UNIBOND® II

Advanced microjoining system

The Unitek Equipment® Unibond Microjoining/Welding System consists of the Model UB2, Unibond II Power Supply; the Model 50, Light Force Weld Head; the Model UWS, Universal Work Station; in combination with Unibond and Unitip® electrodes. The Unibond Welding System is specifically designed for most fine wire and ribbon bonding applications, including fine trace printed circuit board repair, and to manufacture such items as wire wound potentiometers, hybrid microwave devices, heart pacers, electrical fuses, ordnance fuzes, and solar cells.

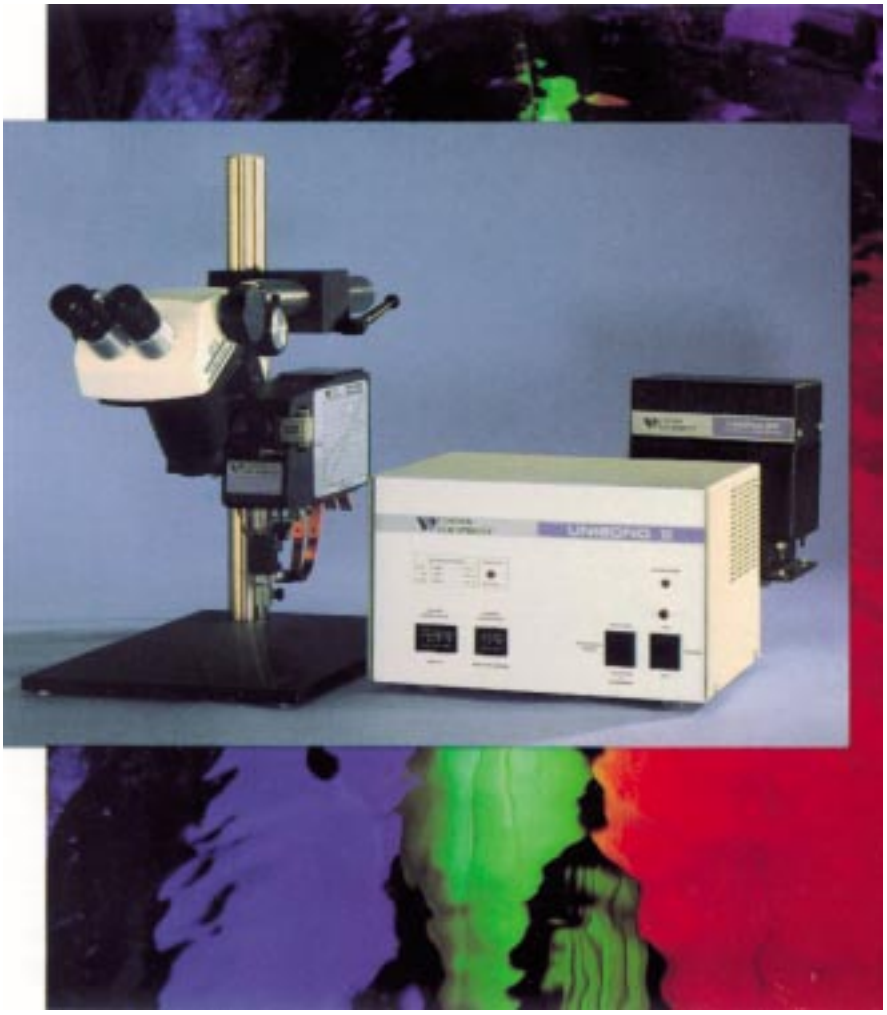
The Unibond II Power Supply is a dual mode Constant Power/Constant Voltage Power Supply that constantly measures and controls the output voltage or pulse amplitude in order to maintain a constant voltage or constant voltage plus current at the electrodes. The patented* VOLTAGE + CURRENT FEEDBACK MODE dramatically improves the consistency of the welding results in those applications where the surface conditions of the parts vary and/or the workpieces are made from highly conductive materials.

The Series 50 Light Force Weld Heads are precision, low inertia, heads designed specifically for delicate, parallel gap welding and reflow soldering. TRUE VERTICAL ELECTRODE MOTION, a unique Series 50 feature, eliminates electrode wiping action. A low mass spring and compound lever force system ensures accurate, repeatable welding force in the 40 to 1000 gram-force range.

