SHOULD BE:

+14.25 to +15.57 volts at (+) side of C24.

-14.40 to -15.60 volts at (-) side of C23.

+16.75 to +19.25 volts at (+) side of C27.

Add new sub-paragraph:

8.02.06. Set the pulse duration to ".07." Select voltages and measure levels as follows:

SELECT VOLTS	MEASURE Q16 - Q22
3.99	170V ±5V
2.99	143V ±5V
2.00	115V ±5V
1.99	170V ±5V
0.99	120V ±5V
0.00	70V ±5V

1.00. DESCRIPTION

1.01. FEATURES - The Model UB2, Unibond II Power Supply, Stock No. 1-191-01, is specifically designed for use with either the Unitek Model 40, 46, 86, 87, 127 or 147 Parallel-Gap Weld Heads. These systems are used to: terminate fine wire on miniature components; bond ribbons to microwave devices; join flatpack leads to printed circuit boards; or bond fine wire or ribbon to thin film or thick film substrates.

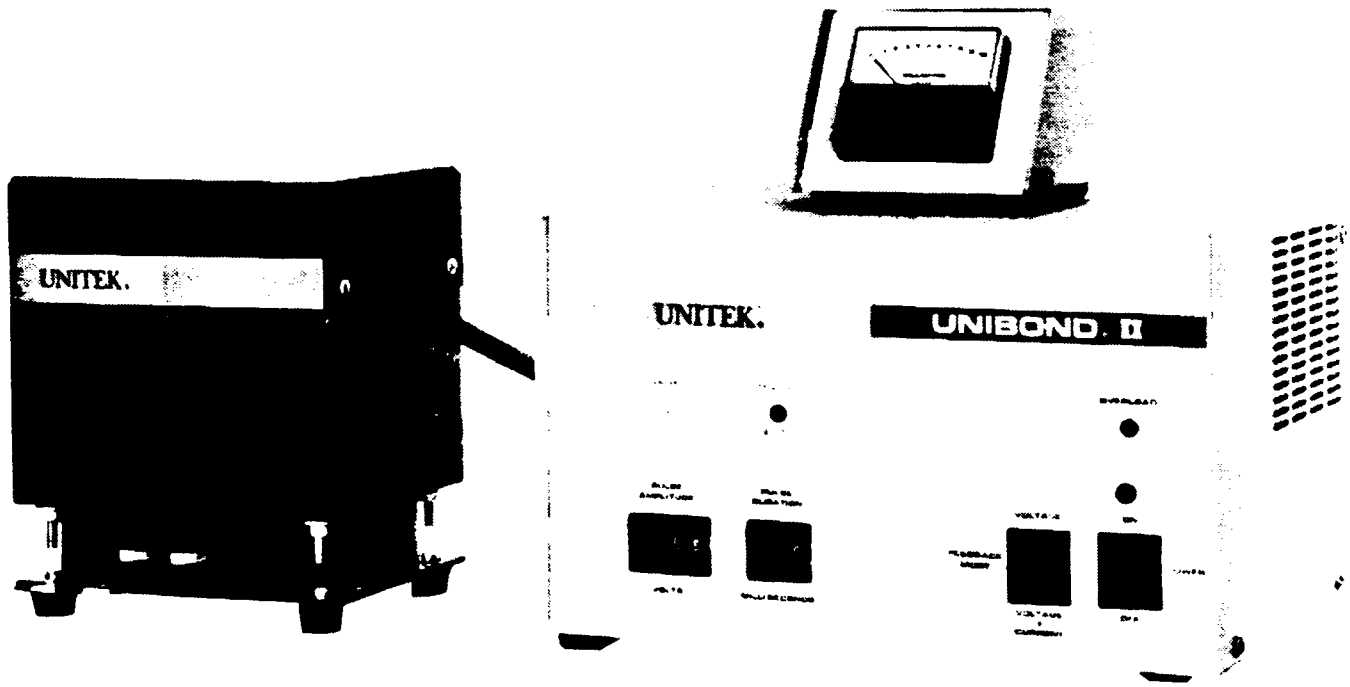


Figure 1 - Unibond II with Output Transformer and optional Meter Accessory.

1.02. The Unibond is a dual mode Constant Power/Constant Voltage Power Supply. The output PULSE AMPLITUDE and DURATION are selected using the convenient digital thumbwheel switches located on the front panel. The Unibond's exclusive solid state design uses a capacitor bank as a low impedance current source rather than bulky and expensive to maintain batteries. In the VOLTAGE FEEDBACK Mode, the output voltage is regulated so that the preset PULSE AMPLITUDE is continuously maintained at the remote sensing point which is usually at the electrodes. In the VOLTAGE + CURRENT Feedback Mode, the PULSE AMPLITUDE is increased or reduced by a maximum factor of two, in an effort to maintain the current-voltage product defined by the PULSE AMPLITUDE and WELD RESISTANCE Selectors. For a more detailed explanation, see the Theory of Operation, Paragraphs 2.10 and 2.11. The VOLTAGE + CURRENT Feedback Mode dramatically improves the consistency of the welding results in those applications where the physical parameters of the parts vary and/or the plastic zones of the materials are narrow with respect to temperature, i.e. copper.

1.03 An OPTIONAL Model UBM, Meter Accessory, Stock No. 10-266-01, allows the user to determine the resistance of the welding load, which includes the electrodes and the weldments. This Meter is required if the user intends to correctly use the Unibond II in the VOLTAGE + CURRENT Feedback Mode. The Meter is only used to determine or confirm the weld schedule for a given application. Since no particular purpose is served by leaving the meter permanently connected to the Unibond II, it is suggested that one or two meters be purchased for each production line.

2.00. SPECIFICATIONS

2.01. FEEDBACK MODES - VOLTAGE or VOLTAGE + CURRENT Feedback.

2.02. OUTPUT -

	AMPLITUDE volts	DURATION milliseconds
ALLOWABLE SETTINGS	0.01 - 0.99	1.0 - 79
	1.00 - 1.99	1.0 - 39
	2.00 - 3.99	1.0 - 19

2.03. RISE TIME - 0.5 milliseconds, nominal. Rise Time may typically vary from 0.4 to 0.6 ms depending upon the Pulse Amplitude and the impedance of the load. Rise Time can increase to 1.5 ms under oxidized workpiece conditions and is indicative of a poor weld. Rise Time is a critical parameter.

2.04. MAXIMUM OUTPUT CURRENT - 1000 amps, peak. 800 amps for 19 milliseconds.
400 amps for 39 milliseconds.
200 amps for 79 milliseconds.

2.05. MAXIMUM SECONDARY LOOP RESISTANCE - Which can be connected to the Output Transformer is 1.7 milliohms, looking back into the Output Transformer from the sensing point, usually the electrodes of the welding head. Therefore the resistance of either the Model 40, 46, 86 87, 127, or 147 and any cabling must be less than 1.5 milliohms. Excessive weld head resistance may mean a reduction in the maximum output voltage, since the Unibond cannot generate more than 5.2 volts at the terminals of the Output Transformer.

2.06. REPETITION RATE - 30 to 250 welds per minute, continuous.
30 to 500 welds per minute, intermittent.

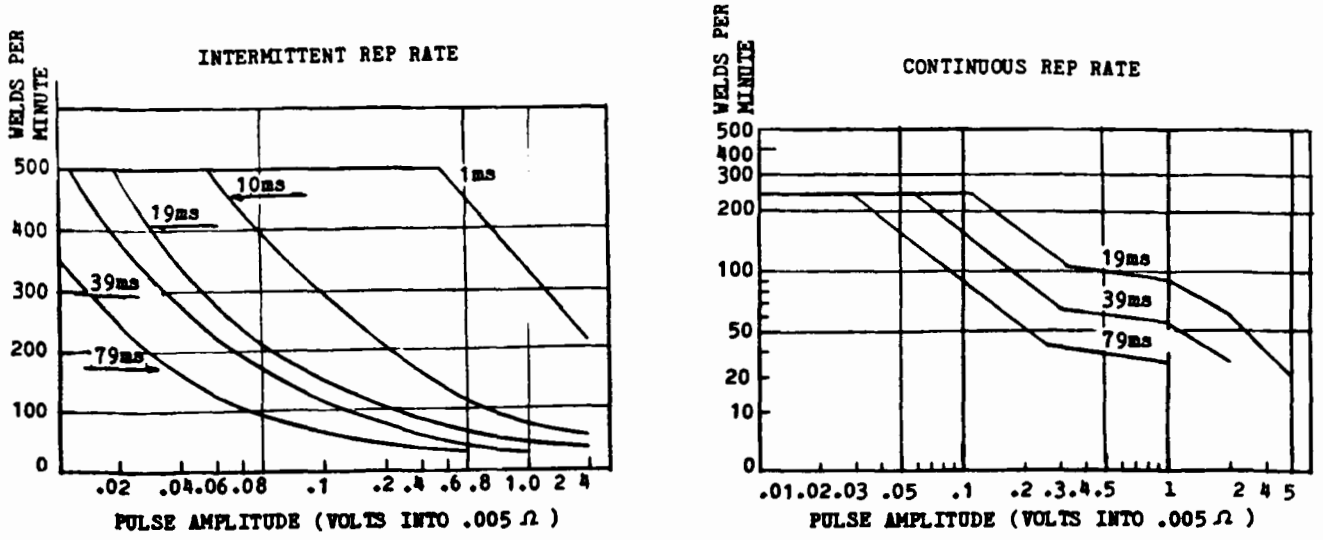


Figure 2 - Repetition Rate vs. Output Voltage using a welding head and cables, with a resistance of less than 1.5 milliohms, connected to a 5 milliohm load.

2.07. LINE/LOAD REGULATION - In the VOLTAGE FEEDBACK Mode, the Line Regulation of the Unibond is 1% total for a ±13% change in input line voltage. The Load Regulation is 1% for an 800 amp change in output current. The response time is approximately 0.5 ms.

2.08. ACCURACY - The absolute accuracy of the PULSE AMPLITUDE Thumbwheel settings, measured at the sensing point, is ±3% of setting, ±5 mv, in the VOLTAGE FEEDBACK Mode. The output voltage for any given setting will repeat within 0.1%. The width of the output pulse will be linear within 0.05 ms of the value set on the PULSE WIDTH Thumbwheels.

2.09. VOLTAGE FEEDBACK MODE - In this mode, the Unibond will maintain constant voltage, at the sensing point, as preset on the PULSE AMPLITUDE Thumbwheels. WHEN THE UNIBOND II IS USED IN THE VOLTAGE FEEDBACK MODE ITS OUTPUT WILL BE IDENTICAL TO THAT OF THE UNITEK UNIBOND I, Stock Numbers 01-124-01 through 05, AND OUTPUT TRANSFORMER, Stock Numbers 9-001-01 or 10-105-01 through 04, OPERATED IN THE MANUAL MODE.

2.10. VOLTAGE + CURRENT FEEDBACK MODE - In this mode, the Unibond will continuously increase the Pulse Amplitude to a maximum of twice, or reduce it to a minimum of one-half, of the value preset on the Pulse Amplitude Thumbwheels in an effort to maintain the output voltage-current product as indicated in Figure 24. This Mode is designed to be effective for Weld Resistances between 1 and 15 milliohms. The resistance connected between the Output Transformer Terminals and the Welding Load should not exceed 1.5 milliohms. The resistance of the Models 40, 46, 86, 87, 127, and 147 Weld Heads are 1.5 milliohms or less. The performance of the system will be reduced as the resistance between the Terminals of the Output Transformer and the Sensing Point is increased or if the Weld Resistance is less than 5 milliohms.

2.11. VOLTAGE + CURRENT FEEDBACK MODE - HOW IT WORKS - The welding process uses both heat and pressure to form a weld. Electrode pressure is used to force the metals together. Heat, generated by the resistance of the workpieces to the flow of electricity, either melts the material at the interface or at least reduces its strength to a level where the surface becomes plastic. When the flow of current stops, the electrode force is maintained for the fraction of a second required for the weld to cool and solidify.

Figure 3 illustrates why the workpieces melt at their interface. The surfaces of metal are quite rough if they are examined on a molecular scale. When the metals are forced together with a relatively small force some of the peaks make contact. On those peaks where the contact pressure is sufficiently high the oxide layer breaks, forming a limited number of metal-to-metal bridges. The weld current is distributed over a large area as it passes through the bulk metal. As it approaches the interface, the current is forced to flow through these metallic bridges. This "necking down" increases the current density, generating enough heat to cause melting. As the first of these bridges melt and collapse, new peaks come into contact, forming new bridges and additional current paths. The resistance of the molten metal is higher than that of the new bridges, so that the current flow transfers from bridge-to-bridge. This process continues until the entire interface is molten. When the current stops, the electrodes rapidly cool the molten metal which solidifies, forming a weld.

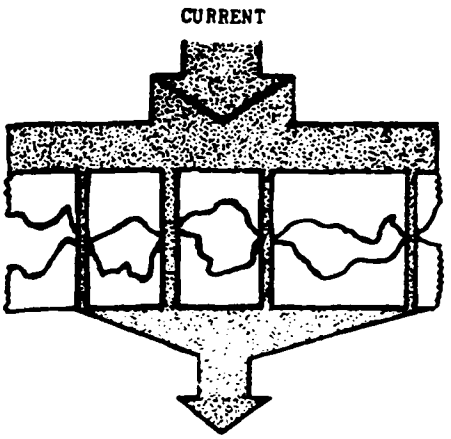


Figure 3

Figure 4

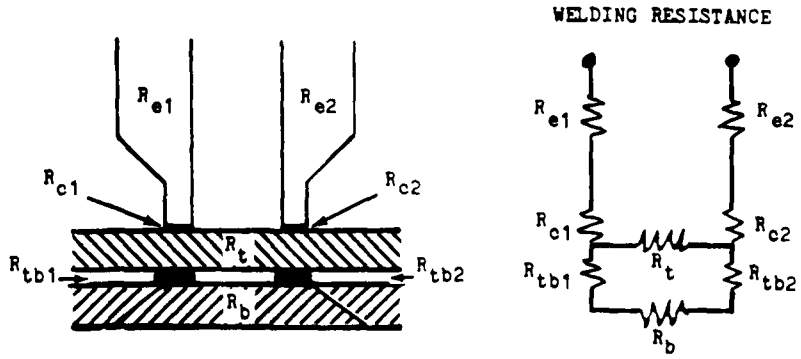


Figure 4 shows the mechanical and electrical equivalents of a typical weld. The electrode force is relatively low so that the contact resistance between the electrodes and the ribbon, R_{c1} and R_{c2}, remains high with respect to the resistance of the workpieces, R_t and R_b. The contact resistances between the two workpieces, R_{tb1} and R_{tb2}, are also larger than R_t or R_b, but are usually of the same magnitude as R_{c1} and R_{c2}. As the weld cycle progresses, the heat generated at the interface between the electrodes and the ribbon causes this interface to become "plastic" and the electrodes "seat" themselves into the material causing the contact resistance to become quite low. Simultaneously the heat generated by current flowing through R_{tb1} and R_{tb2} must be sufficient to cause the faying surface of the workpieces to form a bond. It is not uncommon for the resistance between the electrodes at the end of the welding cycle to be less than one-third of the initial resistance. In this case the change in contact resistances masks the increase in the resistance of the workpieces caused by the increased temperature. The welding resistance changes as indicated in Figure 5a.

Figure 5

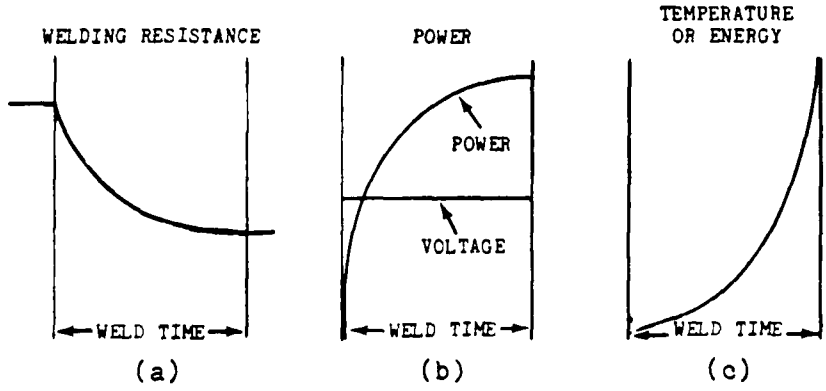


Figure 5a illustrates the resistance between the electrodes, as a function of time, during a normal parallel gap weld. At the beginning of the weld, the contact resistances between the electrodes and the top weldment and between the two weldments are relatively high. As the materials begin to flow, these resistances drop considerably more than the increase in resistance caused by the increase in temperature of the weldments. In a constant voltage application, the current will continue to increase as the total welding resistance decreases. Since temperature and energy are the integral of power with respect to time, the heating rate near the end of the welding cycle is considerably greater than at the beginning of the cycle, as illustrated.

Figure 5b shows the power delivered to the workpieces in a Constant Voltage System. Note that:

$$\text{Power} = \text{Voltage} \times \text{Current} = (\text{Voltage})^2 / \text{Resistance}$$

$$\text{Temperature} = k \times \text{Energy} = k \times \text{Power} \times \text{Time}$$

The Energy delivered to the workpieces is illustrated in Figure 5c. It is apparent, from Figure 5c, that in a Constant Voltage System where the the contact resistance controls the welding resistance, the power delivered to the workpieces is much greater at the end of the cycle than at the beginning. Therefore, it becomes very difficult to compensate for small changes in the physical parameters of the workpieces and electrodes.

Figure 6

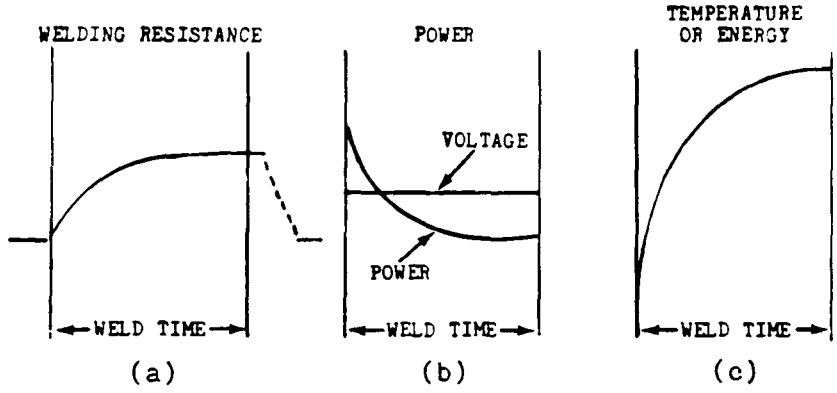
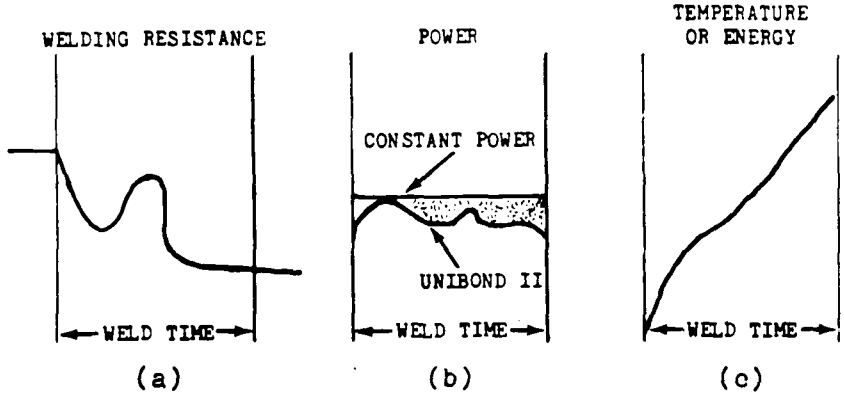


Figure 6 illustrates that a Constant Voltage System is ideal for those cases where the welding resistance remains constant or increases during the welding cycle. As shown in Figure 6b the power is lowest at the end of the cycle and is almost constant, which means that the energy and temperature are changing at nearly constant rates. This makes the process easier to control.

A Constant Current System continues to deliver increasing amounts of power to the workpieces since their resistances, R_{tb1} and R_{tb2}, continue to increase during the welding cycle. In a Constant Current System, the power increases at the same rate as the resistance increases. This system is difficult to control since maximum power is delivered to the workpieces at the critical time as indicated by Figure 5c. A second problem is that the energy dissipated at the interface between the electrodes and workpiece in the beginning of the cycle is usually sufficient to cause spitting and/or sticking which will reduce the electrode life.

Figure 7



In a Constant Power System, Figure 7. the power will remain constant regardless of what changes occur in the welding resistance. This makes the process easier to control whenever:

1. The contact resistance is large with respect to the resistance of the workpieces.
2. The workpieces have very narrow "plastic zones" such as copper.

The Unibond II maintains Constant Power as illustrated in Figure 7. The circuitry of the Unibond II is so unique that Unitek has applied for a patent. In the VOLTAGE + CURRENT Mode, the Unibond II will dynamically increase or reduce the amplitude of the welding pulse in an effort to maintain a constant voltage-current product, constant power, at the electrodes.

2.12. WELD RESISTANCE COMPENSATION - Continuously adjustable from 1 to 15 milliohms.

2.13. WELD FIRE LOCKOUT FEATURE - Prevents the Unibond from firing if: (1) the magnetic circuit of the Output Transformer Core has not been fully reset by the Unibond's internal circuitry; or (2) the PULSE AMPLITUDE and PULSE DURATION Thumbwheels are improperly set.

2.14. OVERLOAD PROTECTION FEATURE - If the welding load draws more than 1000 amps or if the output transistors are caused to operate in an unsafe region as a result of a radical change in load resistance, the Unibond will automatically terminate the output pulse prior to the time preset on the PULSE DURATION Thumbwheels and illuminate the OVERLOAD INDICATOR. Any attempt to fire the Unibond before the Output Transformer has been reset by the Unibond, will also illuminate the OVERLOAD INDICATOR.

2.15. POWER REQUIREMENTS - 100, 115, 208 or 230 Volts ±13%, 50-60Hz
Uses 2 amp Circuit Breaker at 100 or 115 volts
or 1 amp Circuit Breaker at 208 or 230 volts.

2.16. PHYSICAL DATA -

		HEIGHT	WIDTH	DEPTH	WEIGHT
UNIBOND	(inch)	7.4	11.7	9.2	20 lbs
	(cm)	18.8	29.7	23.4	9 Kg
OUTPUT TRANSFORMER	(inch)	7.5	6.6	8.8	36 lbs
	(cm)	19.1	16.8	22.4	16 Kg

2.17. **CONTROLS**

2.17.1. FEEDBACK SELECTOR - Selects either the VOLTAGE FEEDBACK MODE or VOLTAGE + CURRENT FEEDBACK MODE.

2.17.2. PULSE AMPLITUDE - Can be preset in 0.01 volt increments between 0.01 and 3.99 volts. Allowable settings are shown in 2.02. and on the Unibond's front panel.

2.17.3. PULSE WIDTH - Can be preset in 1 millisecond increments to any value between 1 and 79 milliseconds. Allowable settings are shown in 2.02.

2.17. CONTROLS

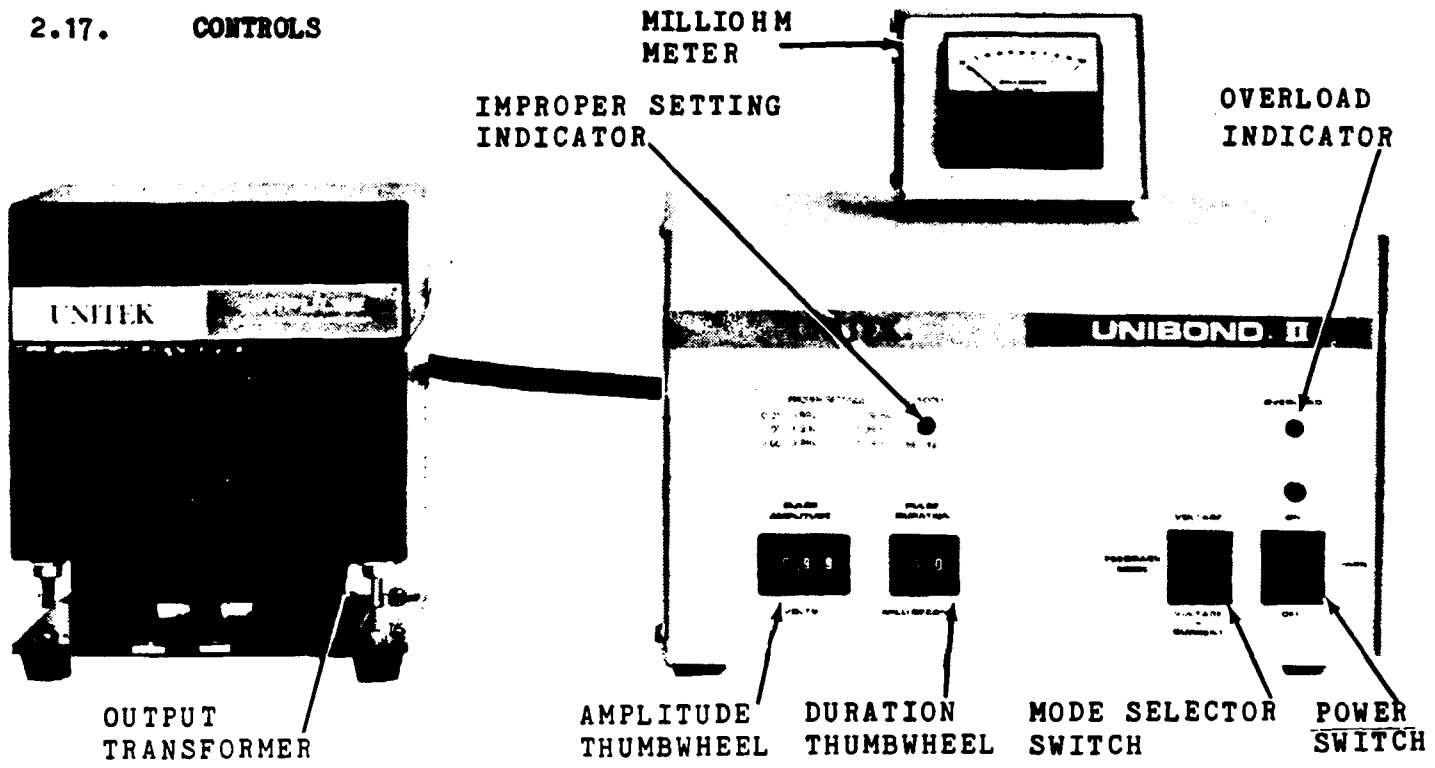


Figure 8A - Unibond II with with optional Meter Accessory, front view.

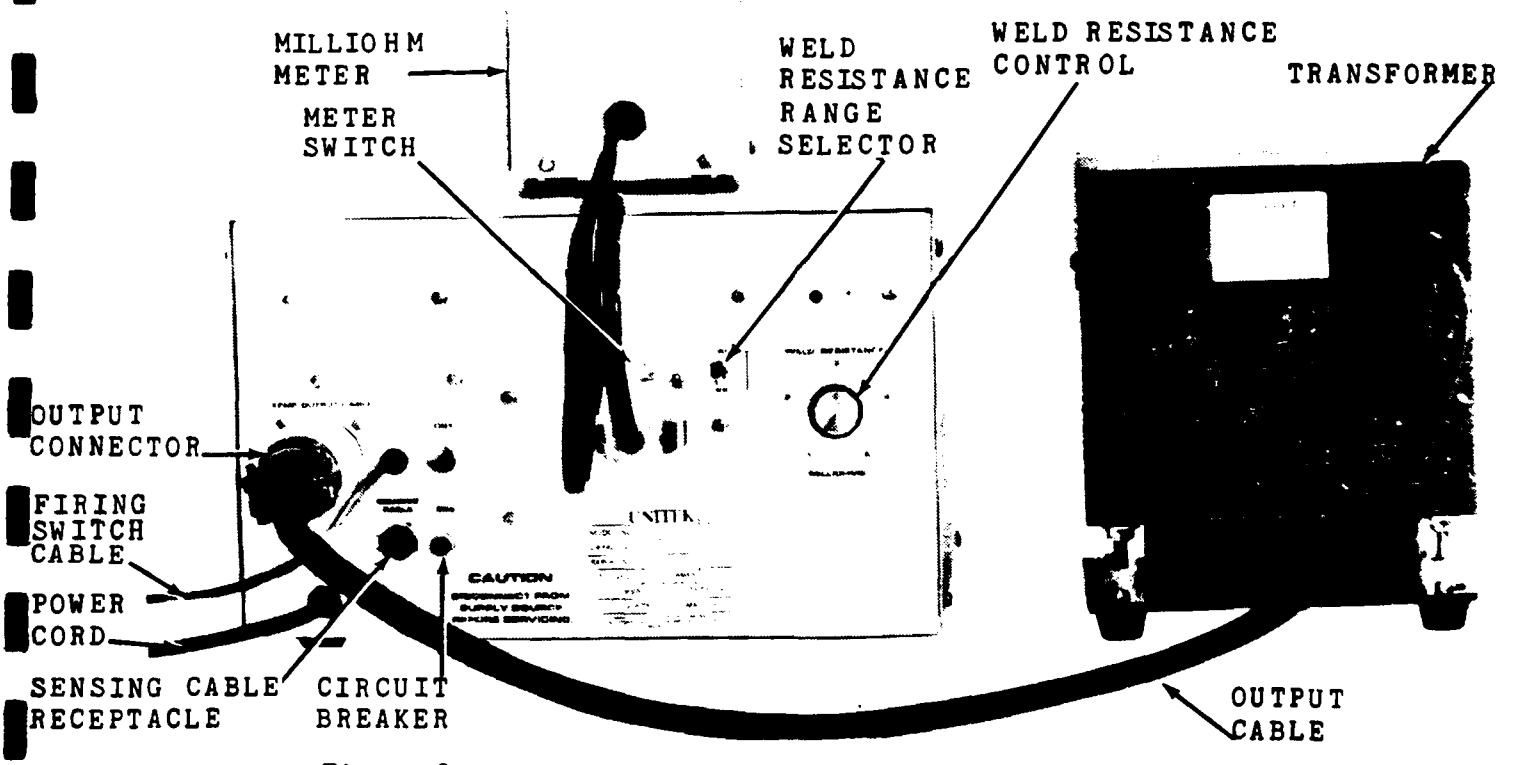


Figure 8B - Unibond II with with optional Meter Accessory, rear view.

2.17.4. IMPROPER SETTING INDICATOR - Will illuminate whenever the combination of Pulse Amplitude and Pulse Width are not within the allowable settings as shown in 2.02. When this Indicator is illuminated, the Unibond will be inhibited from further operation until the settings are corrected.

2.17.5. OVERLOAD INDICATOR - Will illuminate whenever the welding load or intermittent rep rate causes the output transistors to operate in an unsafe region. See 2.14.

2.17.6. AUDIBLE WELD SIGNAL - Will sound whenever the Unibond's output meets the parameters preset on the Pulse Amplitude and Pulse Duration Thumbwheels. If the Overload Indicator is illuminated during the welding cycle, the Unibond will not sound a tone. The loudness of the tone can be adjusted, within reasonable limits, by adjusting the potentiometer R16 on the Control Board.

2.17.7. WELD RESISTANCE RANGE SELECTOR AND CONTROL (Rear Panel) - Allows the output resistance of the Unibond to be matched to that of the welding load. By using the Selector Switch and Control, the Resistance can be set to any value from 1 to 15 milliohms. The Weld Resistance is measured at the sensing point, usually the electrodes of either the Model 50, 86, or 87 Weld Heads. This Control should be set with the aid of the Unibond Meter Accessory or an oscilloscope.

2.17.8. METER SWITCH AND CONNECTOR - The Connector is used to connect the Unibond Meter to the Unibond II. The Meter will display the resistance of the load connected to the sensing point whenever the Meter Switch is pressed.

2.18. SENSING CABLE - Allows the Unibond to sense the voltage at the electrodes of the Welding Head. If the Sensing Cable is disconnected or reversed, it will cause an OVERLOAD which may destroy small electrodes such as Unitips.

2.19. METER ACCESSORY

2.19.1 The Meter Accessory is a direct reading milliohmmeter with a range of 1-30 milliohms. The range of the meter corresponds to the position of the Weld Resistance Range Switch. An audible signal will sound to indicate that the Force Firing Pressure Switch has closed in the Welding Head. The purpose of this Meter is to measure the weld resistance, at the preset welding force, immediately before and after making a weld. In order to obtain an accurate reading, the electrodes must not be removed from the workpiece during the measurement process. The Meter serves no purpose except to assist the user in correctly setting the Weld Resistance Control on the rear of the Unibond II. The correct setting is the approximate average of the resistance before and after the weld.

2.19.2. A second use for the Meter Accessory is to accurately measure the resistance of the welding head and cables. This can be a valuable tool in critical applications where small changes in contact or cable resistances effect the quality of the weld.

2.19.3. The Milliohmmeter is accurate within 5% of full scale when properly calibrated with a 10 milliohm ±2% dummy load.

2.19.4. PHYSICAL DATA - 3.4 in High x 4.2 in Wide x 5.3 in Deep x 2.1 lb.
METER ACCESSORY - 8.7 cm High x 10.7 cm Wide x 13.5 cm Deep x 1 kg.

2.20. TYPICAL SYSTEMS

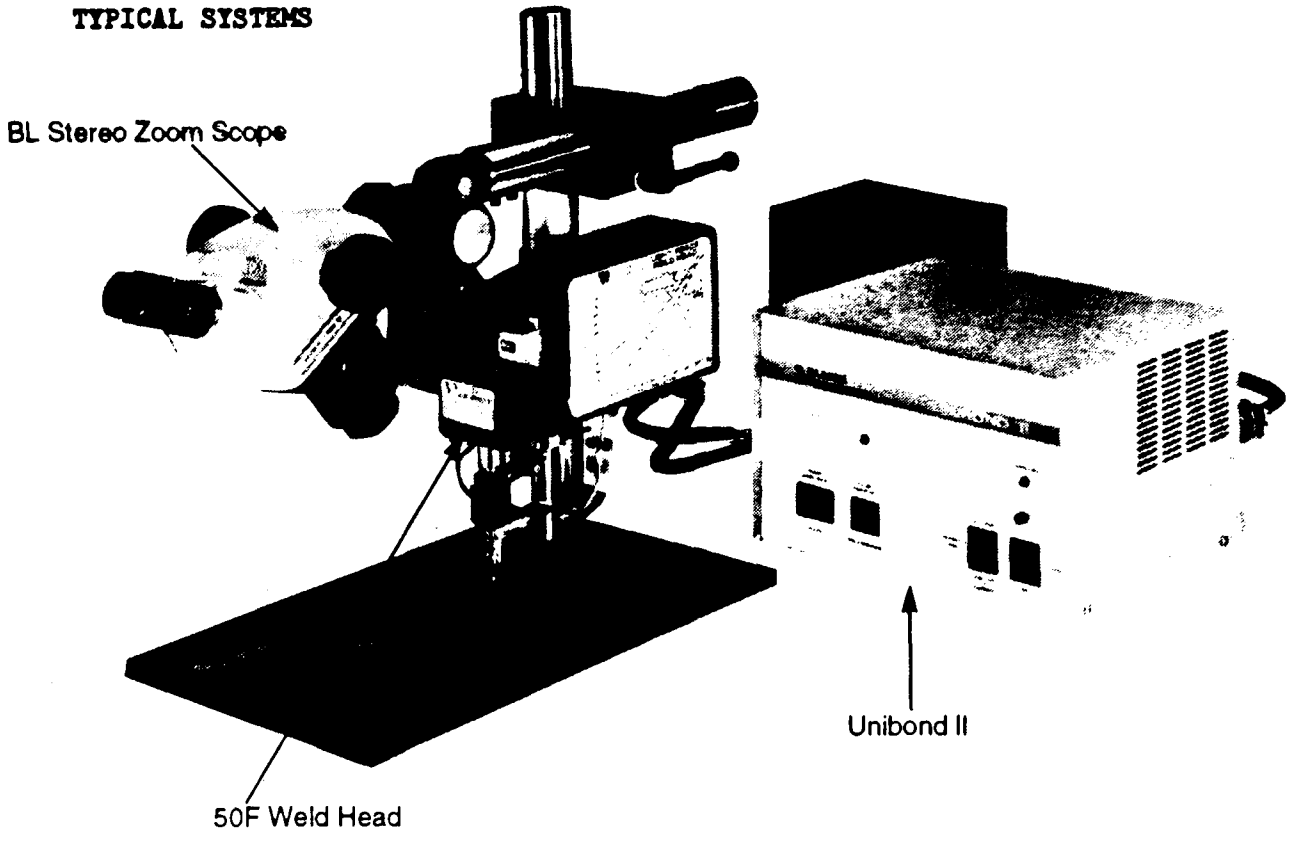


Figure 9A - Typical Unibond II System using Model 50F.

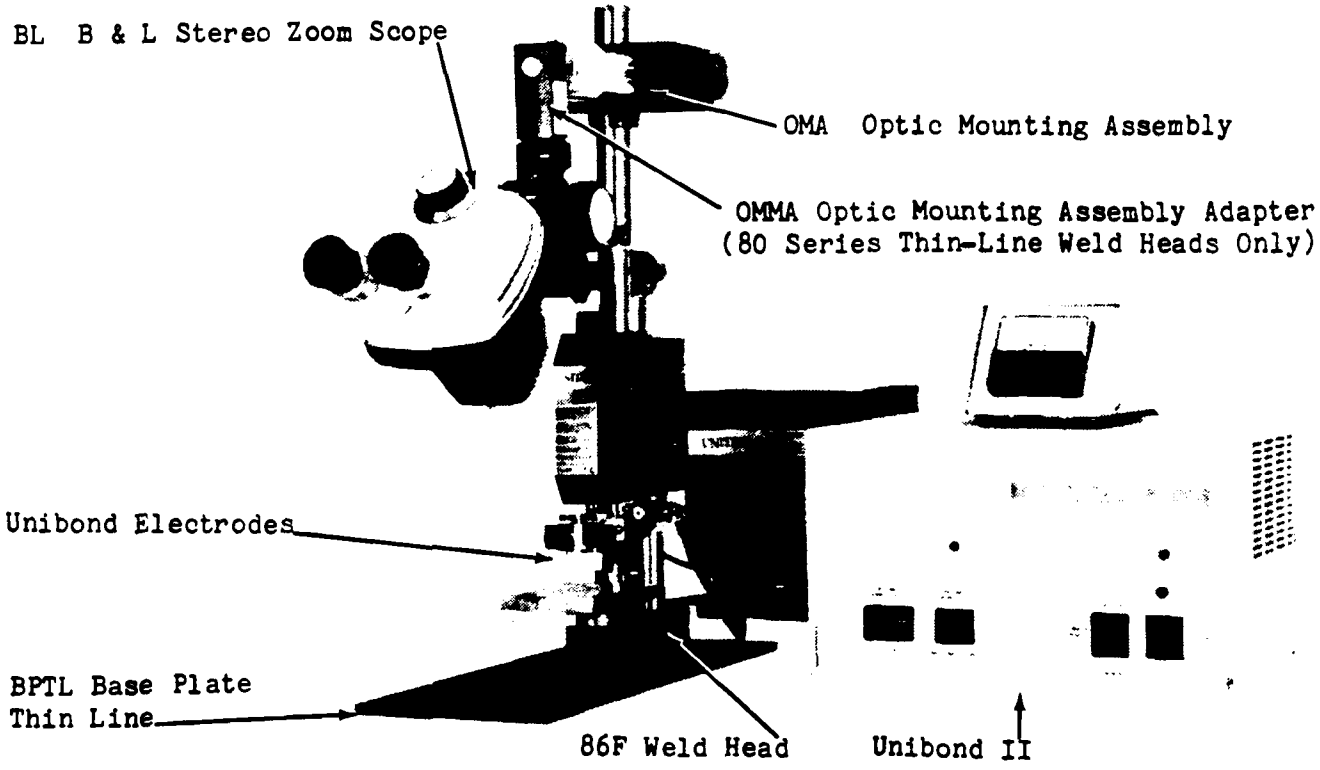


Figure 9B - Typical Unibond II System using Model 86F.

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3.0. MACHINE INSTALLATION

3.01. The Unibond II is shipped in a single container which contains the Control and the Output Transformer. The Meter Accessory is shipped in a separate carton.

3.02. CONNECT UNIBOND FOR PROPER LINE VOLTAGE - The Unibond is a multivoltage power supply. Refer to the Connection Diagrams shown in Figure 36. It can be connected for 100. 115. 208 or 230 volts. 50 or 60 Hz. by changing (a) the Circuit Breaker (b) the Plug on the end of the Line Cord and (c) the position of the jumpers on the Control Transformer (Figure 33) as indicated below:

TABLE I - Unibond II Control Transformer Connections

VOLTAGE	CIRCUIT BREAKER	TERMINAL NUMBER 1	2	3	4	5	6
100 VOLTS	2 Amp	LINE 1	TERM 5	N/C	TERM 1	LINE 2	N/C
115 VOLTS	2 Amp	LINE 1	N/C	TERM 6	TERM 1	N/C	LINE 2
208 VOLTS	1 Amp	LINE 1	TERM 4	N/C	TERM 2	LINE 2	N/C
220 VOLTS	1 Amp	LINE 1	N/C	TERM 4	TERM 3	LINE 2	N/C
230 VOLTS	1 Amp	LINE 1	N/C	TERM 4	TERM 3	N/C	LINE 2

N/C = No Connection
Pilot Light is always connected between Terminals 4 and 6.

3.03. Connect the Output Transformer to the Unibond by attaching the cable from the Output Transformer to the Transformer Output Connector located on the rear panel.

3.04. Install the Weld Head and Optics in accordance with the instructions found in the Instruction Manual for the Weld Head.

3.05. Connect the Remote Sensing Cable from the Weld Head to the Sensing Cable Connector on the rear of the Unibond. Connect the Firing Switch Cable from the Unibond to the Firing Switch Cable from the Weld Head.

4.00. ELECTRODE INSTALLATION AND MAINTENANCE

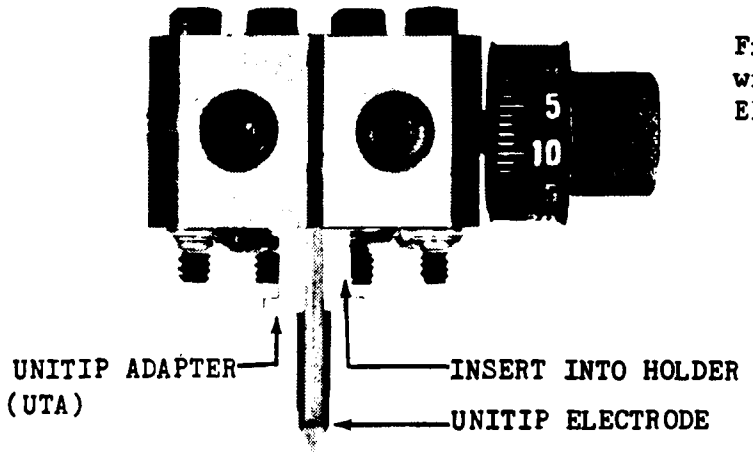


Figure 11 - Model 86 Electrode Holder with Model UTA Unitip Adapter and Unitip Electrode partially installation.

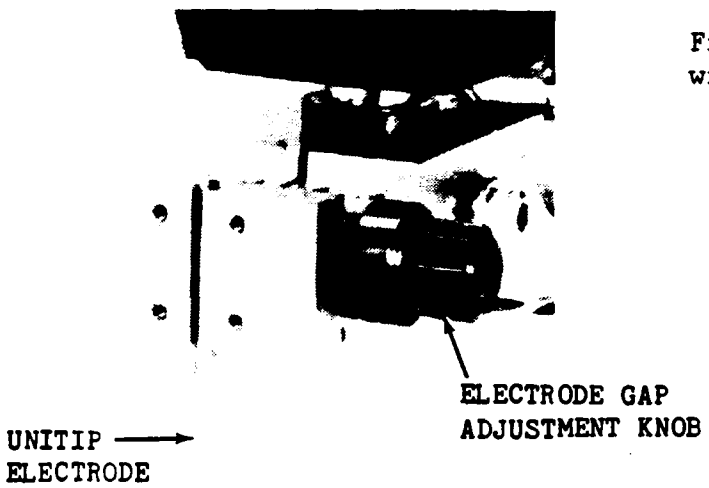


Figure 12 - Model 87 Electrode Holder with Unitip Electrode fully installed.