The Universal Work Station, which is used to repair the traces on printed circuit boards, as well as for other applications, offers a new level of flexibility by eliminating "goal post" supports which limit the depth of the work station. The rigid frame, independent shelves, large open space, and flexible design permit the UWS to be adapted for a wide range of application requirements.

Unitip Electrodes are exclusive to Unitek Equipment and are designed for parallel gap bonding ribbons (wire) smaller than 0.010 inch (0.25 mm). Unibond Electrodes are designed for parallel gap bonding and reflow soldering, and exclusively for microjoining.

* U.S. Patent 4,564,735



FEATURES

- Solid State Low Impedance Power Supply
- Constant Voltage and Voltage + Current Feedback Modes
- Digital Pulse Amplitude and Duration Controls
- High Voltage Output and Short Weld Duration
- True Vertical Weld Head Electrode Motion
- Weld Force can be as low as 40gf (0.39 N)
- Flexible "Jungle Gym" Work Station with Adjustable Shelves and Rigid Construction

BENEFITS

- Eliminates need for bulky, expensive and limited life batteries
- Ensures weld quality despite variations in material quality
- Ensures repeatable microwelding of miniature parts
- Achieves better weld quality and increases electrode life
- Eliminates electrode wiping action which improves weld quality
- Bonds ribbons as small as 0.0003 inch (7.6 microns) thickness
- Supports wide variety of equipment and enables efficient use of workbench space

UNITEK EQUIPMENT®
World Leader in Precision Metals Joining

A Unitek Miyachi Group Company

PARALLEL GAP MICROJOINING (BONDING)

The Parallel Gap Resistance microjoining technique can be used to perform Resistance Welding, Thermocompression Bonding, Resistance Brazing or Reflow Soldering. All of these processes use different combinations of Temperature, Pressure and Time to achieve the final result. The primary applications for parallel gap microjoining are to bond fine wire and ribbon to:

Hybrid or Microwave circuitry.
Thin or thick film substrates.
Potentiometers and other miniature components.
Semi-rigid substrates.
Fine line printed circuit traces.

It is also used to weld flat packs to printed circuit boards and parallel gap reflow solder small parts. The materials which can be bonded with the parallel gap technique include: copper, gold, gold-plated dumet, gold-plated Kovar, platinum, silver, nichrome and pyrofuse.

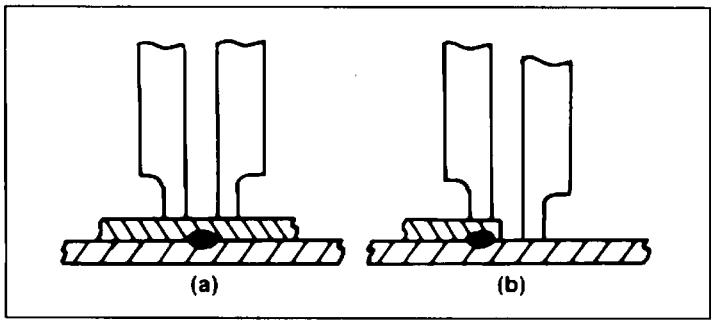


Figure 1 – (a) Parallel gap bond and (b) parallel gap step bond.

THE PROCESS – For purposes of this discussion, microjoining and bonding mean joining a ribbon (wire) to a metallized substrate by passing current through the ribbon and the substrate. The resistance of the ribbon and the substrate to the flow of electricity generates the heat necessary to obtain a mechanical connenction whose strength approximates the tensile strength of the ribbon. In Parallel Gap Microjoining, two electrodes are positioned, within .025 inch of each other, on top of a ribbon which has been positioned on top of a metallized area on a substrate as illustrated in Figure 1a. Step bonding is a variant, in which one electrode is placed on the ribbon and the other is placed on a metallized area of the substrate, and the parameters are adjusted so that the bond occurs between the ribbon and the substrate, as illustrated in Figure 1b.