4.01 INSTALLATION OF UNIBOND(R) ELECTRODES - MODELS 50UB AND 86

4.01.1. Set the Weld Head Firing Force to the desired value. Use the Direct Reading Force Indicator on the top of the Model 86 Weld Head. On the Model 50UB Weld Head Weld Head, use the Force Indicator and the Force Conversion Table located on the weld head side panel.

4.01.2. Loosen the Electrode Holder Clamp Screws. Set the Electrode Gap Adjustment Knob for maximum gap width (past 35) and insert the Unibond Electrodes into the Holders until the shoulder of each Electrode contacts its holder. While loosely holding the Electrodes in place, return the Electrode Gap Adjustment Knob to its full counterclockwise position. Make sure the Electrodes are: parallel to each other;perpendicular to the work positioner; and the Electrode Faces are at the same level. Tighten the Clamp Screws. IF THE SCREWS ARE OVER-TORQUED, THE FLEXURES WILL DEFORM AND CAUSE MISALIGNMENT OF THE ELECTRODES AND A DRAMATIC REDUCTION IN THE LIFE OF THE FLEXURE.

4.01.3. Adjust the Electrode Gap Adjustment Knob to produce the desired Electrode Gap.

4.02. INSTALLATION OF UNITIP(TM) ELECTRODES - MODELS 50UB AND 86

4.02.1. Loosen the Electrode Holder Clamp Screws. Set the Electrode Gap Adjustment Knob for maximum gap width (past 35) and insert the Model UTA Unitip Adapter into the Electrode Holder in place of the Unibond Electrodes. Position it as shown in Figure 11, with the flanged ends "down" and the half-round slots facing each other. Insert the Unitip between the Adapter halves so that it fits snugly against the curved inner surfaces of the UTA. Be certain that the gap in the Unitip is aligned with the gap between the UTA Holders.

4.02.2. Return the Electrode Gap Adjustment Knob to its fully counterclockwise position and tighten the Clamp Screws. IF THE SCREWS ARE OVER-TORQUED, THE FLEXURES WILL DEFORM AND CAUSE MISALIGNMENT OF THE ELECTRODES AND A DRAMATIC REDUCTION IN THE LIFE OF THE FLEXURE.

4.02.3. With the exception of the Models 50A and 50A/UB, the use of Unitip Electrodes should be limited to pedal actuated weld heads. Their use in other air actuated weld heads requires great caution in adjusting electrode force because of the potential of damaging the electrodes by applying excessive force. Table II gives the maximum permissible force for each Unitip.

TABLE II - MAXIMUM UNITIP FORCE

UNITIP MODEL	MAX FORCE (kgf)	MAX FORCE (oz)
→UTM111L	0.94	33
UTM112L	0.94	33
→UTM152L	0.47	17
UTM222L	3.75	132
→UTM111C	0.94	33
→UTM112C	0.94	33
→UTM222C	3.75	132
UTM224C	3.75	132
UTM237C	4.57	161

4.03 INSTALLATION OF UNITIP(TM) ELECTRODES - MODELS 50 AND 87

4.03.1. Open the Electrode Clamping Thumbscrew on the Model 50. Set the Electrode Gap Adjustment Knob on the Model 87 for maximum gap width (past 35). Insert the Unitip between the concave inner surfaces of the electrode holder arms.

4.03.2. Rotate the Unitip so that the vertical line on the Unitip, formed by the insulated electrode gap, is exactly between the two electrode holder arms.

4.03.3. Firmly tighten the Electrode Clamping Thumbscrew on the Model 50. Return the Electrode Gap Adjustment Knob to its fully counterclockwise position. This action will secure the Unitip in place.

4.04. VOLTAGE SENSOR CABLE

4.04.1. Be sure that the screws attaching the Sensing Cable to the Electrode Holders are securely tightened. Erratic operation can result if they are loose. Verify that the Red Sensing Lead is connected to the left-hand side of the Electrode Holder and that the Black Sensing Lead is connected to the right-hand side of the Electrode Holder. The Unibond II is the only Unitek Equipment Power Supply which uses remote voltage sensing.

4.05. ELECTRODE MAINTENANCE

4.05.1. New Unibond and Unitip electrodes must be dressed to ensure that the electrode face is parallel to the workpiece surfaces. Dress both electrode types by following 4.05.2 through 4.05.4.

4.05.2. Periodic resurfacing is required to remove oxides and welding debris from parallel gap electrodes. Intervals at which this service is performed is dependent upon usage. Electrodes can be resurfaced using the following procedure.

4.05.3. Ensure that the Unibond II Power Supply "ON/OFF" Switch is in the "OFF" position. Do not change the Electrode Gap Adjustment Knob from its normal setting.

4.05.4. Cleaning of electrodes on the production line should be limited to the use of #600 grit emery paper or a piece of non-vitreous ceramic. Place emery paper between the Electrodes and the Work Positioner or working surface. Actuate the Footpedal to bring the Electrodes into light contact with the paper and then slowly pull the paper out toward you, keeping the paper parallel to the Electrode Gap. Repeat as necessary until the tracks on the paper are the same width when minimum force is applied to the Electrodes. Clean polished electrode face with a small, lint free, swab saturated in alcohol. A dental mirror is an excellent inspection tool.

5.00 OPERATION

5.01. PARALLEL GAP WELDING - A certain amount of experimentation is necessary to achieve the proper weld force and gap setting for a specific application. A typical starting point with Unibond electrodes is an electrode force setting of 32 ounces with a 0.010 inch electrode gap.

5.02. VARIABLES FOR PARALLEL GAP WELDING

5.02.1. **GAP** - The larger the distance between the electrodes, the Gap, the greater the energy required to make a given bond.

5.02.2. **FORCE** - Increasing the electrode force lowers the contact resistance between the weldments and between the weldments and the electrodes, therefore, more energy is required to make a given weld. The Force, in most cases, should be in the knee of the Force vs Contact Resistance Curve. See Figure 18.

5.02.3. **AREA OF ELECTRODE FACE** - The larger the electrode area in contact with the weldments, the lower the pressure and the larger the size of the bond area. A larger face requires more energy provided the contact resistances do not change drastically. Lower pressure, force per unit of area, on the weldments is more likely to cause spitting or sticking. For conductive materials, make that portion of the electrode face which actually contacts the weldment as small as practical.

5.02.4. **PULSE DURATION** - the longer the Pulse Duration, the greater the penetration of the bond into both weldments and the greater the effect of the heat upon the metallurgical structure of the weldments. In general, use pulse durations less than 15 ms for bonding and durations greater than 20 ms for brazing or reflow soldering. Pulse Duration is critical, and should be kept to a minimum, for conductive materials, such as copper. Pulse Duration is also critical when welding resistive materials in the Voltage + Current Feedback Mode. See Figures 17 and 19.

5.02.5. **ELECTRODE MATERIALS** - use RWMA 2 copper electrodes for resistive and/or hard materials such as gold plated Kovar and nichrome. Use molybdenum or tungsten electrodes for conductive or soft materials such as copper and gold.

5.03. Select the appropriate electrodes. Place the Unibond in the VOLTAGE Mode.

5.04. Starting with an AMPLITUDE of .5 volt and a DURATION of 2 ms, systematically determine the appropriate combination for satisfactory bonds. For a given AMPLITUDE, gradually increase the DURATION until acceptable welds are made. Increase the AMPLITUDE by .2V and repeat the process. This method will determine the DURATION range required to make welds for several values of AMPLITUDE. The Duration becomes more critical as the Amplitude is increased. Plot the values obtained as illustrated to the right:

Figure 13 illustrates combinations of Pulse Amplitude, Duration and Force settings which result in acceptable bonding of .003 x .015 gold plated Kovar ribbon to an unplated .015 inch wide, 1 oz copper trace on a glass epoxy printed circuit board. Model EU1000 Copper Unibond Electrodes were used with the Electrode Gap set to .012 inch.

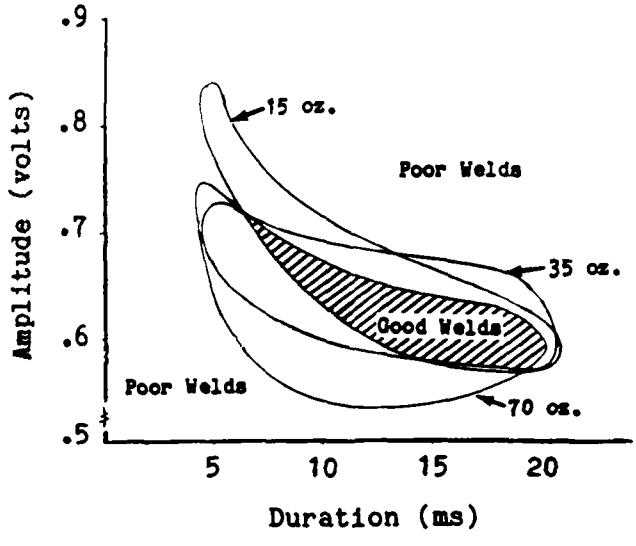


Figure 13

5.05. Figure 14 shows the voltage and current waveforms obtained from welding gold plated Kovar to an unplated copper trace in the Constant Voltage Mode using 35 oz Electrode Force, .010 inch Gap with a Pulse Amplitude of .62 V with a Duration of (a) 10 ms and (b) 37 ms. The ripple on the voltage waveform, in 14(a), after 6 ms is caused by melting. The Current in 14(b) started at 120 amps and decreased to 60 amps within the first 15 ms after which time it remained constant. It is this characteristic which makes the Constant Voltage Mode ideal for this type application.

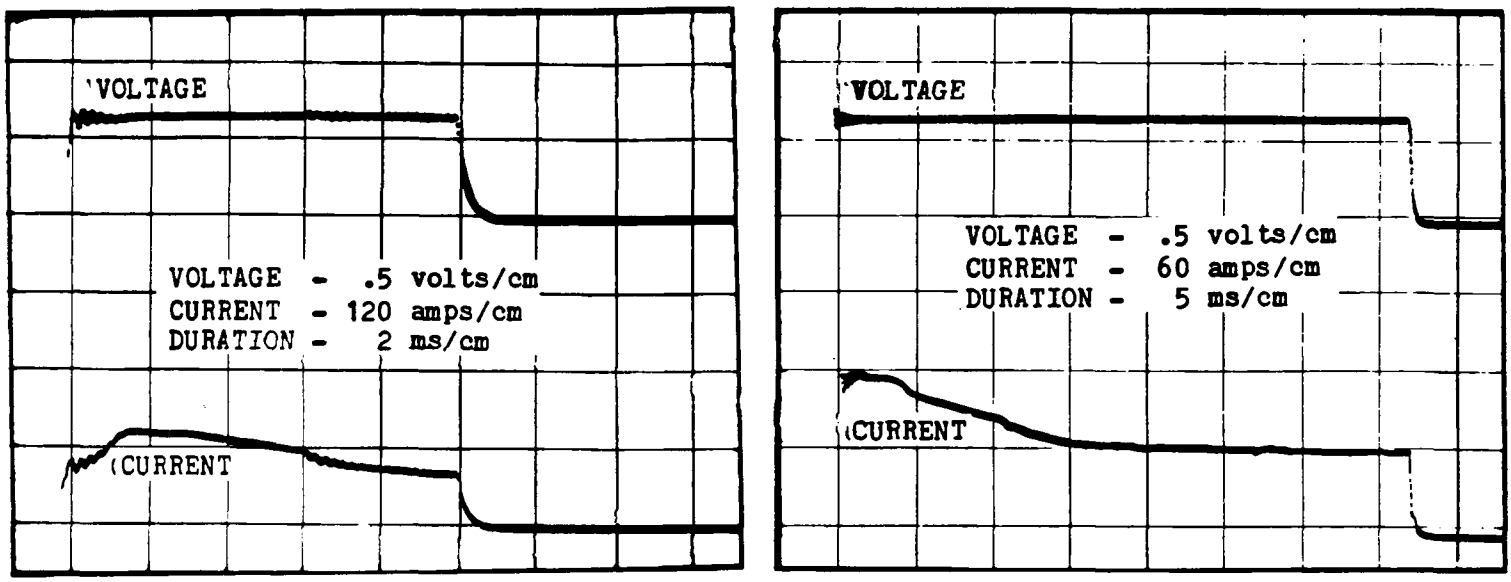


Figure 14 - Gold plated Kovar ribbon welded to an unplated 1 oz copper trace in the Constant Voltage Mode for (a) 10 ms and (b) 37 ms.

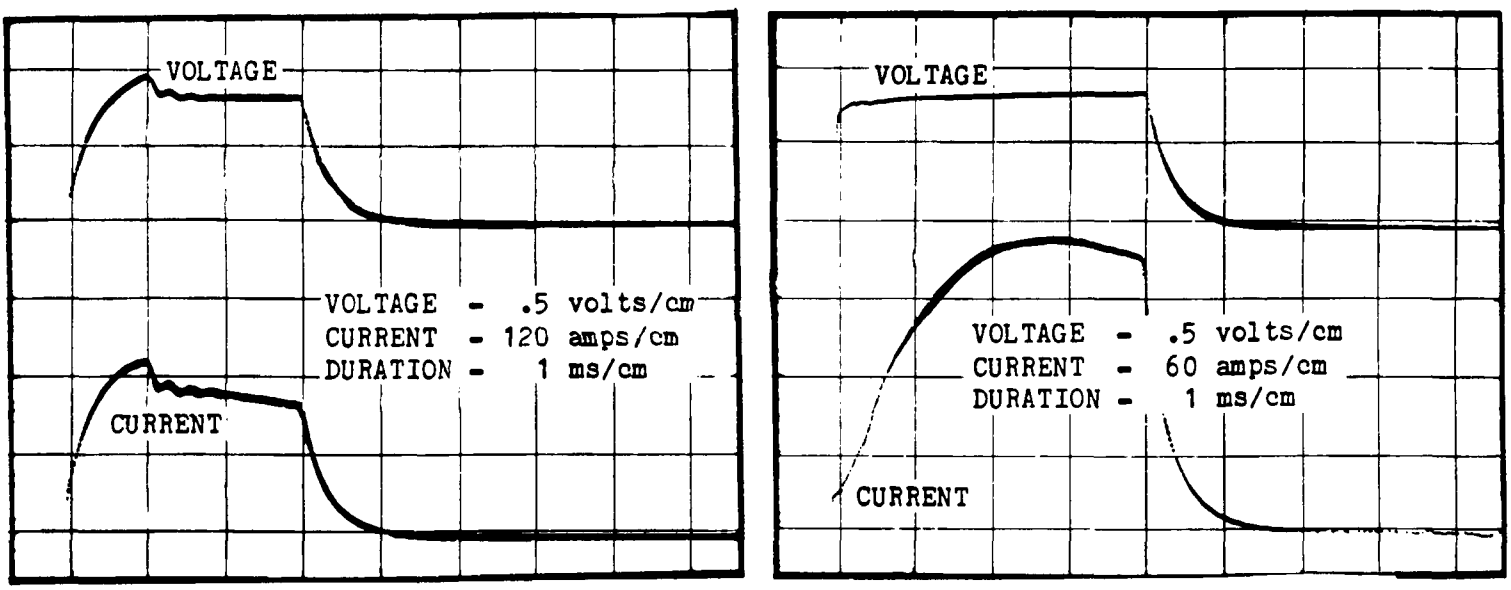


Figure 15 - Copper ribbon welded to an unplated 1 oz copper trace in the Constant Voltage Mode for (a) 3 ms and (b) 4 ms.

5.06. Figure 15(a) and (b) show the waveforms obtained from welding .003 x .010 inch unplated copper ribbon to an .010 inch wide. 1 oz unplated copper trace in the Constant Voltage Mode using Moly Unibond Electrodes, 35 oz Electrode Force and a .012 inch Gap. The Amplitude and Duration Settings were 0.79 V and 3 ms, respectively.

Notice that during the first 1 ms the current increased to 260 amps and then decreased to 200 amps, primarily as a result of the increased resistance of the molybdenum electrodes. The differences in the waveforms was caused by the oxidation on the ribbon and contamination on the electrodes. In order to successfully weld the contaminated parts the Duration setting had to be increased from 3 to 4 ms. Conductive parts weld better when the parts are heated rapidly which reduces the conducted heat loss.

5.07. The repeatability of welding copper ribbon was vastly improved by:

a. Cleaning the copper ribbon with alcohol.
b. The copper trace was buffed with an ordinary pencil eraser.
c. Putting a 1 inch radius on the moly electrode faces as indicated in Figure 16(a).

5.08. The shape of the Electrode, 16(a), increased the pressure on the copper ribbon sufficiently to force the tip of the electrode through the surface oxides. Since the contact area was still very small, this area rapidly heated and deformed, reducing the pressure and increasing the contact area. This is illustrated in Figure 16(b) and 16(c). This also explains the differences between the first 2 ms of the waveforms shown in Figures 15(a) and 15(b).

5.09. Figure 17 illustrates the results when the Duration was increased to 10 ms. At 3.2 ms, the ribbon melts (point X), followed by some debris (point Y) 0.2 ms later. As a result of other tests, it was observed that the current waveform peaked within 1 or 2 ms and the time required for the ribbon to melt was between 3.2 and 6 ms. It should be obvious that the welding parameters for copper ribbon, in the Constant Voltage Mode, are much more critical than those for Kovar ribbon.

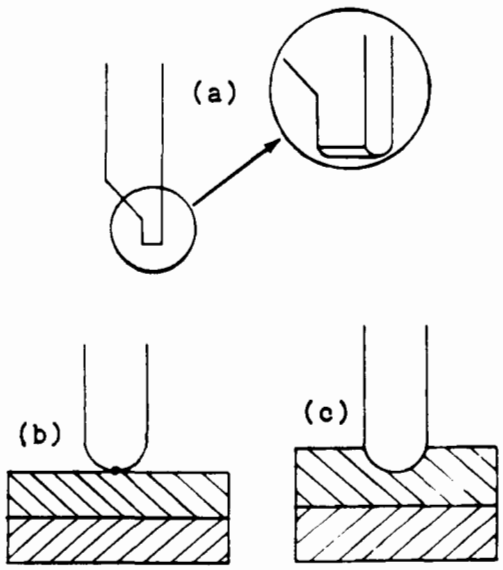


Figure 16 - A EU1001 Moly Electrode was modified to enhance the welding of copper ribbon.

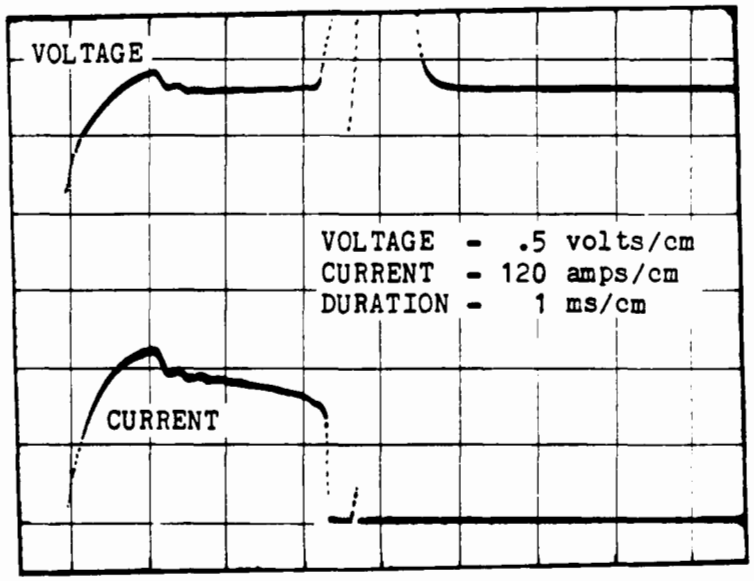


Figure 17 - Copper ribbon welded to an unplated 1 oz copper trace in the Constant Voltage Mode for (a) 10 ms.

5.10. Connect the Milliohmmeter Meter Accessory to the Unibond II. NOTE- IT IS IMPORTANT THAT THE ELECTRODE FACES BE CLEAN AND ALIGNED WITHIN .0005 INCH.

5.11. Figure 18 illustrates the relationship of contact resistance and electrode force. This data was obtained by carefully applying a low force to the parts. and reading the Milliohmmeter as the force was increased by simultaneously turning the Force Adjustment Knob on the weld head and increasing the force applied to the Footpedal. Notice the steep slope of moly electrodes on copper ribbon combination. Compare the difference between copper and moly electrodes on gold plated Kovar.

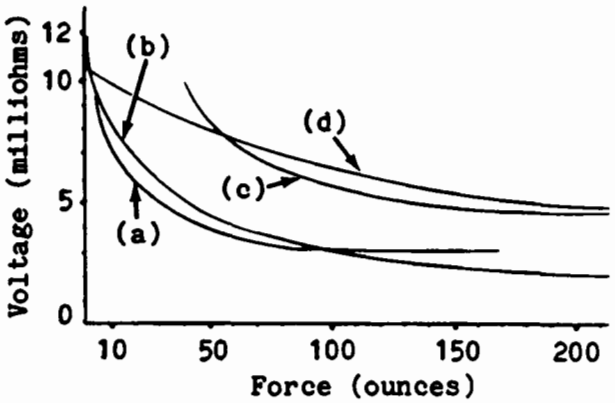


Figure 18 - Contact Resistance of: (a) EU1001, Moly Electrodes on copper ribbon on an unplated copper trace; (b) EU1000, Copper Electrodes on gold plated Kovar on a tinned copper trace; (c) EU1001, Moly Electrodes on gold plated Kovar on a gold plated copper trace; and (d) EU1000, Copper Electrodes on gold plated Kovar on a gold plated copper trace.

5.12. The Unibond should remain in the VOLTAGE Mode. Set the Amplitude, Duration, Force and Gap so that a satisfactory weld is made. Place the weldments under the electrodes. All measurements must be made using the exact electrode configuration and Electrode Force which would be used on the production line. Apply enough force, with the Footpedal, to hold the parts in position. Press the Meter Switch on the rear of the Unibond. Press the Cable Pedal until the Meter audible alarm sounds. Record the value of the Meter Reading.

5.13. Release the Meter Switch and the Unibond will make the weld. Be careful not to increase the force on the Footpedal. Do not be concerned if the Overload Indicator lights. Carefully control the Footpedal so that the force applied by the electrodes does not change. Press the Meter Switch and record the Meter Reading. This value should be lower than the value obtained in 5.12. Repeat this process five or ten times. Set the Weld Resistance Selector and Control to a value which corresponds to the average of the "before" and "after" weld resistances.

5.14. Place the Unibond in the VOLTAGE + CURRENT Mode. In all probability it will be necessary to increase the AMPLITUDE in order to optimize the weld schedule. The following is a comparision showing the effect of various Output Resistance settings for welding .003 x .015 inch gold plated Kovar ribbon and a .015 inch, 1 oz unplated copper trace:

MODE	V	V+I	V+I	V+I
AMPLITUDE (volts)	0.75	0.75	0.88	0.50
DURATION (ms)	4	4	4	4
ELECTRODES	EU1000	EU1000	EU1000	EU1000
ELECTRODE FORCE (oz)	35	35	35	35
ELECTRODE GAP (inch)	.012	.012	.012	.012
OUTPUT RESISTANCE	-	3.75	5	1
RESISTANCE RANGE	-	X 1	X 1	X 1

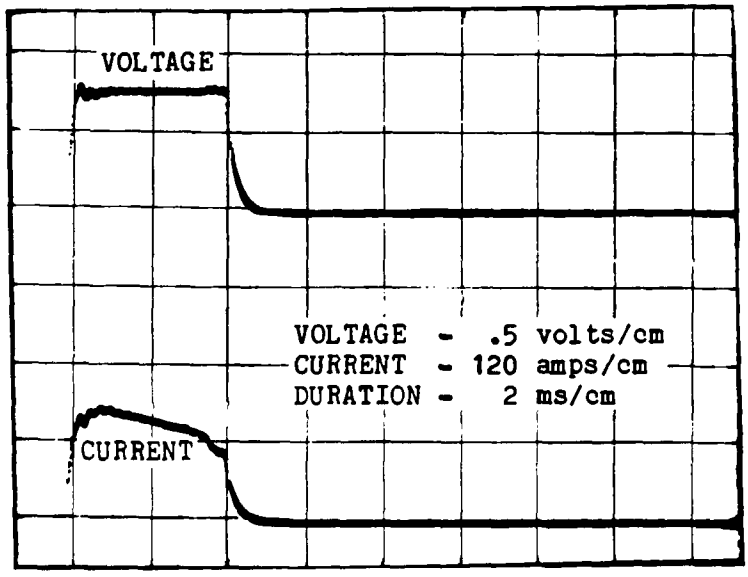


Figure 19 - Gold plated Kovar ribbon welded to an unplated, 1 oz copper trace for 4 ms in the Voltage Mode.

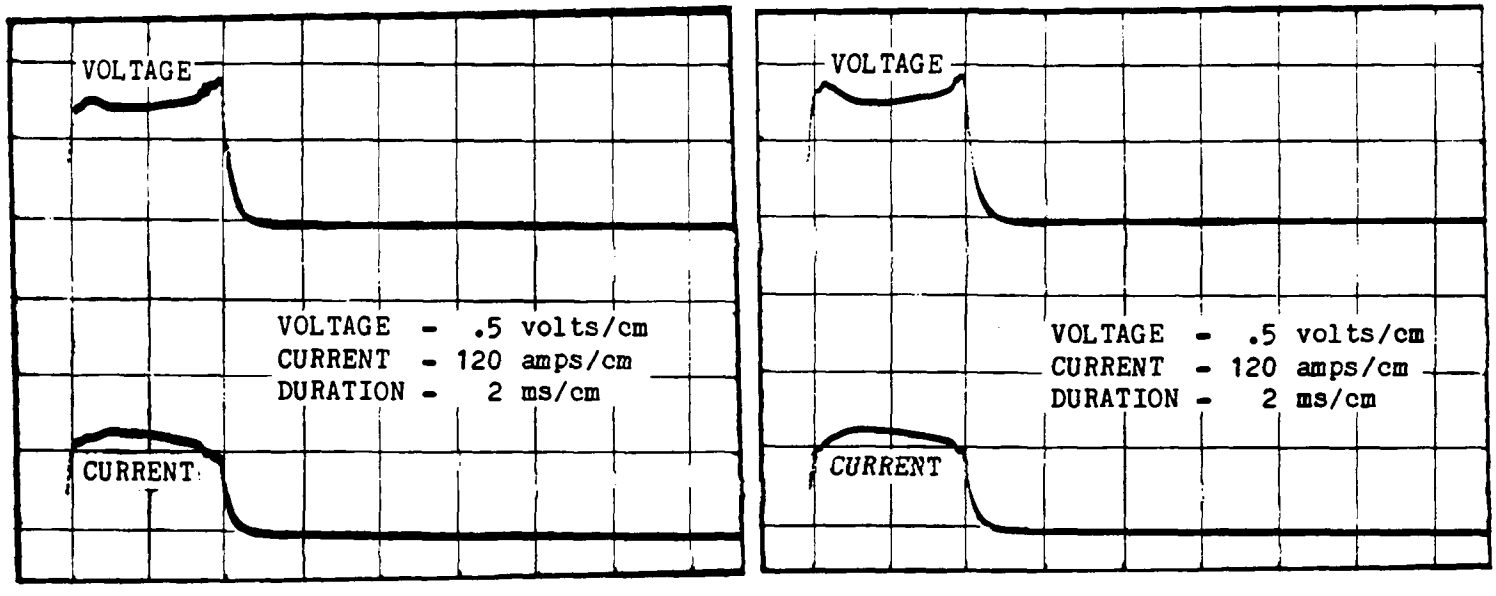


Figure 20 - Gold plated Kovar ribbon welded to an unplated 1 oz copper trace for 4 ms in the in the Voltage + Current Feedback Mode using Amplitude and Output Resistance settings of (a) .75 v and 3.6 milliohms and (b) .88 volts and 5 milliohms.

5.15. The current peaked to 160 amps during the first 1 ms of Figure 19 and 20(a). In the Constant Voltage Mode the current decreased linearly to 120 amps until melting occurred. In the VOLTAGE + CURRENT MODE, the Unibond automatically increases the output voltage at the beginning of the pulse until the electrodes seat themselves reducing the welding resistance. The voltage continues to change as the resistance between the electrodes changes. Melting occurred during the last .2 to .4 ms of the welding pulse as indicated by the ringing in both 20(a) and (b). The settings used in the Voltage + Current Mode all resulted in the Unibond maintaining a constant voltage-current product of 105 watts (.75 volts x 145 amps). Increasing the Output Resistance

and the Amplitude increased the compensation during the beginning of the cycle. The disadvantage of welding resistive materials in the Voltage + Current Mode is that the power does not decrease as the materials approach their melting point as illustrated in Figure 14b.

5.16. Figure 21(a) illustrates the output of the Unibond II in the Voltage + Current Mode when welding .003 x .010 inch unplated copper ribbon to a .010 inch unplated, 1 oz copper trace. as described in 5.06.

MODE	VOLTAGE	VOLTAGE+ CURRENT
AMPLITUDE (Volts)	0.79	0.79
DURATION (ms)	3	3
ELECTRODES	EU1001	EU1001
ELECTRODE FORCE (oz)	35	35
ELECTRODE GAP (inch)	.012	.012
OUTPUT RESISTANCE	-	2.5
RESISTANCE RANGE	-	X 1

5.17. The electrodes rapidly become contaminated by the residues from the adhesives used on circuit boards. The Voltage + Current Mode does provide some compensation. Figure 21 shows the output in the Voltage + Current Mode using contaminated parts and electrodes to weld copper ribbon to an unplated copper trace. With clean parts and electrodes, the waveforms in Figure 21(a) are nearly identical to those obtained in the Voltage Mode. Figure 15(a). With contaminated parts and electrodes, in the Voltage + Current Mode the voltage increased to 1.1 volts in an effort to maintain a constant voltage-current product of 83 watts. The Voltage Mode would not have produced a satisfactory weld under these conditions.

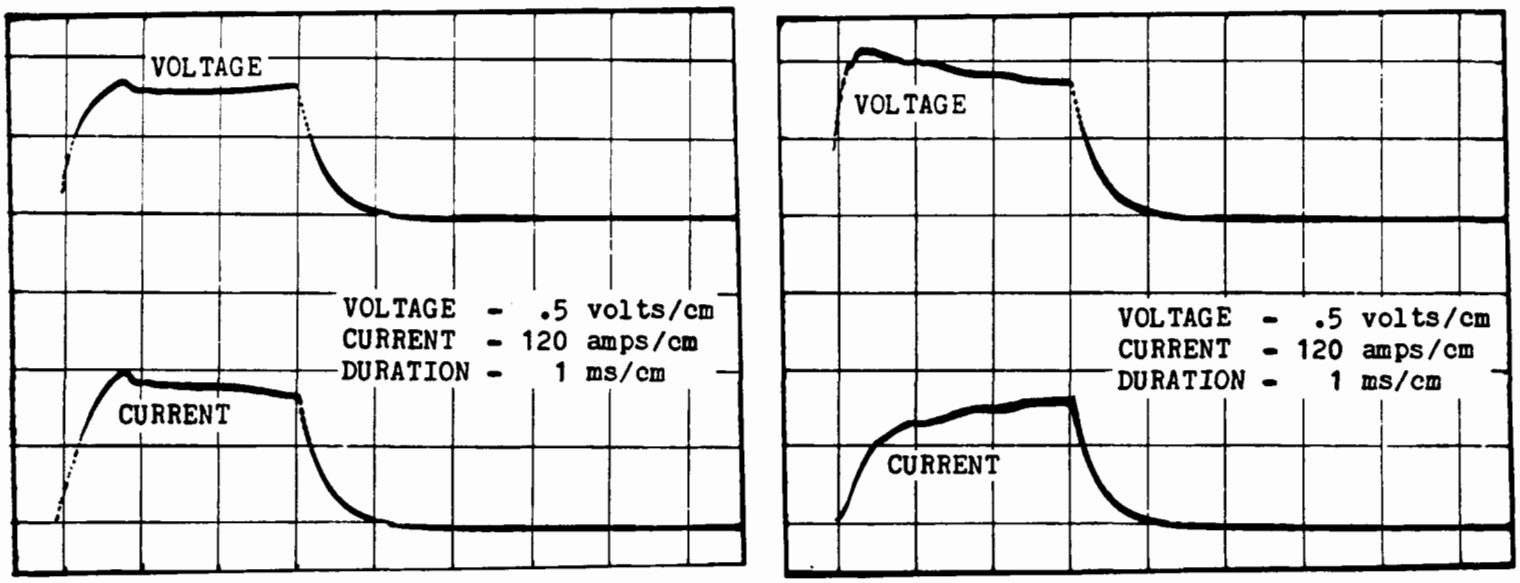


Figure 21 - Copper ribbon welded to an unplated copper trace in the Voltage + Current Mode with (a) clean parts and electrodes and (b) contaminated parts and electrodes.

6.00. PRINTED CIRCUIT BOARD TRACE REPAIR

6.01. Parallel gap welding is a special form of series welding in which the spacing, usually less than 0.025 inch, between the electrodes is such that a single weld is formed between the electrodes. The heat sink effect of the electrodes usually limits fusion to approximately 80% of the electrode gap.

In parallel gap welding, Figures 22(a) and (b), the current distribution between the ribbon and substrate depends largely on the resistance between the two conductors. The contact resistance varies with the electrode force.

In a typical repair, 22(c), the electrodes should be as wide as the ribbon.

An alternate electrode position with respect to the Trace is shown in 22(d). This technique is sometimes used to bond narrow ribbon or wire using a UNITIP.

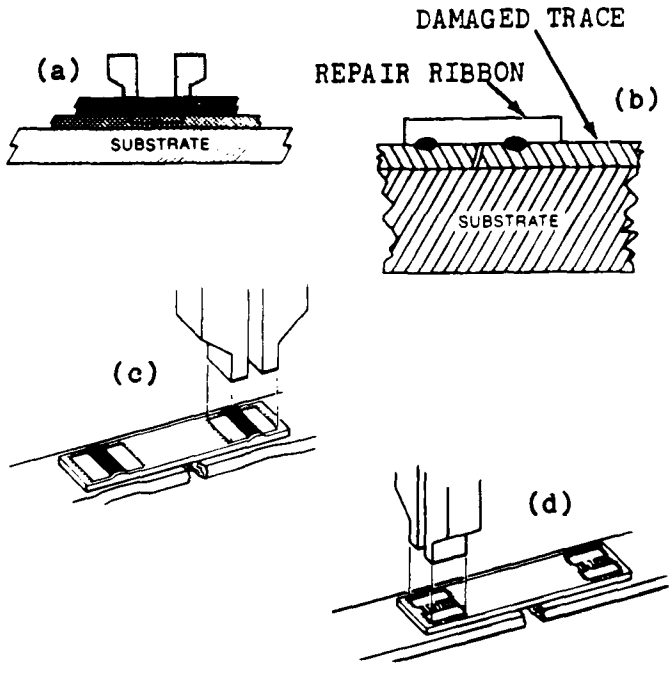


DIAGRAM OF TYPICAL REPAIR

Figure 22

6.02. Gold-plated Kovar, usually .002 to .005 inch thick, is used to repair gold or solder-plated boards which will subsequently be (a) conformaly coated, or (b) completely covered with solder in the repaired area, or (c) not subject to high temperatures, high humidity environments. Gold ribbon, .002 inch thick, is the preferred material for gold-plated or unplated copper traces. Conformal coating of gold ribbon repairs is not required.

6.03. The reliability and repeatability of welding gold plated Kovar in the Voltage Mode is excellent. The settings in Voltage + Current Mode are more critical, but the number of welds which can be made before cleaning the electrodes will be increased.

6.04. Copper wire, 29 to 34 gauge, can be used to make welded or reflow soldered repairs and/or engineering changes on unplated copper boards. Unplated, plated or tinned copper ribbon is an ideal choice for reflow soldered repairs but is not recommended for welding because of its low resistance. Some users successfully bond .002 inch copper ribbon to one ounce copper traces. This process requires very tight production controls. Copper wire as large as 20 gauge has been successfully welded to 1 oz bare copper traces using the Voltage + Current Feedback Mode of the Unibond II.

6.05. The width of the ribbon should be approximately the same as the trace. For boards with line widths and line spacing greater than .010 inch, a ribbon which is .002 to .005 inch narrower than the trace is acceptable and makes alignment considerably easier.

6.06. EU1001 or EU2030M Molybdenum Electrodes, are used for welding gold or copper. EU1000, RWMA-2 Electrodes, are used for welding gold-plated nickel, Kovar or other high resistance materials. The electrode width is usually wider than the ribbon. Model PD Polishing Disks are used to keep the electrodes flat and clean.

6.07. Typically, 10 to 30 ounces of force is required on each electrode in order to weld a .003 x .015 inch ribbon to a circuit trace on an epoxy glass board. Higher forces cause the trace to sink into the laminate during the welding cycle.

6.08. The most critical parameter is the electrode gap. The energy required to form a weld is proportional to the gap. Large gaps can require excessive energy, which may cause considerable melting and delamination of the epoxy glass base material. Small gaps can result in welds which are extremely sensitive to small changes in energy and which may also be weaker due to the reduced cross section of the weld. The electrode gap is generally set at .010 to .015 inch for ribbons from .010 to .025 inch wide.

6.09. MELTING OF LAMINATE - The quality of a parallel gap weld can be accurately determined by optical examination using a binocular microscope which facilitates reliable inspection of the metal flow. Parallel gap welding causes some loosening of the weld nugget region from the epoxy glass board. This is not serious since the strength of the joint remains high with some separation and the extent of loosening can be evaluated by measuring the visible liquification of the epoxy glass substrate. Light welds can be re-welded by increasing the energy level. Over-welds or misaligned welds can be bridged or removed and replaced with a longer section of ribbon. By using visual techniques, the user should be able to ensure weld strengths which exceed the peel strength of the copper conductor to the circuit board.

6.10. When adhesives from the circuit board begin to form on the electrodes, the cleaning procedure outlined in 4.05., should be used. Adhesives will start to accumulate on the edges and then, rapidly contaminate the surface of the electrodes. Proper attention to electrode maintenance will ensure reliable and repeatable welding.

6.11. OPERATION - PRINTED CIRCUIT TRACE REPAIR

6.11.01. Ensure that all electrical connections between Weld Head, output Transformer, and Power Supply are secure. Make all necessary settings as outlined in Table III.

6.11.02. A certain amount of experimentation is necessary to achieve proper force and gap settings for a specific application. Generally, greater electrode force is required at higher power settings, and a larger electrode gap is required to cover larger weld areas. Table III shows typical starting points.

6.11.03. Position the ribbon and damaged trace under the electrodes. Actuate the Cable Pedal to bring electrodes into contact with the ribbon. Ensure that the ribbon and trace are correctly aligned, and continue to apply pressure until the Weld Head causes the Unibond to trigger. Inspect the ribbon for proper weld.

6.11.04. First, make satisfactory welds in the Voltage Mode. Be sure to keep the electrodes clean. Try to keep the Duration short in order to minimize melting of the laminate.

6.11.05. Use RWMA-2 copper electrodes against resistive materials. Use molybdenum or tungsten electrodes against conductive materials.

6.11.06. If you are welding unplatted copper ribbon, try the electrode configuration shown in Figure 16. If you are welding to unplatted copper traces, the results will be improved if the traces are buffed with an ordinary, clean pencil eraser just prior to making the repair.

6.11.07. If you elect to use the Voltage + Current Mode, make the weld resistance measurements outlined in 5.12 and 5.13. Set the Output Resistance Range Selector and Control and switch to the Voltage + Current Mode.

6.11.08. As the Output Resistance is increased, the Amplitude must be increased to obtain a satisfactory weld. This will also increase the compensation during the beginning of the cycle. Conversely, a lower Output Resistance will make it necessary to reduce the Amplitude.

6.11.09. If you have established welding schedules using Unitek's original Unibond in the Manual Mode, it will not be necessary to modify those schedules to use the Unibond II in the Voltage Mode.

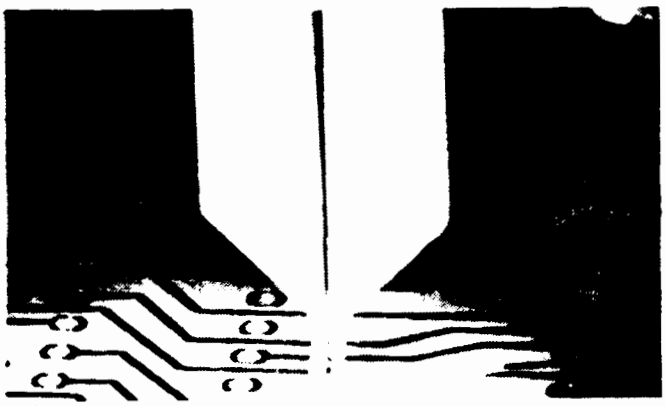


Figure 23a - Kovar Ribbon positioned over a broken trace and welded.

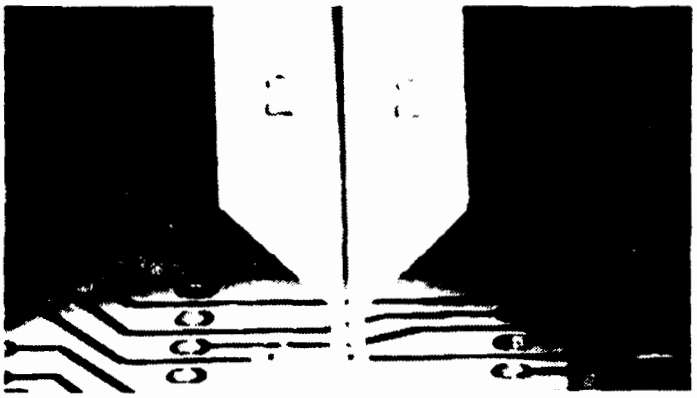


Figure 23b - Ribbon cut to length and welded on the other end.

TABLE III - TYPICAL SETTINGS FOR WELDING WITH THE UNIBOND II POWER SUPPLY

TRACE	TIN PLATED 1 oz COPPER	GOLD PLATED 1 oz COPPER	Unplated 1 oz COPPER	Unplated 1 oz Copper
TYPE BOARD	Epoxy Glass	Epoxy Glass	Epoxy Glass	Epoxy Glass
TRACE WIDTH (in)	.015	.015	.015	.015
MATL. USED FOR REPAIR	.003 x .015 inch Gold Plated Kovar	.003 x .015 inch Gold Plated Kovar	.003 x .015 inch Copper Ribbon	32 gauge Bare Wire
FORCE (oz)	35	35	35	35
UNIBOND ELECTRODE MATERIAL	RWMA 2	RWMA 2	MOLY	MOLY
GAP (inch)	.012	.010 - .012	.012	.018
MODE	VOLTAGE	VOLTAGE	V + I	V + I
AMPLITUDE (volts)	.60	.70	.90	1.1
DURATION (ms)	10	10	4	4
RESISTANCE (milliohms)	-	-	3	3

7.00. THEORY OF OPERATION

7.01. In resistance spot welders, it is of prime importance to deliver the same amount of energy to each weld site, assuming that the weld sites are identical. For this reason, many schemes have been devised to deliver a precisely controlled burst of voltage or current, in order to provide uniform welds. This would accomplish the objective, if the weld sites were identical. In production situations, however, parts vary in thickness, surface finish, cleanliness and purity. To further complicate matters, electrode area and pressure may vary with time. All of these factors influence the weld schedule, requiring an adjustment in voltage and/or current, but in most instances, the instantaneous power required will remain the same.