CONSTANT VOLTAGE OPERATION

A Constant Voltage power supply is ideal in those cases where the bonding resistance remains constant, or increases, during the bonding sequence. Figure 2 illustrates the relationship of voltage and current as a function of time, using a Constant Voltage power supply to bond a Kovar ribbon to a copper trace on a printed circuit board. At the beginning of the process, the contact resistances between the electrodes and ribbon and between the ribbon and the substrate are relatively low with respect to the resistance of the Kovar ribbon. As the surfaces of the ribbon and metallized substrate become plastic, the reduction in the contact resistances is masked by the increase in resistance of the Kovar ribbon caused by the increased temperature. In this example, the current, and therefore the heating rate, are considerably higher at the beginning of the bonding sequence. This compensates, in part, for variations in the physical parameters associated with the ribbon and metallized substrate. Since the heating rate continues to decrease as the temperature of the work pieces increases, the initial setting is less important and is, to some degree, self limiting. In this example, satisfactory welds can be made with a pulse amplitude of 0.62 volts and pulse durations which range from 8 to 40 milliseconds.

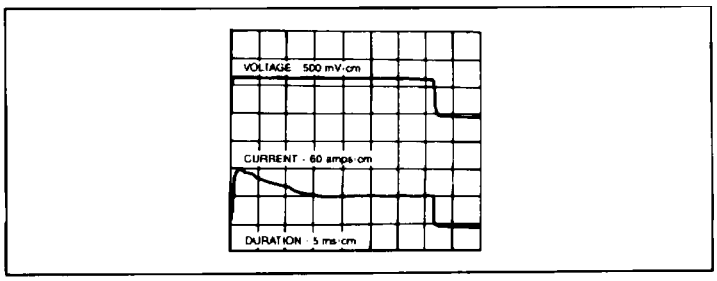


Figure 2 – A Constant Voltage supply is ideal for parallel gap welding a resistive ribbon to a metallized substrate as illustrated by the time relationship of voltage and current.

Figure 3 illustrates what happens when a Constant Voltage power supply is used to bond a copper ribbon to a copper trace on a printed circuit board. At the beginning of the bond, the contact resistances between the electrodes and ribbon and between the ribbon and the trace are relatively high with respect to the resistance of the copper ribbon. As the surface of the ribbon and trace are heated, the increase in the resistance of the ribbon is masked by the reduction in the contact resistances. Since the voltage remains constant, the current continues to increase as the total resistance decreases as shown in the first millisecond of the current waveform in Figure 3. During the remaining portion of the pulse, the decrease in current is approximately 20% as contrasted to the 50% decrease shown in Figure 2. The substantially higher heating rates in combination with copper's relatively small plastic temperature zone, makes this process more difficult to control.

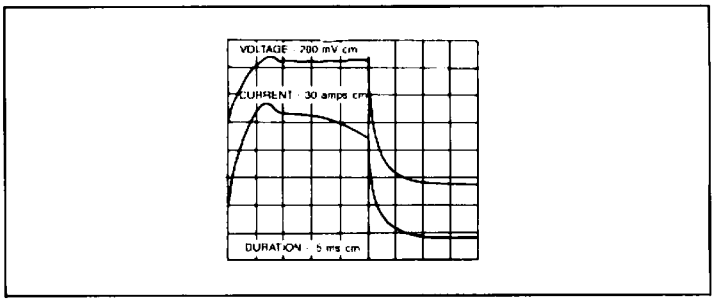


Figure 3 – A Constant Voltage supply may not be ideal for parallel gap welding a conductive ribbon to a metallized substrate as illustrated by the time relationship of voltage and current.

CONSTANT POWER OPERATION

In a Constant Power System the power will remain constant regardless of what changes occur in the bonding resistance. In the VOLTAGE + CURRENT (V + I) Mode, the Unibond II will dynamically increase or reduce the amplitude of the bonding pulse in an effort to maintain a constant voltage-current product, constant power, at the electrodes. The voltage and current waveforms shown in Figure 4 are the result of welding a "clean" and "oxidized" copper ribbon to a "clean" and "oxidized" trace on a printed circuit board in the V + I Mode. Figure 4b shows that the voltage during the first 25 ms of the sequence for the "oxidized" combination was 25% higher than that shown for the "clean" combination which resulted in nearly identical heating rates.