Many devices have been designed which allow the instantaneous power to vary, as a result of the aforementioned influences, and compensate for the error in energy by adjusting the duration of the weld pulse proportionately. This will work satisfactorily over a narrow range, but half the power for twice the time may not produce a final temperature high enough to yield a strong weld, or may produce a metallurgically different weld.

The Unibond II uses voltage and current feedback to produce an output impedance which is approximately the same as the interface resistance of the weld site. The power delivered to the weld versus the degree of impedance mismatch is shown in Figure 24.

$$\% \text{ Power} = \frac{\left[\frac{R_L}{R_L + R_O}(2)\right]^2}{R_L} 100$$

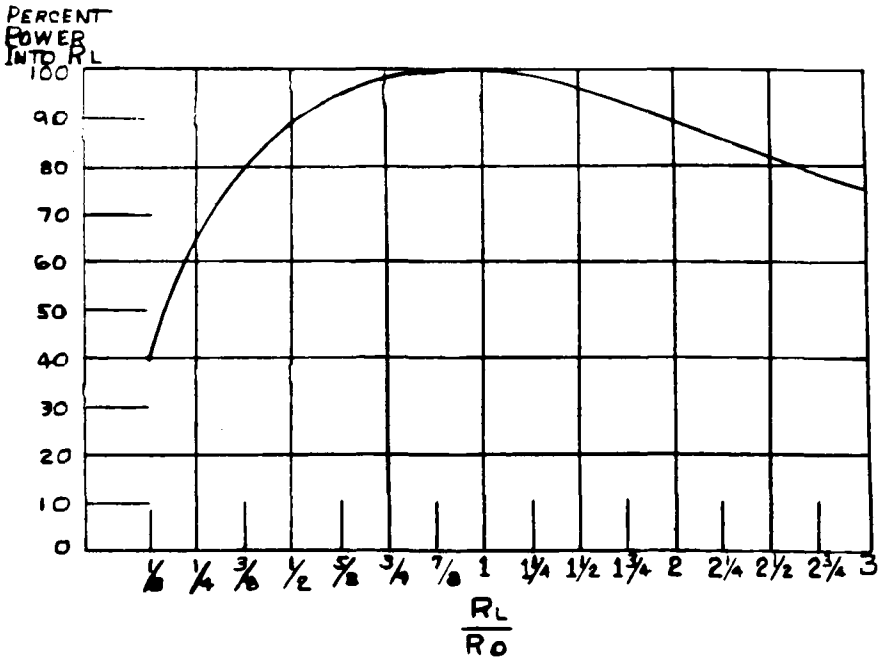


Figure 24 - Percent of Power delivered to the Welding Load as a function of the Ratio of Load Resistance to Unibond Output Resistance.

This principle can be readily demonstrated by looking at the simple voltage divider shown in Figure 25. This artificial output impedance can be produced in an amplifier by reducing the voltage feedback by a factor of two, to double its voltage gain, and making up the difference with current feedback.

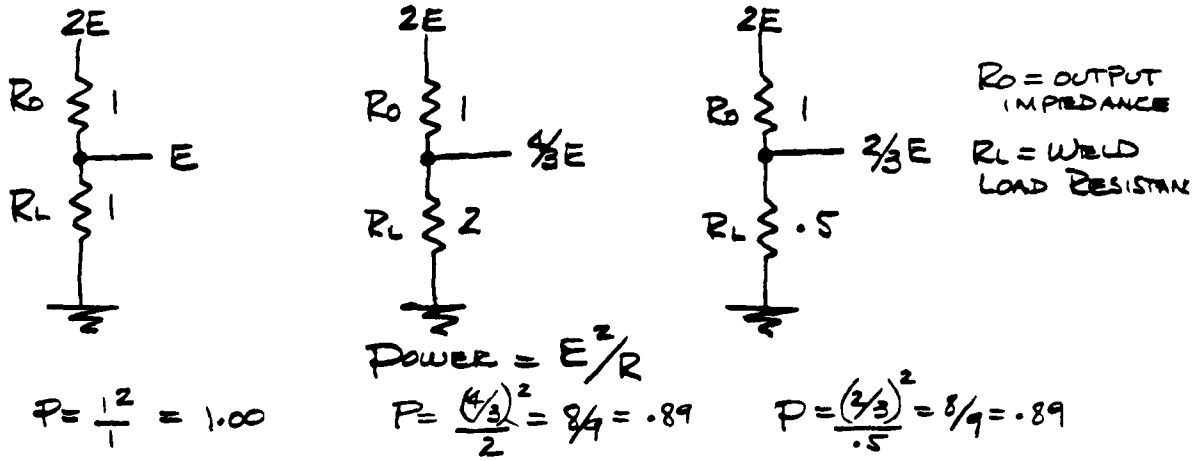


Figure 25 - Simple Voltage Divider illustrates the Percent of Output Power delivered to R_L, the output load, when R_L is: (a) equal to R_{out}; (b) twice R_{out}; (c) one-half R_{out}.

In the Unibond II design, as shown on the block diagram, most of the circuitry is devoted to generating a pulse that has its amplitude and duration determined by thumbwheel switch settings, and keeping that pulse within the volt-second capabilities of the transformer and the safe operating area of the transistors.

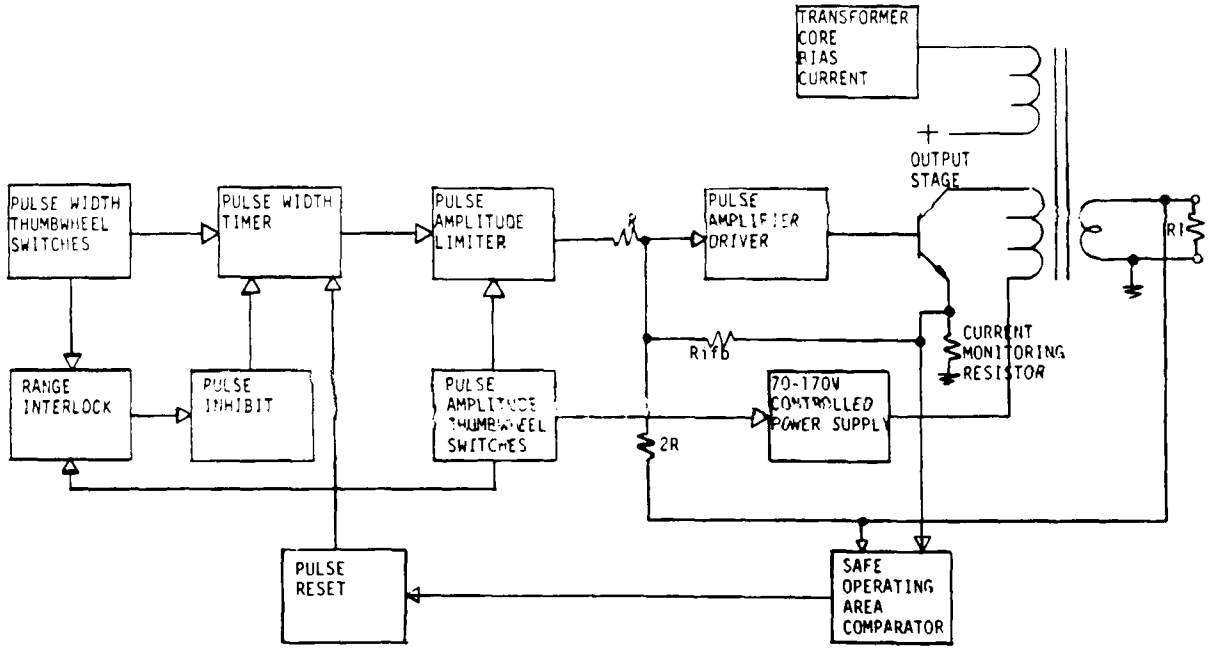


Figure 26 - Block Diagram of Unibond II.

7.02. OUTPUT CIRCUIT

Unitek has applied for a patent on the Pulse Amplifier/Driver, the Output Stage, and the Feedback Network used in the Unibond II. Figure 27 shows the Unibond output amplifier and feedback network, without the range switching and protection circuitry so that it may be more easily described and understood. The component designators are the same as on the Schematic shown in Figure 36. Because of unsafe areas of transistor operation, the power supply that supplies the output stage is programmed by the pulse amplitude thumbwheels.

R88 is the input resistor to the amplifier and R132 and R131 - R133 are respectively the voltage and current feedback resistors. R132 is twice the value of R88 so that there is a voltage gain of two. The remaining components form a power amplifier.

U9 and Q15 provide the voltage gain and voltage levels necessary to drive the output stage, Q16 thru Q22. R98 determines the loop gain and R97. C18 and C19 provide for feedback loop stability. R100, R104 and R105 limit the current and power dissipation in Q15. R101 and R102 provide the proper initial bias for Q15. R103 allows a path for collector to base leakage currents for Q16 - Q22. Resistors R106, R109, R112, R115, R118, R121 and R124 help the transistors to share current. Resistors R108, R111, R114, R117, R120, R123 and R126 also help the transistors to share current and are simultaneously used to monitor the transformer primary current by means of averaging resistors R107, R110, R113, R116, R119, R122 and R125. This current is directly related to the secondary current by the transformer ratio and must be scaled by that factor. Since the primary windings are switched from series to parallel connection at Pulse Amplitude selections over 1.99 volts, the current feedback must also be changed by a factor of two. This is accomplished by means of Q14 and R93 in conjunction with feedback resistors R131 and R133. Potentiometer R4 and resistor R5 attenuate the current feedback signal, requiring a lower value of RL. the Weld Load Resistance, to provide sufficient current feedback to balance the loop. This effectively reduces the output impedance. Resistor R2 limits the dissipation in the core bias circuit.

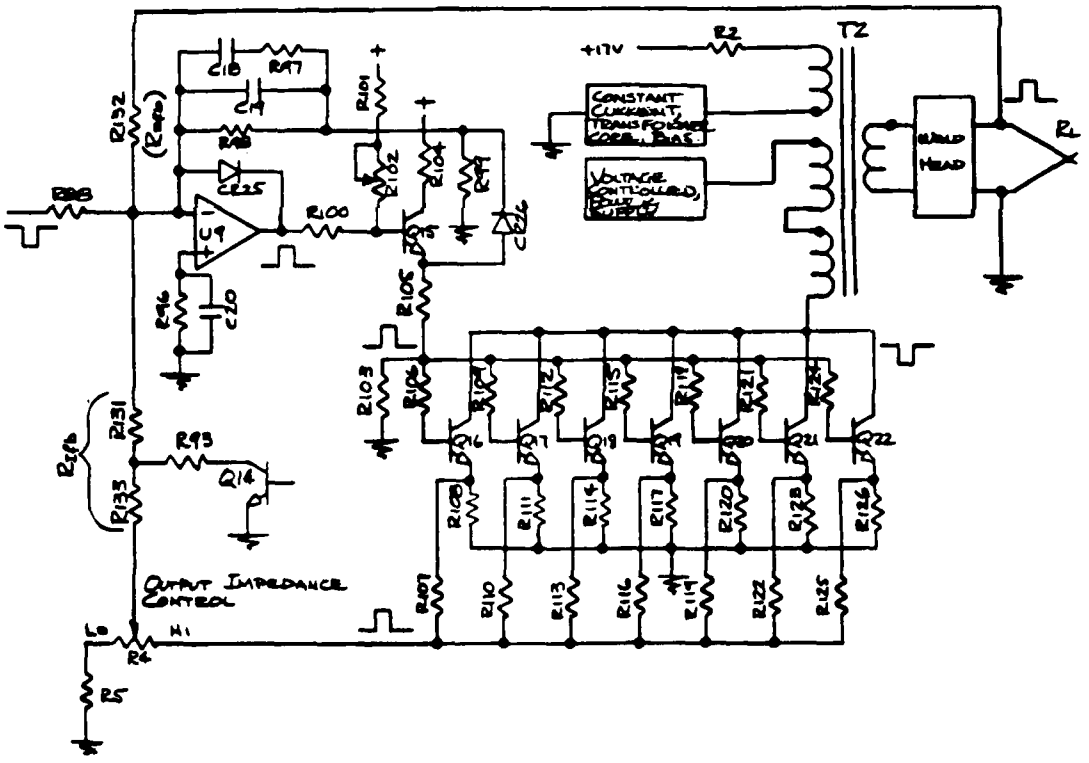


Figure 27 - Pulse Amplifier with Voltage + Current Feedback.

7.03. HOW THE FEEDBACK LOOP DETERMINES OUTPUT IMPEDANCE

Probably the most common method of measuring output impedance is to connect a resistance across the output that causes the unloaded output voltage to drop to one-half of its original value. This is because it forms a voltage divider of equal resistances as illustrated below:

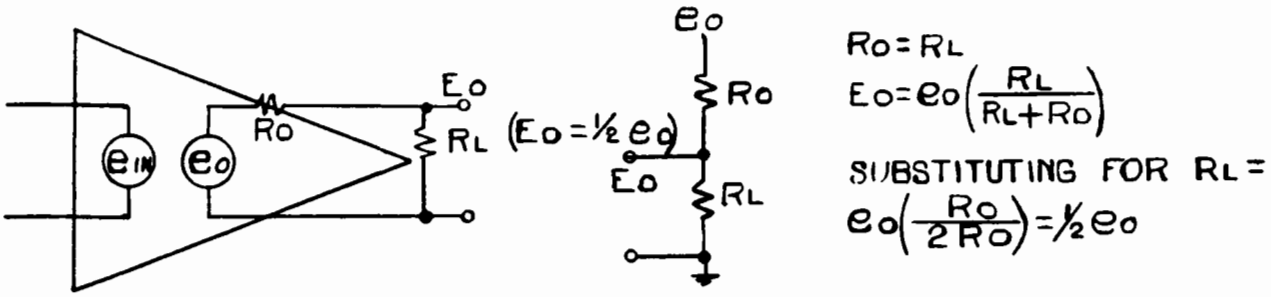


Figure 28 - When the output impedance of an amplifier equals the load resistance, the output voltage will be one-half the open circuit voltage.

If the output amplifier behaves this way for a given R_L, then R_L is equal to the output impedance of the amplifier. In a perfect feed back amplifier, Figure 29, the output can only change in response to an input voltage, until the current feedback, I_{fb} equals the input current. I_{in}. Since the currents are equal, the voltage drops across the resistors are proportional to the resistances, and the gain is equal to $R_{fb/Rin}$.

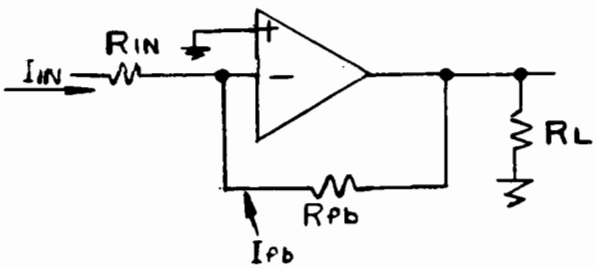


Figure 29

If R_{fb} is twice R_{in}, there will be a voltage gain of two. If a second feedback path is provided, as shown in Figure 30, so that the feedback voltage, E_{fb2}, is proportional to the current in the load resistor R_L, there will be a load resistor value that will produce a feedback current I_{fb2} that is equal to I_{fb1}.

Under these conditions, the loop can only be balanced if the output voltage drops to one-half the previous output voltage, hence the amplifier has an output impedance equal to R_L. Furthermore, the current sampling resistor can be a potentiometer or rheostat, and vary the resistance, R_L, required to produce one-half the output voltage, and therefore vary the output impedance.

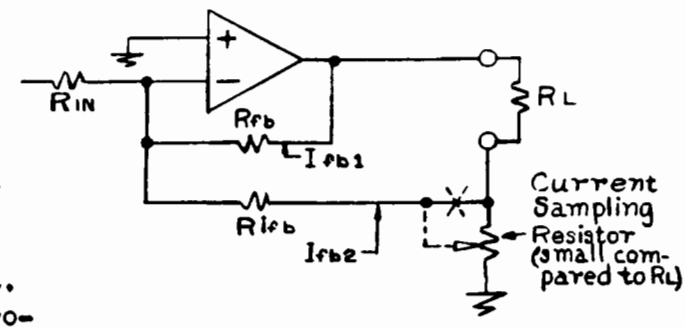


Figure 30

In the Unibond II, voltage feedback is taken from the output winding of the pulse transformer, and the current feedback is taken from the primary winding circuit and scaled by the transformer step-down ratio.

8.00. CALIBRATION

8.01. Unitek uses a special sample and hold technique to precisely measure the pulse amplitudes and pulse durations. You will have to rely on the accuracy of your oscilloscope. Calibrate it carefully. The width of the trace can cause errors of greater than 10% when measuring pulse amplitude.

8.02. SETUP

8.02.01. The following equipment is required for calibration:

1. 4 1/2 digit digital voltmeter.
2. Oscilloscope.
3. 6 inch piece of 20 gauge copper wire, the resistance of which should be approximately 5 milliohms.
4. 12 inch piece of 20 gauge copper wire, the resistance of which should be approximately 10 milliohms.

8.02.02. Set Unibond Controls as follows:

PULSE AMPLITUDE:	0.50
PULSE DURATION:	07
FEEDBACK MODE:	VOLTAGE
WELD RESISTANCE:	5
WELD RESISTANCE RANGE:	X1
POWER SWITCH:	OFF

8.02.03. Connect the Output Transformer and the Feedback and Firing Cables from the Weld Head to the Unibond. Remove the cover from the Unibond.

8.02.04. Connect a jumper across R103. Connect a jumper across CR33.

8.02.05. Switch the power to "ON" and check that the following voltages are present at the points indicated below: If any of these voltages are not present, trouble-shoot the regulator circuits.

+14.25 to +15.75 volts at (+) side of C24.
-14.40 to -15.60 volts at (-) side of C23.
+16.75 to +19.25 volts at (+) side of C27.
+85.00 to +95.00 volts on collector (case) of Q16 - Q22.

8.03. ADJUSTING PULSE WIDTH

8.03.01. With the power OFF, connect the scope to pin 9 of U4. Set the sweep to 10 ms/cm. With power ON, trigger the Unibond firing circuit by lifting up on the Weld Head.

8.03.02. With the Unibond Pulse Duration Switch set to 70 ms, a 70 ms pulse should appear on the scope whenever the Unibond is fired. Pulse duration calibration may be changed, if necessary, by adjusting R1.

8.04. IMPROPER SETTING INDICATOR CHECK

8.04.01. Set Pulse Amplitude to 0.99. The Improper Setting Indicator should remain OFF.

8.04.02. Set Pulse Amplitude to 1.00. The Improper Setting Indicator should light.

8.04.03. Change Pulse Duration to 40. The Improper Setting Indicator should remain ON. Change Pulse Duration to 39 and the Indicator should be extinguished.

8.04.04. Change Pulse Amplitude to 1.99 volts. Indicator should remain OFF. With Pulse Amplitude set at 2.00 volts, Indicator should be ON.

8.04.05. With Pulse Duration at 20 ms, Indicator should still be ON, but it should extinguish at a setting of 19 ms.

8.04.06. The Unibond should not be able to be triggered when the Improper Setting Indicator is ON.

8.04.07. If the Unibond fails any of these tests, check U8.

8.05. CHECK HIGH VOLTAGE SUPPLY

8.05.01. With an accurate meter, confirm that the voltage on the collector of Q16 is between 168 and 172 volts when the Pulse Amplitude Switch is set at 3.99 volts.

8.06. CHECK OUTPUT STAGE BIAS

8.06.01. Turn power OFF. Disconnect the Output Transformer.

8.06.02. Set the Pulse Amplitude Switch to 0.10 volts. Remove the jumper which was placed across R103 in 8.02.04. Turn power On. The voltage across R103 should be between 0.19 and 0.20 volts. Adjust R102, if necessary. CAUTION: DO NOT ALLOW THE OUTPUT STAGE BIAS TO EXCEED 0.30 VOLTS. Turn power OFF.

8.07. CHECK THE OUTPUT PULSE

8.07.01. Turn power OFF. Remove the jumper from CR33. See 8.02.04.

8.07.02. Reconnect the Unibond Output Transformer.

8.07.03. Connect the 12 inch piece of 20 gauge copper wire across the output terminals of the Unibond Output Transformer. Set the Pulse Amplitude Switch to 0.99 volts. Set the Pulse Duration to 19. Connect the scope across the Feedback Leads.

8.07.04. Turn power ON and set the scope to trigger on and display a 1 volt, 19 ms pulse. Fire the Unibond and confirm that it is producing a 19 ms pulse, approximately 1 volt in amplitude. A short "beep" should be heard following each pulse.

8.07.05 **IT IS OUR EXPERIENCE THAT A SCOPE DOES NOT OFFER A PRACTICAL METHOD TO MAKE THESE MEASUREMENTS. UNLESS THE FOLLOWING TEST DETERMINES THAT A GROSS ERROR EXISTS - DO NOT CHANGE TRIMPOT R87!**

8.07.06. Fire the Unibond several times, noting the reading on the scope during each pulse. Adjust trimpot R87 for 0.96 to 1.02 volts.

8.07.07. When the Pulse Amplitude is changed to any value between 1.00 and 1.99 volts, the pulse amplitude of the display should be within 0.06 volts of the amplitude selected.

8.07.08. When the Pulse Amplitude is changed to any value between 2.00 and 3.99 volts, the pulse amplitude of the display should be within 0.12 volts of the amplitude selected.

8.08. CHECK THE OVERLOAD INDICATOR

8.08.01. The Overload Circuit is intended to discontinue the Output Pulse in case one of the following occurs:

a. The Unibond is triggered before the Output Transformer core has recovered from the last pulse.
b. The output current exceeds 1000 amps.
c. The output transistors are operating in an unsafe operating area.

Such an occurrence will be indicated by the absence of a "beep" following the weld, and the Overload Indicator should light. The Indicator will remain lit until a pulse is fired which does not cause an overload.

8.08.02. Connect a 5 milliohm load across the output terminals of the Unibond Output Transformer. Set the Pulse Amplitude to 0.99 volts and the Pulse Duration to 79 ms. Fire the Unibond. A "beep" should be heard and the Overload Indicator should remain OFF.

8.08.03. Now, fire the Unibond, and fire it again within 1 second. The second pulse should not be completed, as evidenced by the absence of a "beep." The Overload Indicator should be ON.

8.09. CALIBRATING THE MODEL UBM METER ACCESSORY

8.09.01. Connect the Meter to its receptacle on the rear of the Unibond. Insert the the 10 milliohm load provided with the UBM into the Electrode Holders of the Weld Head.

8.09.02. Verify that it correctly reads 10 milliohms and sounds its audible alarm when the Push-to-Read Button is pressed on the rear of the Unibond.

8.09.03. If the Meter does not read and/or operate properly, switch power OFF and remove its cover.

8.09.04. Set the Unibond II controls as follows:

AMPLITUDE	1.00 volts
DURATION	5 milliseconds
WELD RESISTANCE CONTROL	5 milliohms
WELD RESISTANCE SWITCH	X1

8.09.05. Mechanically rezero the Meter, if necessary. Adjust R1, the 1 KHz Drive Potentiometer, until the Meter reads 10.0 milliohms. R1 is accessible through the side cover of the Meter on Stock No. 10-266-02.

8.09.06. Replace the Meter Cover.

8.10. CHECKING RESISTANCE OF THE WELD HEAD

8.10.01. The resistance of the Weld Head can be measured. Connecting the Weld Head to the Unibond in the usual manner, short the Head by inserting a single RWMA-2 Electrode into the Electrode Holders in a manner which allows it to be firmly clamped by both Holders.

8.10.02. Switch the power OFF. Remove the Sensor Leads from the Flexures and connect them to the Output Terminals on the Transformer as illustrated in Figure 31. BE SURE THAT THE POLARITY OF THE SENSOR LEADS IS NOT REVERSED.

8.10.03. Do not actuate the Footpedal. Press the Push-to-Read Button, the Meter will display the resistance of the Weld Head. Bad connections can be found by moving the clip leads toward the Electrodes, one connection at a time.

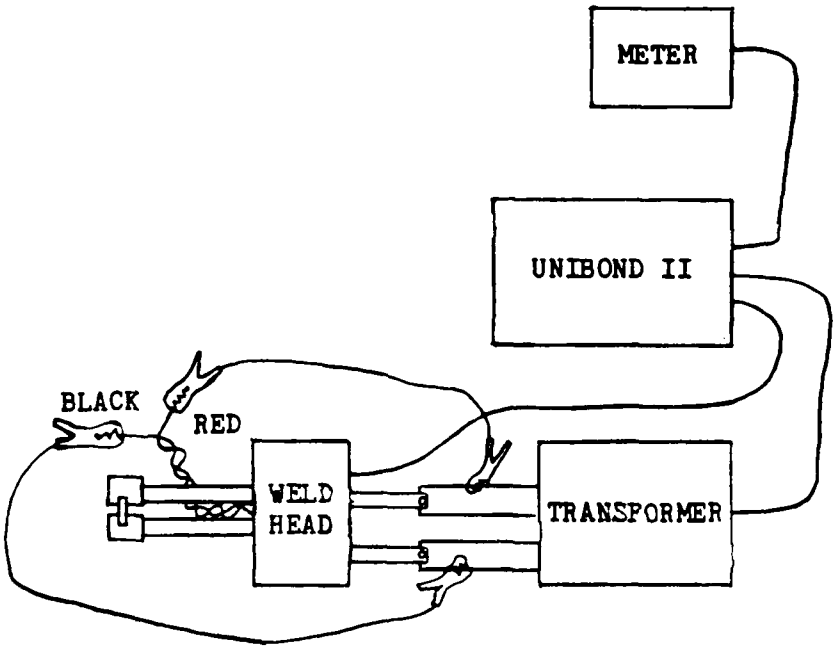


Figure 31 - Set up necessary to measure the resistance of the Welding Head.

9.00. REPAIR SERVICE

9.01. PHONE CALLS - Ask for the FIELD SERVICE DEPARTMENT. PLEASE KNOW your model number and the serial number when calling. You will find a nameplate with the model number and serial number typed on it. located on the rear of the power supply.

9.02. REPAIRS - ALL items shipped to Unitek for repair must be PREPAID by the SHIPPER. For FASTER SERVICE. please include on your packing slip a purchase order number covering repairs together with the "shipping" and "billing" addresses.

10.00. TROUBLE-SHOOTING

PROBLEM - Unibond does not work at all and "Power On" light is not illuminated:

SOLUTION #1: Check that proper voltage is at outlet and Unibond is properly connected.

SOLUTION #2: Check that Circuit Breaker has not "blown". With power "OFF" depress the Circuit Breaker fully.

SOLUTION #3: With power "OFF", check connectors at Printed Circuit Board.

PROBLEM - OVERLOAD Light illuminates.

SOLUTION #1: The Feedback Cable is not connected.

SOLUTION #2: The Weld Load exceeds 1000 Amps. Check with Milliohmeter.

SOLUTION #3: The resistance of the Weld Head is too high. Check with Milliohmmeter.

PROBLEM - Poor welds.

SOLUTION #1: Improper weld pressure. improper weld schedule, dirty or oxidized parts. inconsistent parts. or incorrect electrodes.

SOLUTION #2: Electrodes not properly maintained or aligned. See Section 4.00.

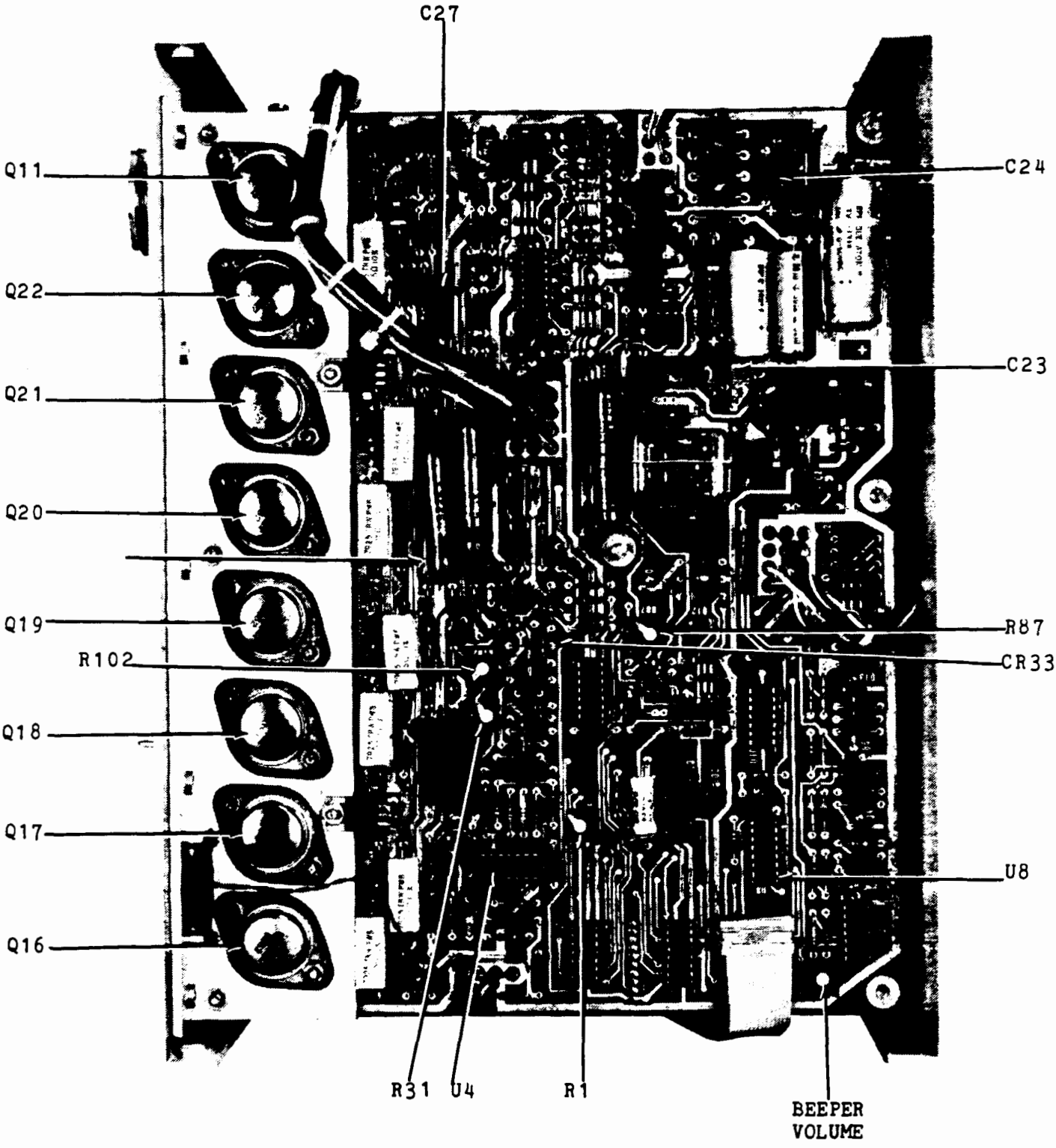
SOLUTION #3: Weld Resistance Compensation not properly adjusted. See Paragraph 2.16.7.

SOLUTION #4: Feedback Cable not connected.

PROBLEM - IMPROPER SETTING Light is illuminated.

PROBABLE SOLUTION: Thumbwheels improperly adjusted. See paragraph 2.16.4. of this manual.

Figure 32 - Unibond II Control Board



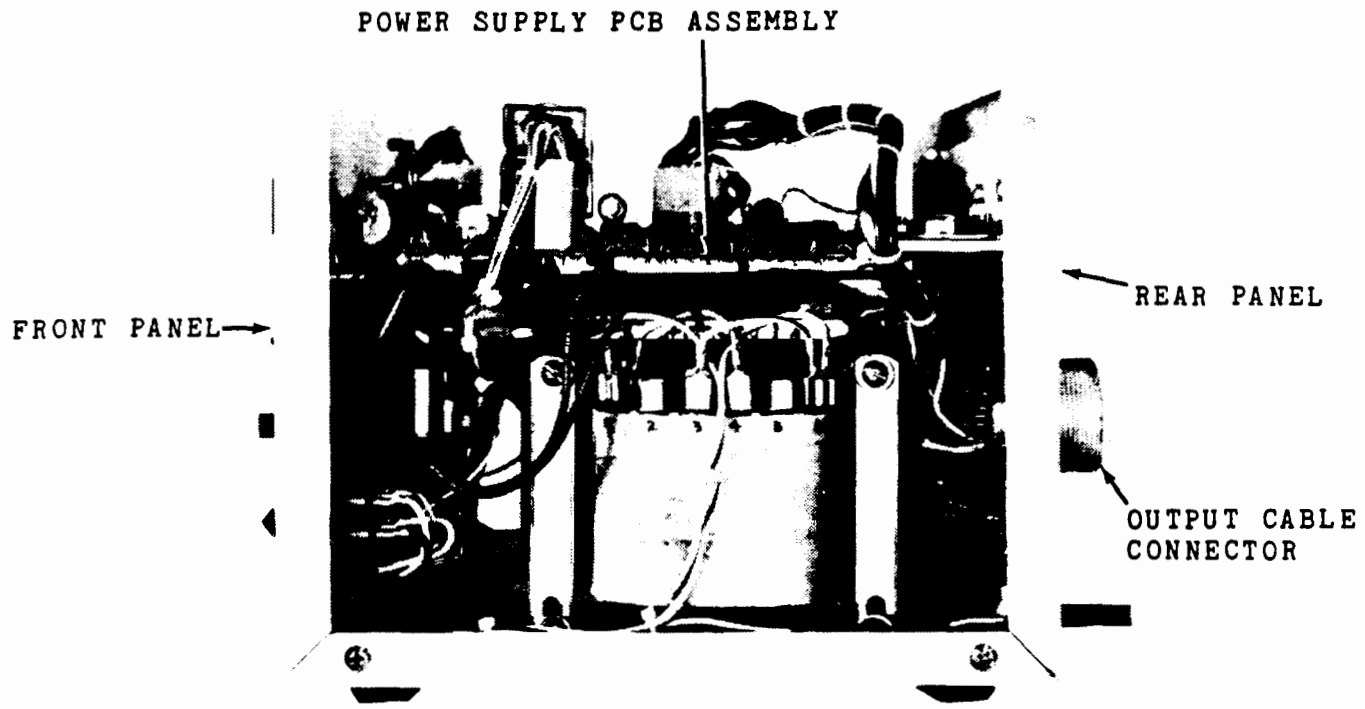


Figure 33A - Internal view of Unibond II. Right Side View

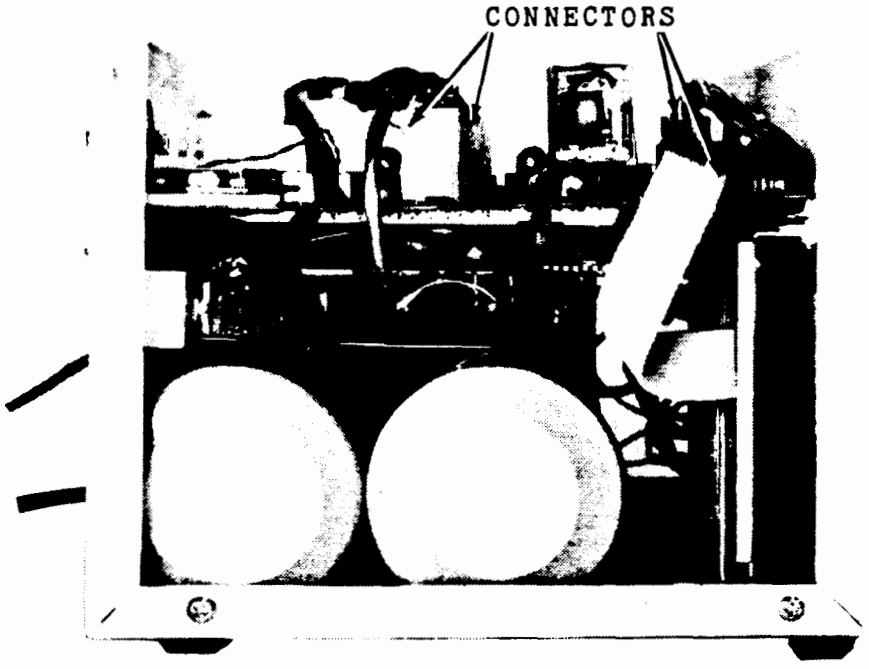


Figure 33B - Internal View of Unibond II. Left Side View

Figure 34 - Internal view of Milliohm Meter

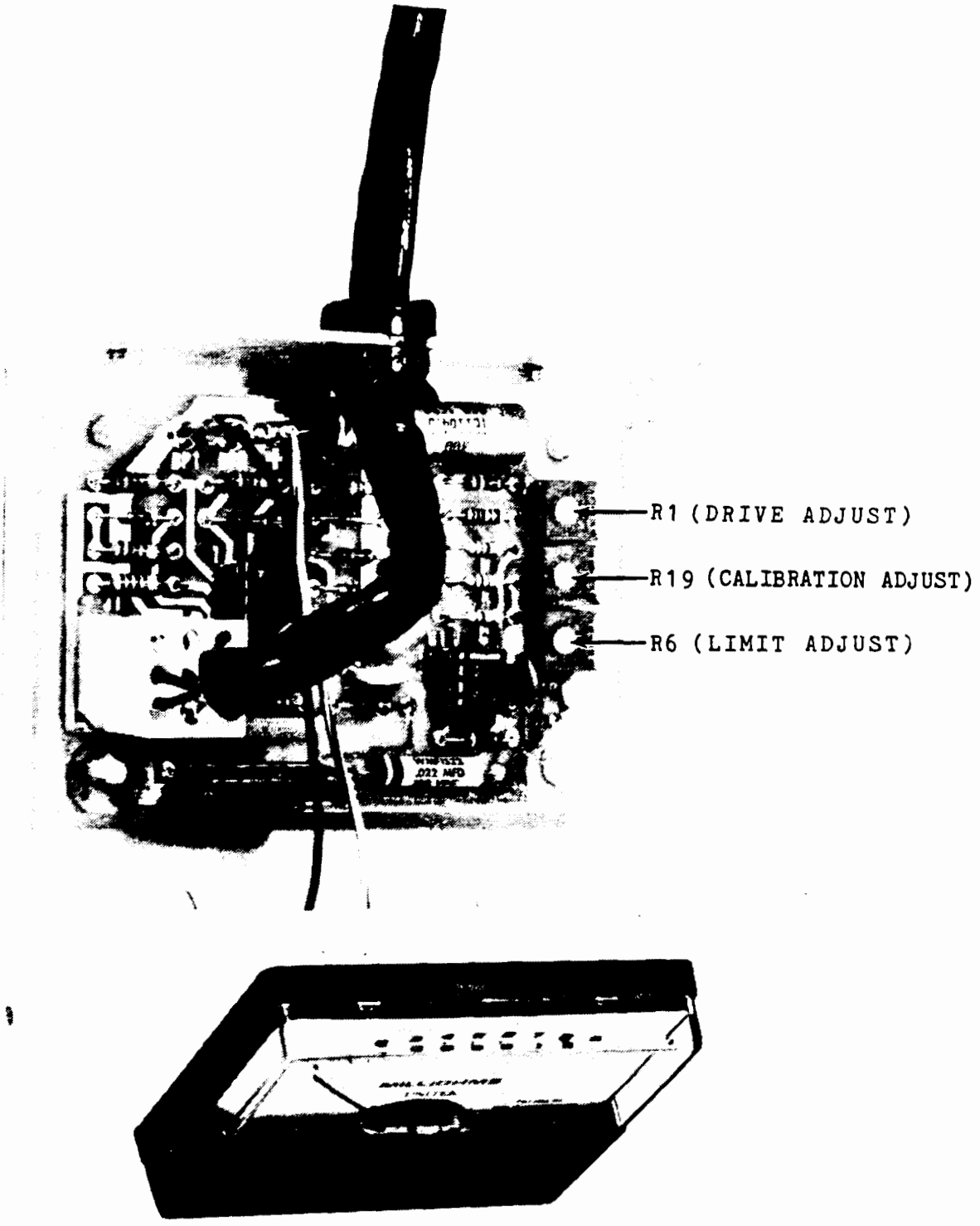
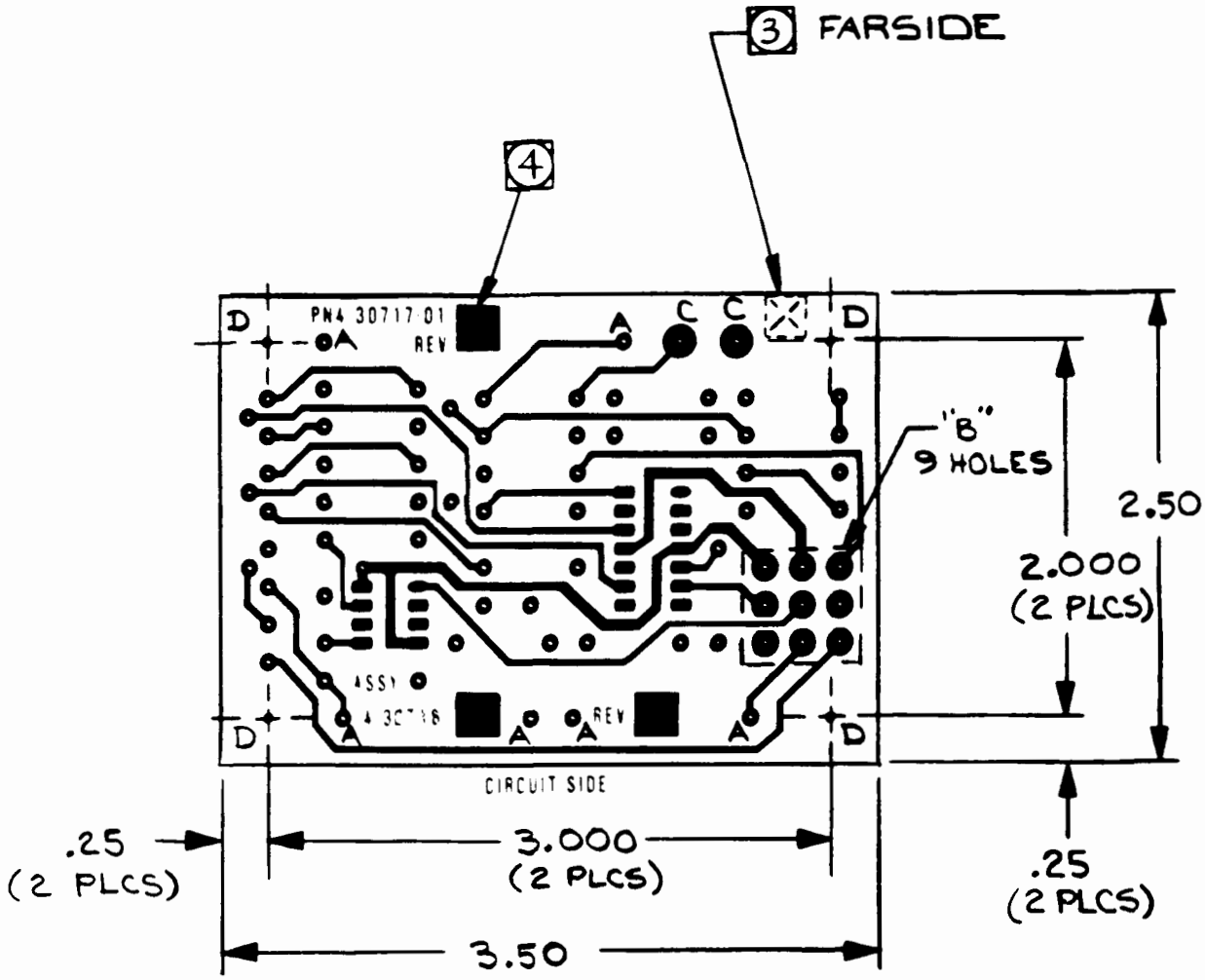