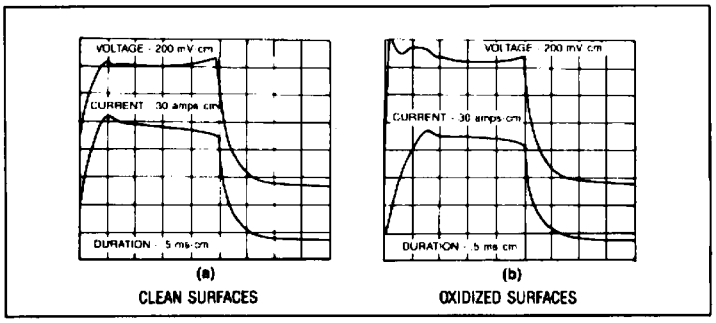


Figure 4 – Copper ribbon welded to an unplated copper trace in the Voltage + Current Mode using parts with (a) "clean" and (b) "oxidized" surfaces.

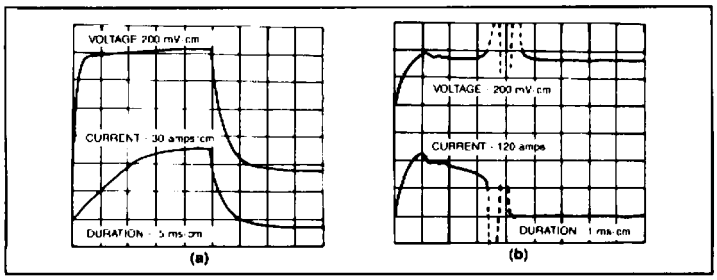


Figure 5 – Oxidized copper ribbon welded to an unplated oxidized copper trace in the Constant Voltage Mode. In (a) the energy was not sufficient to bond the parts while in (b) the same settings caused the ribbon to explode.

Contrast this to the results shown in Figure 5 in which a Constant Voltage supply was used to weld the same "oxidized" copper combination. In one case, the current did not reach its peak until the end of the cycle and the "oxidized" parts were not bonded. In the second, the "oxidized" ribbon and trace exploded. The Constant Voltage Mode is unable to compensate for the variations in surface conditions routinely encountered in making copper-to-copper welds. In contrast, the Unibond II with its Voltage + Current Mode is ideally suited for microjoining Copper, gold, gold-plated dumet, gold-plated Kovar, platinum, silver, nichrome and pyrofuse.

VARIABLES FOR PARALLEL GAP MICROJOINING

PULSE AMPLITUDE – Bonding energy is a function of pulse amplitude and pulse duration. The heating rate varies as the square of the amplitude. Higher heating rates cause the ribbon and substrate to melt faster, which in turn, increases the probability of blowouts and/or excessive deformation. It is considered good practice to use the lowest energy and shortest time which will consistently produce the desired bond.

PULSE DURATION – The longer the Pulse Duration the greater the penetration of the bond into both the ribbon and the metallized surface, and the greater the effect upon the metallurgical structure of the bond. In general, use pulse durations less than 15 ms for welding and durations greater than 15 ms for thermocompression bonding, brazing or reflow soldering. Pulse Duration is critical, and should be kept to a minimum for conductive materials, such as copper. Long pulses can cause excessive heating of delicate components.

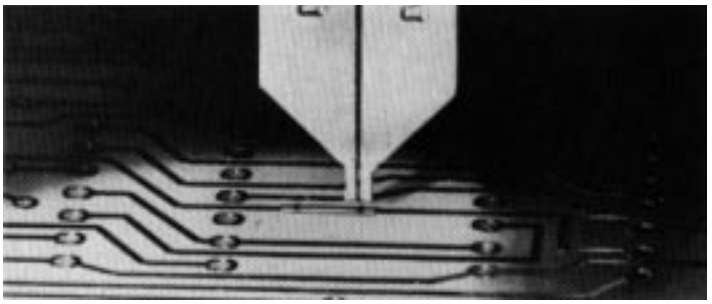
ELECTRODE FORCE is the least critical parameter. Increasing the electrode force lowers the contact resistance between the ribbon and the substrate and between the ribbon and the electrodes. High force causes excessive deformation of the ribbon; low force causes "blowouts."

ELECTRODE GAP is the distance between the inside edges of electrodes. Thicker materials usually require a wider gap to allow for proper current penetration into the lower material. The larger the gap, the greater the energy required to make a given bond.