Figure 35 - Milliohm Meter Printed Circuit Board



DRAWN D&A	DATE 8-30-84
ENGR	DATE 9-14-84
CHKD	DATE 9/3/84
APPR	DATE 9/17/84
APPR	DATE
RELEASE EO 12549	SCALE 1X1
SIZE C / DWG NO. 4-30717	REV
SHEET 1 OF 1	

11.00. PARTS LIST

ASSEMBLY	PART NO.	NAME	QUANTITY		REFERENCE DESIGNATOR(S)							
4-30430-01		UNIBOND II FINAL ASSEMBLY	1	EA	A3							
	420-1-113	KNOB, OUTPUT RESISTANCE	1	EA	A3							
	10-266-01	MILLIOHMETER ASSY, OPTIONAL	1	EA	A3	A1						
	4-30487-01	POWER SUPPLY PCB ASSY	1	EA	A3	A1						
	4-30493-01	THUMBWHEEL PCB ASSY	1	EA	A3	A2						
	220-1-079	CAPACITOR, 5600MFD, 150VDC	2	EA	A3	C1	C2					
	240-1-044	CIRCUIT BREAKER, 2 AMP	1	EA	A3	CB1						
	435-1-009	PILOT LIGHT, RED	1	EA	A3	DS1						
	435-1-114	PILOT LIGHT, RED LED	2	EA	A3	DS2	DS3					
	656-1-007	ALARM, OHMETER	1	EA	A3	DS5						
	520-1-011	JACK, FIRING SWITCH, AMPH 80MC2F	1	EA	A3	J5						
	550-1-009	RECEPTACLE, AMPH 126-281, 5 SOCK	1	EA	A3	J6						
	564-2-264	RESISTOR, WW, 3.3 OHM, 10%, 5W	1	EA	A3	R02						
	564-1-263	RESISTOR, WW, 3K, 10%, 20W	1	EA	A3	R03						
	566-1-197	POT, LINEAR, 100 OHM, 10%, 1W	1	EA	A3	R04						
	568-2-024	RESISTOR, CBN, 24 OHM, 1/4W, 5%	1	EA	A3	R05						
	565-1-255	RESISTOR,CBN, 249 OHM, 1/4W, 1%	1	EA	A3	R06						
	680-1-271	SWITCH, ROCKER, DPDT, ON-ON	1	EA	A3	S1						
	680-1-242	SWITCH, ROCKER, DPST	1	EA	A3	S2						
	680-1-273	SWITCH, DPDT, 5AMP	1	EA	A3	S6						
	680-1-214	SWITCH, DPDT, 1A	1	EA	A3	SW7						
	4-30429-01	POWER TRANSFORMER	1	EA	A3	T1						
	4-30422-01	OUTPUT TRANSFORMER ASSY	1	EA	A3	T2						
	4-30548-01	TERMINAL STRIP ASSEMBLY	1	EA	A3	TB4						
	4-26958-01	TERMINAL STRIP ASSEMBLY	1	EA	A3	TB5						
4-30430-01	4-30738-01	TERMINAL STRIP ASSEMBLY	1	EA	A3	TB6						
4-26958-01		TERMINAL STRIP ASSEMBLY	1	EA	TB5							
	222-1-082	CAPACITOR, DISC, .01MF, 300V,20%	1	EA	TB5	C1						
4-26958-01	222-1-094	CAPACITOR, DISC, .005, 2KV,20%	1	EA	TB5	C2						
4-30422-01		OUTPUT TRANSFORMER ASSY	1	EA	T1							
4-30422-01	520-1-102	PLUG	1	EA	T1	P6						
4-30487-01		POWER SUPPLY PCB ASSY	1	EA	A1							
	222-1-047	CAPACITOR, DISC, .01 MF,100V,20%	6	EA	A1	C01	C03	C04	C10	C30	C31	
	221-1-117	CAPACITOR, DISC, .047MF, 50V, 5%	1	EA	A1	C02						
	222-1-111	CAPACITOR, DISC, .1 MF, 50V, 20%	6	EA	A1	C05	C06	C08	C20	C26	C34	
	220-1-109	CAPACITOR, TA, 1 MFD, 50V, 10%	4	EA	A1	C07	C11	C23	C24			
	220-1-048	CAPACITOR, TA, .47 MFD, 35V, 10%	1	EA	A1	C09						
	222-1-004	CAPACITOR, DISC, .001 MF,1KV,10%	2	EA	A1	C12	C14					
	220-1-055	CAPACITOR, TA, 2.2 MFD, 35V, 10%	1	EA	A1	C13						
	221-1-111	CAPACITOR, FILM, .47 MF,600V,10%	1	EA	A1	C15						
	220-1-097	CAPACITOR, TA, .22 MFD, 35V, 10%	1	EA	A1	C16						
	220-1-110	CAPACITOR, TA, 10 MFD, 35V, 10%	2	EA	A1	C17	C33					
	222-1-002	CAPACITOR, DISC, .003 MF,1KV,20%	3	EA	A1	C18	C19	C28				
	220-1-094	CAPACITOR, ELCTLC, 250 MFD, 50V	1	EA	A1	C21						
	220-1-192	CAPACITOR, ELCTLC, 470 MFD, 35V	1	EA	A1	C22						
	220-1-095	CAPACITOR, ELCTLC, 1000 MFD, 50V	1	EA	A1	C25						
	220-1-104	CAPACITOR, TA, 10 MFD, 35V, 10%	1	EA	A1	C27						
	222-1-096	CAPACITOR, DISC,.047 MF,100V,10%	1	EA	A1	C29						
	632-1-028	DIODE, 1N4148	8	EA	A1	CR01	CR02	CR03	CR04	CR05	CR06	CR15	CR16
	631-1-034	RECTIFIER, 1N4006	4	EA	A1	CR07	CR28	CR29	CR31				
	631-1-053	RECTIFIER, 6A6	7	EA	A1	CR08	CR09	CR10	CR11	CR12	CR13	CR14	
	632-1-028	DIODE, 1N4148	8	EA	A1	CR17	CR18	CR19	CR20	CR21	CR22	CR23	CR24
	632-1-028	DIODE, 1N4148	3	EA	A1	CR25	CR26	CR33					
	631-1-035	RECTIFIER, 30S10	3	EA	A1	CR27	CR30	CR32					
	656-1-006	ALARM	1	EA	A1	DS4							
	555-1-040	RELAY, P&B #KHP17D11, 4PDT	1	EA	A1	K1							
	630-1-056	TRANSISTOR, MPS-A13	3	EA	A1	Q01	Q02	Q04					
	630-1-038	TRANSISTOR, 2N3904	8	EA	A1	Q03	Q05	Q07	Q09	Q10	Q12	Q13	Q14
	630-1-037	TRANSISTOR, 2N3906	2	EA	A1	Q06	Q23						
	634-1-043	TRIAC, 2N6156	1	EA	A1	Q08							
	630-1-085	TRANSISTOR, MJ15022	8	EA	A1	Q11	Q16	Q17	Q18	Q19	Q20	Q21	Q22
	630-1-081	TRANSISTOR, TIP-100	1	EA	A1	Q15							
	566-1-171	POTENTIOMETER, 5K, 10%, 1/2W	2	EA	A1	R001	R031						
	565-1-251	RESISTOR, FILM, 18.2K, 1%, 1/4W	1	EA	A1	R002							
	568-2-310	RESISTOR, CBN, 10K, 5%, 1/4W	6	EA	A1	R005	R018	R032	R068	R069	R136		
	568-2-312	RESISTOR, CBN, 12K, 5%, 1/4W	3	EA	A1	R006	R060	R091					
4-30487-01	568-2-015	RESISTOR, CBN, 15 OHM, 5%, 1/4W	8	EA	A1	R007	R107	R110	R113	R116	R119	R122	R125

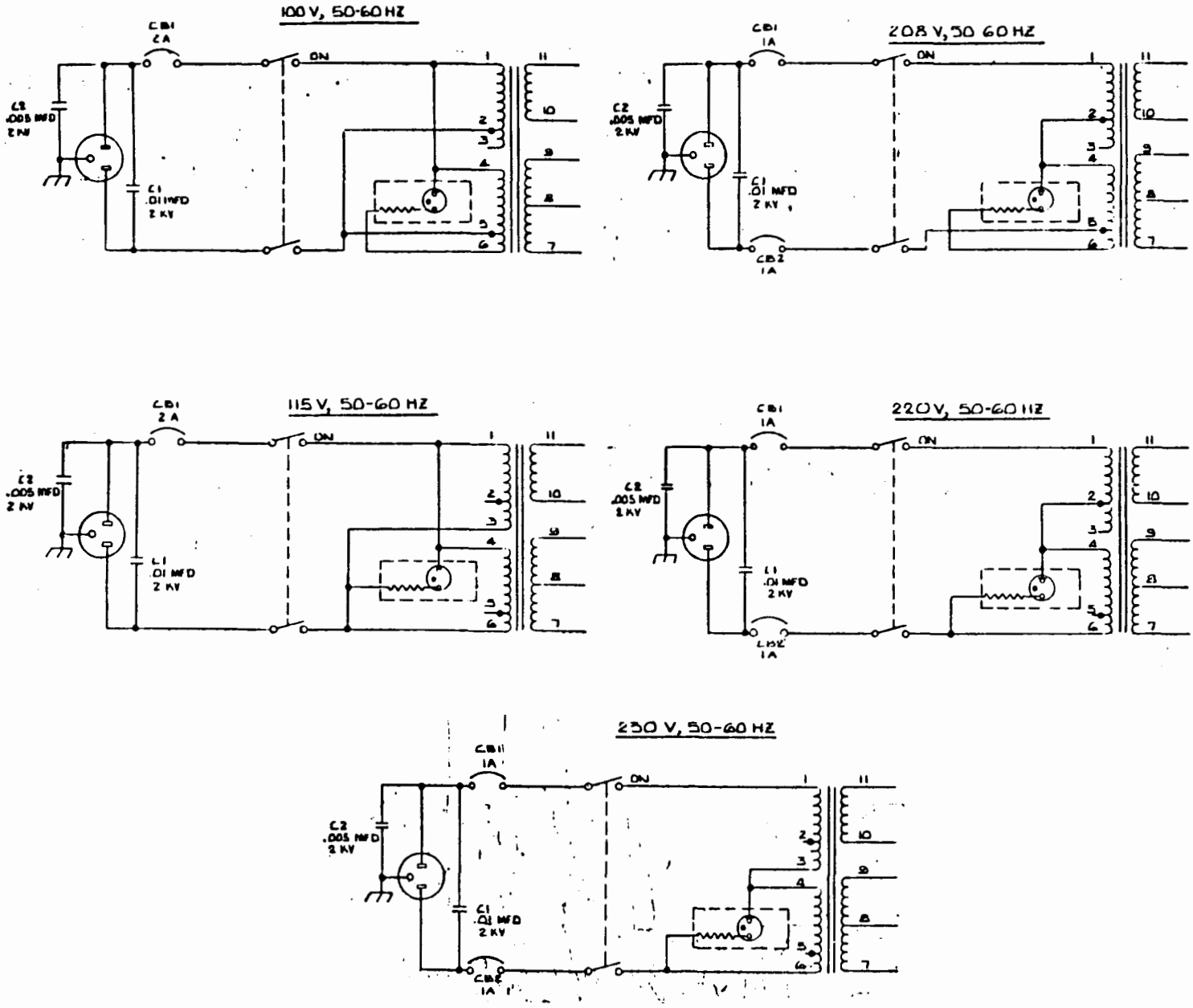
11.00 PARTS LIST (continued)

ASSEMBLY	PART NO.	NAME	QUANTITY		REFERENCE DESIGNATOR(S)
4-30487-01	568-2-410	RESISTOR, CBN, 100K, 5%, 1/4W	8	EA	A1 R008 R020 R021 R052 R055 R089 R094 R095
	562-2-121	RESISTOR, CBN, 1.5K, 10%, 1/2W	2	EA	A1 R009 R010
	568-2-347	RESISTOR, CBN, 47K, 5%, 1/4W	5	EA	A1 R011 R019 R029 R092 R154
	568-2-227	RESISTOR, CBN, 2.7K, 5%, 1/4W	2	EA	A1 R012 R075
	568-2-427	RESISTOR, CBN, 270K, 5%, 1/4W	1	EA	A1 R013
	568-2-210	RESISTOR, CBN, 1K, 5%, 1/4W	4	EA	A1 R014 R057 R096 R100
	566-1-176	POTENTIOMETER, 20K, 10%, 1/2W	1	EA	A1 R015
	568-2-433	RESISTOR, CBN, 330K, 5%, 1/4W	1	EA	A1 R022
	568-2-315	RESISTOR, CBN, 15K, 5%, 1/4W	3	EA	A1 R023 R025 R035
	568-2-282	RESISTOR, CBN, 8.2K, 5%, 1/4W	3	EA	A1 R024 R034 R084
	568-2-220	RESISTOR, CBN, 2K, 5%, 1/4W	3	EA	A1 R026 R036 R045
	565-1-212	RESISTOR, FILM, 30.1K, 1%, 1/8W	2	EA	A1 R027 R028
	568-2-256	RESISTOR, CBN, 5.6K, 5%, 1/4W	2	EA	A1 R030 R058
	568-2-322	RESISTOR, CBN, 22K, 5%, 1/4W	2	EA	A1 R033 R159
	568-2-318	RESISTOR, CBN, 18K, 5%, 1/4W	1	EA	A1 R037
	568-2-418	RESISTOR, CBN, 180K, 5%, 1/4W	3	EA	A1 R038 R098 R158
	565-1-219	RESISTOR, FILM, 49.9K, 1%, 1/8W	1	EA	A1 R039
	565-1-157	RESISTOR, FILM, 10K, 1%, 1/4W	2	EA	A1 R040 R086
	568-2-000	RESISTOR, SELECT IN TEST, 1/4W	1	EA	A1 R041
	565-1-139	RESISTOR, FILM, 12.1K, 1%, 1/8W	1	EA	A1 R042
	565-1-250	RESISTOR, FILM, 1.78K, 1%, 1/4W	1	EA	A1 R043
	565-1-221	RESISTOR, FILM, 249K, 1%, 1/4W	1	EA	A1 R044
	565-1-169	RESISTOR, FILM, 4.75K, 1%, 1/8W	1	EA	A1 R046
	568-2-368	RESISTOR, CBN, 68K, 5%, 1/4W	2	EA	A1 R047 R076
	564-1-215	RESISTOR, FILM, .5 OHM, 5%, 12W	1	EA	A1 R048
	567-2-947	RESISTOR, CBN, 4.7 OHM, 5%, 1/4W	1	EA	A1 R049
	561-2-123	RESISTOR, CBN, 330 OHM, 10%, 1W	2	EA	A1 R050 R051
	565-1-258	RESISTOR, FILM, 60.4K, 1%, 1/4W	1	EA	A1 R053
	568-2-422	RESISTOR, CBN, 220K, 5%, 1/4W	1	EA	A1 R054
	568-2-215	RESISTOR, CBN, 1.5K, 5%, 1/4W	1	EA	A1 R056
	568-2-122	RESISTOR, CBN, 220 OHM, 5%, 1/4W	1	EA	A1 R059
	568-2-247	RESISTOR, CBN, 4.7K, 5%, 1/4W	5	EA	A1 R061 R072 R077 R083 R101
	568-2-222	RESISTOR, CBN, 2.2K, 5%, 1/4W	3	EA	A1 R062 R064 R099
	562-2-045	RESISTOR, CBN, 470 OHM, 5%, 1/2W	1	EA	A1 R063
	568-2-327	RESISTOR, CBN, 27K, 5%, 1/4W	2	EA	A1 R065 R161
	568-2-218	RESISTOR, CBN, 1.8K, 5%, 1/4W	1	EA	A1 R066
	560-1-111	RESISTOR, WW, 1K, 10%, 2W	1	EA	A1 R067
	568-2-212	RESISTOR, CBN, 1.2K, 5%, 1/4W	1	EA	A1 R070
	561-2-118	RESISTOR, CBN, 390 OHM, 10%, 1W	1	EA	A1 R071
	564-1-147	RESISTOR, WW, 1 OHM, 5%, 5W	1	EA	A1 R073
	564-1-267	RESISTOR, WW, 220 OHM, 5%, 12W	1	EA	A1 R074
	568-2-000	RESISTOR, SELECT IN TEST, 1/4W	1	EA	A1 R078
	565-1-209	RESISTOR, FILM, 8.25K, 1%, 1/2W	1	EA	A1 R079
	568-2-620	RESISTOR, CBN, 20MEG, 5%, 1/4W	1	EA	A1 R080
	568-2-320	RESISTOR, CBN, 20K, 1/4W, 5%	2	EA	A1 R081 R162
	568-2-047	RESISTOR, CBN, 47 OHM, 5%, 1/4W	1	EA	A1 R082
	565-1-253	RESISTOR, FILM, 39.2K, 1%, 1/4W	1	EA	A1 R085
	566-1-198	POTENTIOMETER, 2K, 10%, 1/2W	1	EA	A1 R087
	565-1-252	RESISTOR, FILM, 20K, 1%, 1/4W	2	EA	A1 R088 R137
	565-1-184	RESISTOR, FILM, 4.99K, 1%, 1/2W	1	EA	A1 R090
	565-1-256	RESISTOR, FILM,287 OHM, 1%, 1/4W	1	EA	A1 R093
	568-2-233	RESISTOR, CBN, 3.3K, 5%, 1/4W	1	EA	A1 R097
	566-1-172	POT, 3/8" sq, 10K, 10%, 1/2W	1	EA	A1 R102
	561-2-138	RESISTOR, CBN, 33 OHM, 5%, 1W	1	EA	A1 R103
	564-1-153	RESISTOR, WW, 3 OHM, 5%, 5W	2	EA	A1 R104 R105
	568-2-927	RESISTOR, CBN, 2.7 OHM, 5%, 1/4W	8	EA	A1 R106 R109 R112 R115 R118 R121 R124 R156
	564-1-265	RESISTOR, WW, .15 OHM, 10%, 5W	7	EA	A1 R108 R111 R114 R117 R120 R123 R126
	564-1-262	RESISTOR, WW, 20 OHM, 5%, 12W	1	EA	A1 R127
	565-1-126	RESISTOR, FILM, 1.5K, 1%, 1/4W	1	EA	A1 R128
	565-1-248	RESISTOR, FILM,182 OHM, 1%, 1/4W	1	EA	A1 R129
	565-1-254	RESISTOR, FILM, 40.2K, 1%, 1/4W	2	EA	A1 R130 R132
	565-1-257	RESISTOR, FILM,604 OHM, 1%, 1/4W	2	EA	A1 R131 R133
	568-1-456	RESISTOR, CBN, 560K, 5%, 1/4W	1	EA	A1 R134
	568-2-115	RESISTOR, CBN, 150 OHM, 5%, 1/4W	1	EA	A1 R135
	565-1-175	RESISTOR, FILM, 6.65K, 1%, 1/2W	1	EA	A1 R138
	568-2-615	RESISTOR, CBN, 15MEG, 5%, 1/4W	1	EA	A1 R139
	565-1-151	RESISTOR, FILM, 15.0K, 1%, 1/2W	1	EA	A1 R140
	565-1-186	RESISTOR, FILM, 7.50K, 1%, 1/2W	1	EA	A1 R141
	568-2-230	RESISTOR, CBN, 3.0K, 5%, 1/4W	1	EA	A1 R155
	568-2-447	RESISTOR, CBN, 470K, 1/4W, 5%	1	EA	A1 R156
4-30487-01	568-2-610	RESISTOR, CBN, 10MEG, 1/4W, 5%	1	EA	A1 R157

11.00 PARTS LIST (continued)

ASSEMBLY	PART NO.	NAME	QUANTITY		REFERENCE DESIGNATOR(S)			
4-30487-01	565-1-205	RESISTOR, CBN, 3.57K, 10%, 1/2W	1	EA	A1	R160		
	563-1-125	RESISTOR NETWORK, 47K x 9	1	EA	A1	RN1		
	637-1-049	I.C., MC14585BCP	3	EA	A1	U01	U02	U08
	637-1-085	I.C., ICM7250LJE	1	EA	A1	U03		
	637-1-014	I.C., NE556A	2	EA	A1	U04	U05	
	636-1-017	I.C., LM324N	1	EA	A1	U06		
	636-1-036	I.C., MOC3021	1	EA	A1	U07		
	636-1-025	I.C., LM324AN	1	EA	A1	U09		
	637-1-009	I.C., MC14013BCP	1	EA	A1	U10		
	636-1-033	I.C., MC79L15AC	1	EA	A1	U11		
4-30487-01	636-1-031	I.C., MC7815CT	2	EA	A1	U12	U13	
4-30493-01		THUMBWHEEL PCB ASSEMBLY	1	EA	A2			
	220-1-195	CAPACITOR, TA, 5 MFD, 25V, 10%	1	EA	A2	C32		
	631-1-034	RECTIFIER, 1N4006	2	EA	A2	CR35	CR36	
	568-1-147	RESISTOR, CBN, 470 OHM, 5%, 1/4W	1	EA	A2	R142		
	565-1-184	RESISTOR, FILM, 4.99K, 1%, 1/2W	1	EA	A2	R143		
	565-1-157	RESISTOR, FILM, 10K, 1%, 1/4W	1	EA	A2	R144		
	565-1-217	RESISTOR, FILM, 12.4K, 1%, 1/8W	1	EA	A2	R145		
	565-1-218	RESISTOR, FILM, 24.9K, 1%, 1/8W	1	EA	A2	R146		
	565-1-219	RESISTOR, FILM, 49.9K, 1%, 1/8W	1	EA	A2	R147		
	565-1-152	RESISTOR, FILM, 100K, 1%, 1/2W	1	EA	A2	R148		
	565-1-220	RESISTOR, FILM, 124K, 1%, 1/8W	1	EA	A2	R149		
	565-1-221	RESISTOR, FILM, 249K, 1%, 1/8W	1	EA	A2	R150		
	565-1-222	RESISTOR, FILM, 499K, 1%, 1/8W	1	EA	A2	R151		
	565-1-223	RESISTOR, FILM, 1 MEG, 1%, 1/8W	1	EA	A2	R152		
	4-29123-01	DURATION THUMBWHEEL ASSY	1	EA	A2	SW1		
	4-29124-04	AMPLITUDE THUMBWHEEL ASSY	1	EA	A2	SW2		
4-30493-01	637-1-003	I.C., MC14001BCP, 14 PIN	1	EA	A2	U14		
4-30548-01		TERMINAL STRIP ASSEMBLY	1	EA	TB4			
	568-2-010	RESISTOR, CBN, 10 OHM, 5%, 1/4	1	EA	TB4			
4-30548-01	568-2-010	RESISTOR, CBN, 10 OHM, 5%, 1/4	1	EA	TB4	R1		
4-30738-01		TERMINAL STRIP ASSEMBLY	1	EA	TB6			
	568-2-482	RESISTOR, CBN, 820K, 5% 1/4W	1	EA	TB6	R22		
	568-2-510	RESISTOR, CBN, 1M, 5% 1/4	1	EA	TB6	R23		
4-30738-01	568-2-133	RESISTOR, CBN, 330 OHM, 5% 1/4W	1	EA	TB6	R24		
4-30740-01		MILLIOHMETER ASSY, 10-266-01	1	EA				
	4-30718-01	MILLIOHMETER PCB ASSY	1	EA	A1			
	222-1-111	CAPACITOR, MONO, 0.1 MFD, 50V	1	EA	A1	C1		
	222-1-047	CAPACITOR, CER, .01 MFD,100V	1	EA	A1	C2		
	222-1-002	CAPACITOR, CER, .003 MFD, 1000V	1	EA	A1	C3		
	220-1-182	CAPACITOR, ELCTLT, 250 MFD, 16V	1	EA	A1	C4		
	221-1-125	CAPACITOR, FILM, 1 MFD, 200V	1	EA	A1	C5		
	221-1-121	CAPACITOR, FILM, .022 MFD, 50V	1	EA	A1	C6		
	632-1-028	DIODE, 1N4148	3	EA	A1	CR1	CR2	CR3
	250-1-117	CONNECTOR, WAFERCON 9 CKT	1	EA	A1	J1		
	4-30744-01	METER FOR MILLIOHMETER	1	EA	A1	M1		
	566-1-171	POTENTIOMETER, 5K, 1/2W, 10%	1	EA	A1	R01		
	568-2-247	RESISTOR, 4.7K, 1/4W, 5%	2	EA	A1	R02	R15	
	568-2-220	RESISTOR, 2K, 1/4W, 5%	1	EA	A1	R03		
	568-2-439	RESISTOR, 390K, 1/4W, 5%	1	EA	A1	R04		
	565-1-157	RESISTOR, 10K, 1/4W, 1%	1	EA	A1	R05		
	566-1-198	POTENTIOMETER, 2K, 1/2W, 10%	2	EA	A1	R06	R19	
	568-2-239	RESISTOR, 3.9K, 1/4W, 5%	1	EA	A1	R07		
	565-1-137	RESISTOR, 3.92K, 1/4W, 1%	1	EA	A1	R08		
	568-2-210	RESISTOR, 1K, 1/4W, 5%	1	EA	A1	R09		
	565-1-106	RESISTOR, 20K, 1/4W, 1%	4	EA	A1	R10	R11	R12 R14
	568-2-227	RESISTOR, 2.7K, 1/4W, 5%	2	EA	A1	R13	R16	
	568-2-310	RESISTOR, 10K, 1/4W, 5%	2	EA	A1	R17	R21	
	568-2-347	RESISTOR, 47K, 1/4W, 5%	1	EA	A1	R18		
	568-2-151	RESISTOR, 510 OHM, 1/4W, 5%	1	EA	A1	R20		
	637-1-013	I.C., NE555	1	EA	A1	U1		
4-30740-01	636-1-039	I.C., LM348N	1	EA	A1	U2		

Figure 36 - CONNECTION DIAGRAMS FOR UNIBOND II



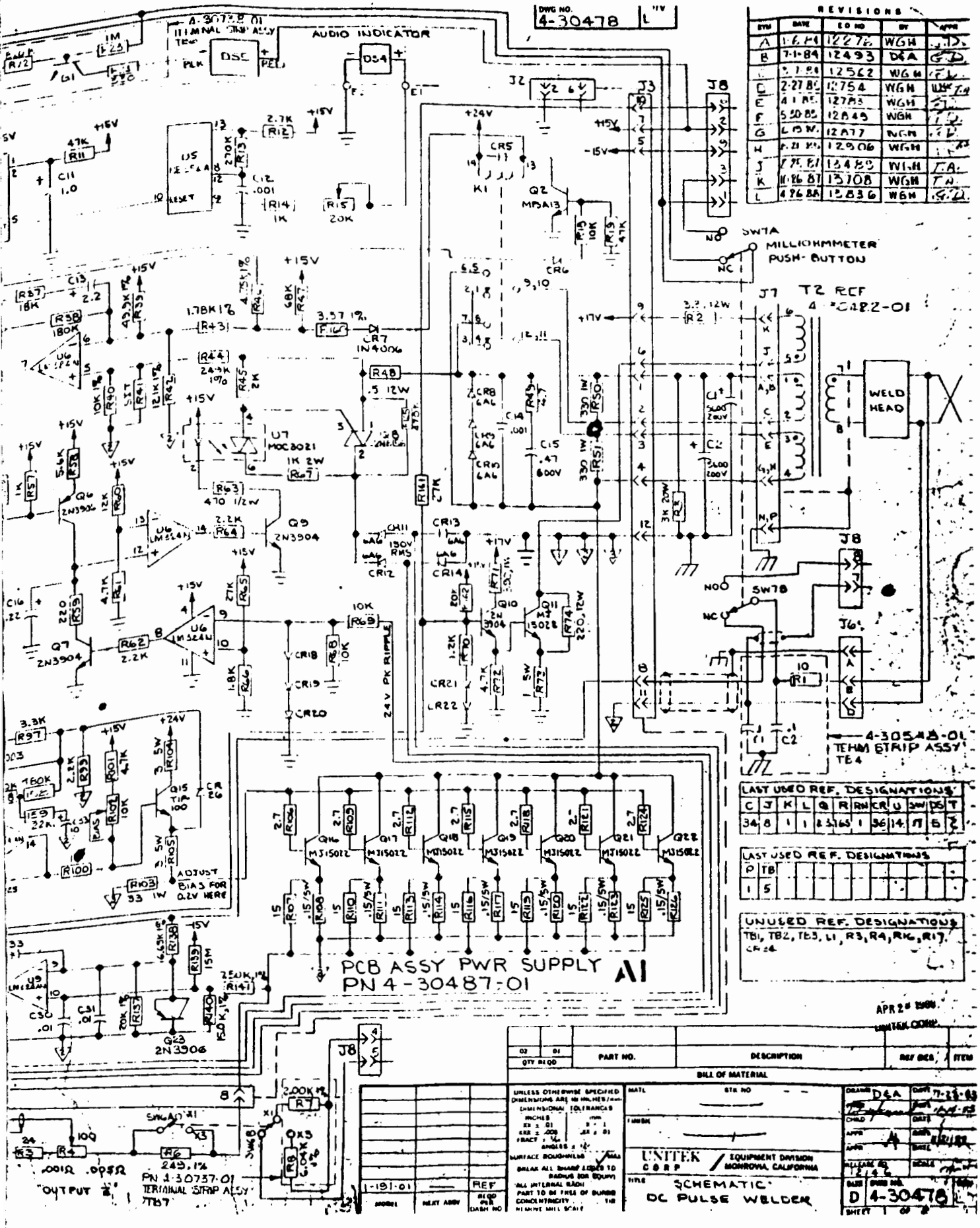
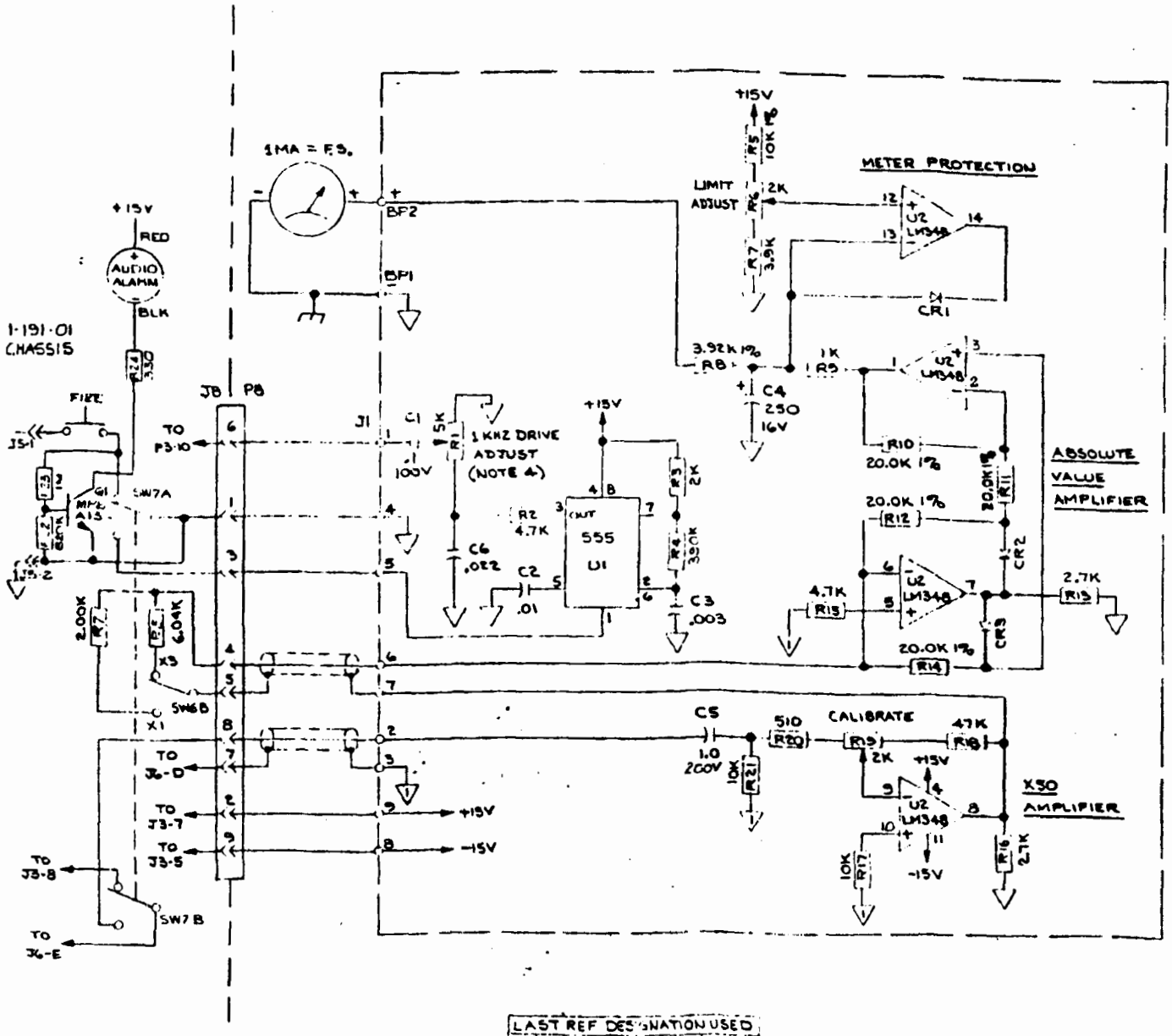

DWG NO. 4-30478
REVISIONS
AUDIO INDICATOR
TERMINAL STRIP ASSY
DS4
DS5
U5
U6
U7
MOC8021
Q2 MPSA13
Q6 2N3906
Q7 2N3904
Q9 2N3904
Q15 TIP100
Q23 2N3906
Q10 MJ15024
Q11 MJ15022
Q16 MJ15022
Q17 MJ15022
Q18 MJ15022
Q19 MJ15022
Q20 MJ15022
Q21 MJ15022
Q22 MJ15022
CR5
K1
CR6
CR7 IN4006
CR8 6A6
CR9 6A6
CR10 6A6
CR11 6A6
CR12
CR13
CR14
CR18
CR19
CR20
CR21
CR22
J2
J3
J8
J7
T2 REF 4-30282-01
WELD HEAD
SW7A MILLIOHMMETER PUSH-BUTTON
SW7B
4-30518-01 TERM STRIP ASSY TB4
24V PK RIPPLE
ADJUST BIAS FOR 0.2V HERE
PCB ASSY PWR SUPPLY A1
PN 4-30487-01
PN 1-30737-01 TERMINAL STRIP ASSY
"OUTPUT"
LAST USED REF. DESIGNATIONS
UNUSED REF. DESIGNATIONS
TB1, TB2, TB3, L1, R3, R4, R6, R17, CR26
BILL OF MATERIAL
UNITEK CORP / EQUIPMENT DIVISION MONROVIA, CALIFORNIA
SCHEMATIC DC PULSE WELDER
D 4-30478

Figure 37 - SCHEMATIC OF MILLIOHM METER PCB



LAST REF DESIGNATION USED								
C	CR	R	U	Q				
6	3	24	2	1				

4-ADJUST FOR 1 AMP RMS OUTPUT AT WELD TRANSFORMER SECONDARY.
3-ALL DIODES ARE TYPE IN4148.
2-ALL CAPACITOR VALUES IN μFARADS.
1-ALL RESISTOR VALUES IN OHMS, 1/4W ±5%.

10-266-01	—	REF	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	MATL	STK NO — —	DRAWN D&A	DATE 7-24-84
MODEL	NEXT ASSY	REQD PER DASH NO	DIMENSIONAL TOLERANCES: INCHES XX ± .01, XXX ± .005, FRACT ± 1/64; MM ± .1, ± .01; ANGLES ± ½°	FINISH		CHKD	DATE
			SURFACE ROUGHNESS 125 MAX; BREAK ALL SHARP EDGES TO RADIUS (OR EQUIV); ALL INTERNAL RADII; PART TO BE FREE OF BURRS; CONCENTRICITY TIR; REMOVE MILL SCALE	UNITEK CORP / EQUIPMENT DIVISION MONROVIA, CALIFORNIA		APVD	DATE 8/21/84
				TITLE SCHEMATIC, MILLIOHMMETER		RELEASED TO 25 87	SCALE
						SIZE C	DWG NO. 4-30719 REV D
						SHEET 1 OF 1	

Figure 38 - SCHEMATIC OF UNIBOND II

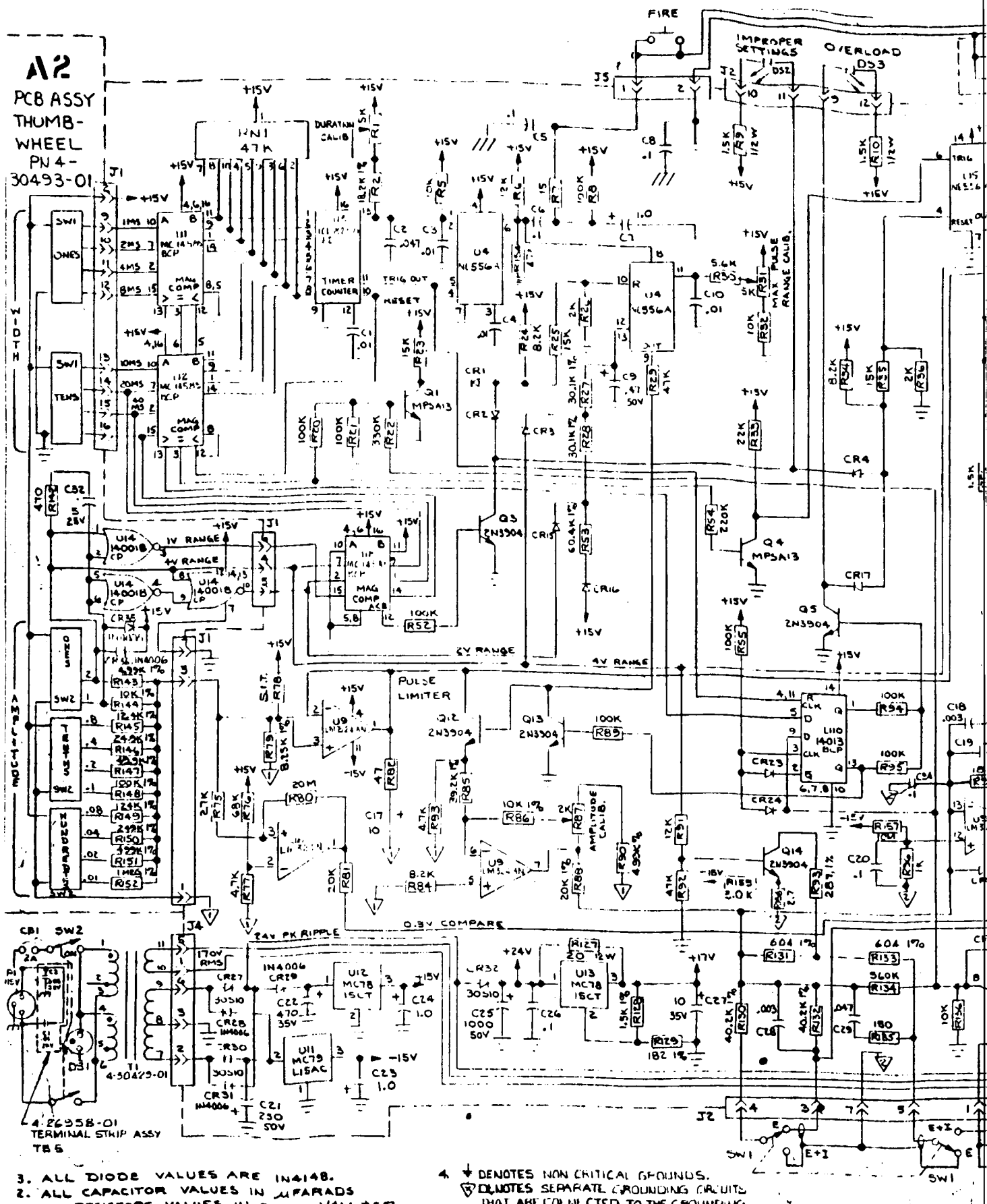
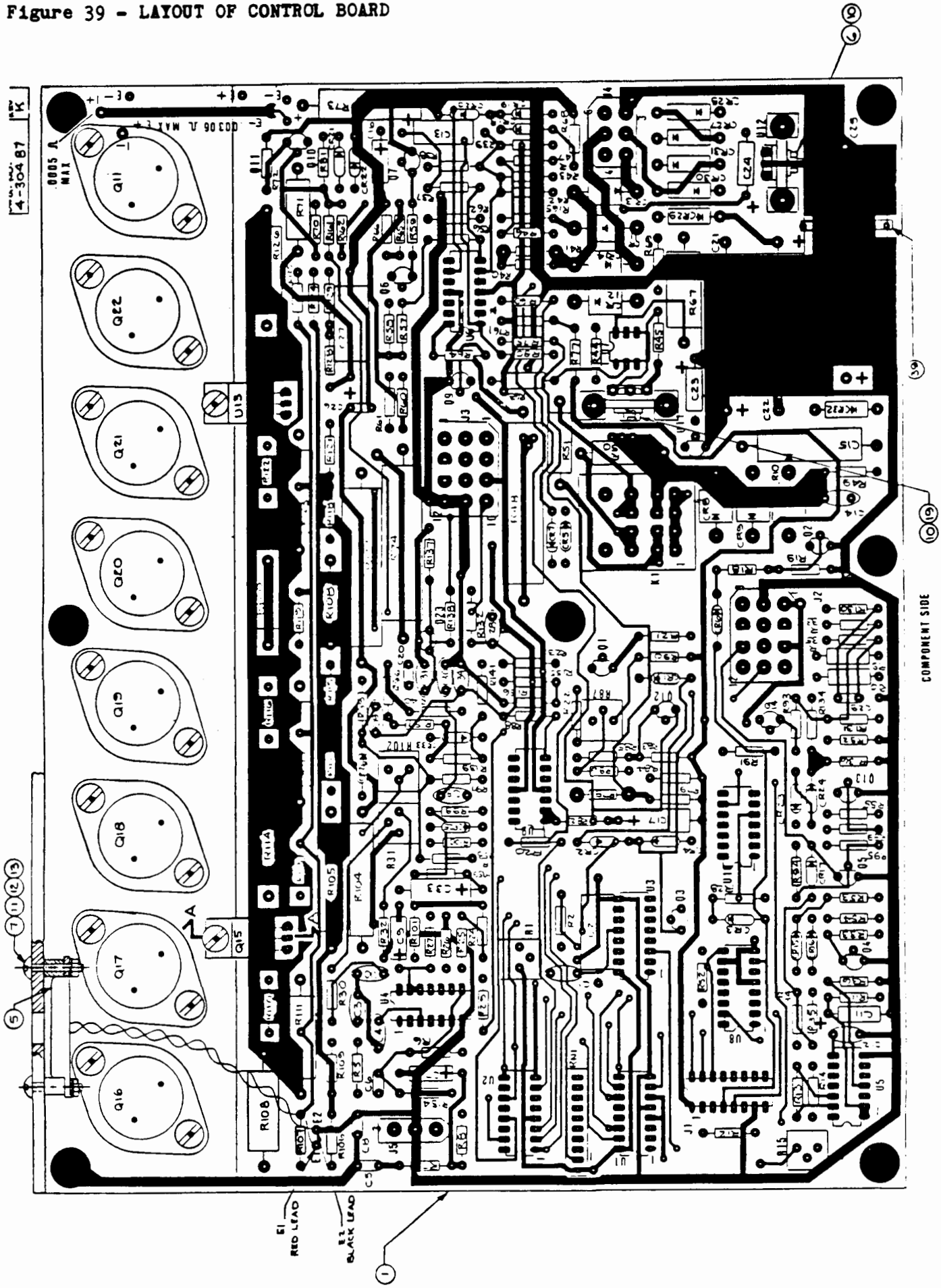


Figure 39 - LAYOUT OF CONTROL BOARD



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