ELECTRODE CONFIGURATION – The larger the electrode face which contracts the ribbon, the lower the pressure (force per unit area) and the larger the size of the bond. Lower pressure is more likely to cause spitting or sticking. To improve the bonding characteristics of conductive materials use molybdenum or tungsten electrodes with small faces. For resistive materials, use RWMA-2 Copper Unibond Electrodes with large faces.

UNIBOND® ELECTRODES

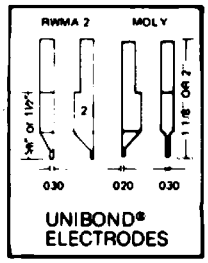
Unibond Electrodes are used for parallel gap bonding and reflow soldering. Generally, RWMA 2 copper Unibond Electrodes are used with the more resistive and/or hard materials such as gold-plated Kovar and nickel. Molybdenum Unibond Electrodes are used for bonding the more conductive or soft materials such as copper and gold. The face of a Unibond Electrode is 0.020 inches (0.5 mm) wide and 0.030 inches (0.75 mm) deep. In unfixtured applications, this limits their use to bonding ribbons (wire) which are at least 0.010 inches (0.25 mm) wide because of the limited visibility.



UNIBOND Electrodes make welded circuit board repair.

Unibond Electrodes can be used on models 50 and 86 weld heads.

MODEL	MATERIAL	LENGTH (Inches)
EU1000	RWMA 2	1⅛
EU2030M	MOLY	1⅛
EU1002	RWMA 2	2
EU2030ML	MOLY	2

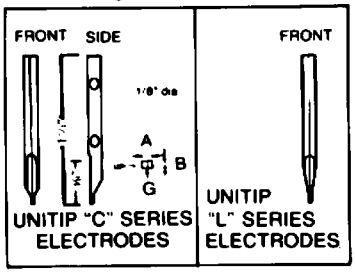


UNIBOND® ELECTRODES

UNITIP® ELECTRODES

Unitips provide a practical electrode for parallel gap bonding ribbons (wires) which are smaller than 0.010 inch (0.25 mm). Unitips are made from two pieces of molybdenum which are permanently bonded to an insulating spacer. The face sizes range from 40 to 400 square mils. The fixed gap, and the bonded construction result in a tip which wears uniformly, when properly dressed. The length of the Unitip, and the flat area on the front side allows it to bond ribbons extremely close to the walls of packages which are as deep as 0.450 inches (11.5 mm). The narrower Thinline "L" Series have a tapered profile which allows them to be used closer to corners.

Unitip electrodes can be used with Unitip Adapter UTA on Model 50F/UB or 50A/UB Light Force Weld Head and also on Model 86 Weld Head.



MODEL	A	B	G	MAX. FORCE OZ.	MAX. FORCE Kgf.
UTM111L	.009	.010	.001	33	.94
UTM112L	.010	.010	.002	33	.94
UTM152L	.010	.005	.002	17	.47
UTM222L	.018	.020	.002	132	3.75
UTM111C	.009	.010	.001	33	.94
UTM112C	.010	.010	.002	33	.94
UTM222C	.018	.020	.002	132	3.75
UTM224C	.020	.020	.004	132	3.75
UTM237C	.020	.030	.007	161	4.57

All dimensions in inches unless noted.

A Unitip electrode used to bond gold ribbon to hybrid inter-connect pin.

Unitip mounted on 50F/UB Light Force Weld Head.

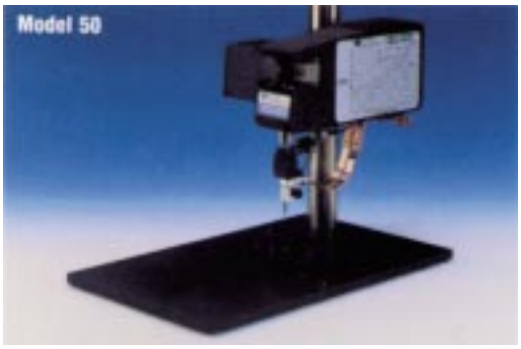
UNIBOND® II

Specifications

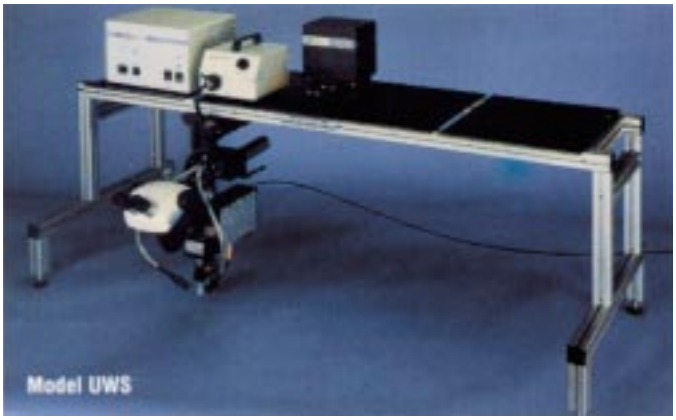
Model UB2 Unibond II Power Supply
Feedback modes – Voltage or Voltage + Current
Pulse duration – Adjustable from 1.0 to 79 ms.
Rise time – 0.5 ms nominal.
Voltage amplitude – Adjustable from 0.01 to 3.99V.
Maximum output current – 1000A.
Repetition rate – 30 to 250 welds per minute.
Weld resistance compensation – Adjustable from 1 to 15 milliohms.
Input power requirements – 100, 115, 208 or 230 Vac ± 13% 50-60 Hz.
Dimensions (H × W × D) – Control 7.4 × 11.7 × 9.2 inch (18.8 × 29.7 × 23.4 cm).
Dimensions (H × W × D) – Transformer 7.5 × 6.6 × 8.8 inch (19.1 × 16.8 × 22.4 cm).
Weight – Control – 20 lbs. (9 Kg), Transformer – 36 lbs. (16 Kg).


Model UB2

Model 50 Light Force Weld Head
Force range – 40-1000 gram-force (0.39 - 9.8 Newtons), continuously adjustable. No over-force.
Stroke – 0.75 inch (1.9 cm). True vertical motion.
Throat depth – 4.66 inch (11.8 cm).
Force adjustment – Large Force Control Knob with digital readout.
Electrode Holder – Parallel gap.
Electrode Options – Unitip or Unibond.
Actuation – Foot or Air.
Dimensions (H × W × D) – 9⅝ × 5⅛ × 10⅞ inch (24.4 × 13.0 × 27.6 cm).
Weight – 5.5 lbs. (2.5 Kg).


Model 50

Model UWS Universal Work Station
Standard System – 1 ea 60 inch (152 cm) frame.
– 4 ea Equipment shelves.
– 1 ea Post clamp, bracket and hardware kit.
Frame – Rigid design suitable for fine microjoining.
Equipment Shelves – Independently adjustable horizontally.
Head Adjustment Range – (H × W) – 3 × 48 inch (7.6 × 122 cm).
Frame Leveling Range – 1 inch (2.5 cm).
Static Shelf Load – 125 lbs. (56.8 Kg) max.
Dimensions (H × W × D) – 25 × 24 × 60 inch (64 × 61 × 152 cm).
Weight – 60 lbs. (27.3 Kg).


Model UWS

ORDERING INFORMATION:

UB2	– Unibond II Power Supply and Unipulse ™ Transformer
50F	– Foot Actuated with Unitip Electrodes
50F/UB	– Model 50 Weld Head with Unibond Electrodes
50A/115	– Model 50 Weld Head, 115V, Air Actuated with Unitip Electrodes
50A/24	– Model 50 Weld Head, 24V, Air Actuated with Unitip Electrodes
50A/UB/115	– Model 50 Weld Head, 50V, Air Actuated with Unibond Electrodes
50A/UB/24	– Model 50 Weld Head, 24V, Air Actuated with Unibond Electrodes
UWS	– Universal Work Station

ACCESSORIES:
FS2 Two Level Footswitch – air operation only.
SZ0 – Stereo Zoom Optic
BLF01 – Fiber Optic Illuminator
PD – Polishing Disk (pack of 50)
CPD – Ceramic Polishing Disk (pack of 20)
UBM – Unibond II Calibration Meter
See Accessories Data Sheet 991-160 for additional accessories.

991-120 7/95

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