SIMPLICITY

SERIES 9160

UNITROL ELECTRONICS INC.
NORTHBROOK, ILLINOIS 60062
847-480-0115

WARRANTY

Unitrol Electronics provides a 5-year limited warranty to cover all of this SIMPLICITY control. The warranty periods are determined using the date the control was shipped from Unitrol Electronics to the first customer. All warranty coverage is FOB Northbrook. Illinois.

This warranty, except for exclusions shown herein covers the following items:

DURING YEAR #1:

1. All parts (exclusive of fuses) that fail due to manufacturing defects.
2. Necessary labor to repair control that has failed due to manufacturing defects.

DURING YEAR #2:

1. 80% cost of all parts (exclusive of SCR, Circuit Breaker, fuses, pressure transducer, printer, infrared thermometer, and load cells.
2. 80% cost of necessary labor to repair control that has failed due to manufacturing defects.

DURING YEAR #3:

1. 60% cost of all parts (exclusive of SCR, Circuit Breaker, fuses, pressure transducer, printer, infrared thermometer, and load cells.
2. 60% cost of necessary labor to repair control that has failed due to manufacturing defects.

DURING YEAR #4:

1. 40% cost of all parts (exclusive of SCR, Circuit Breaker, fuses, pressure transducer, printer, infrared thermometer, and load cells.
2. 40% cost of necessary labor to repair control that has failed due to manufacturing defects.

DURING YEAR #5:

1. 20% cost of all parts (exclusive of SCR, Circuit Breaker, fuses, pressure transducer, printer, infrared thermometer, and load cells.
2. 20% cost of necessary labor to repair control that has failed due to manufacturing defects.

EXCLUSIONS TO WARRANTY

1. Any expense involved with repair of control by other than Unitrol Electronics personnel that has not been authorized in advance and in writing by an officer of Unitrol Electronics.
2. All costs for freight, to and from Unitrol Electronics, are excluded from this warranty
3. All field service labor, travel expense, and field living expenses associated with field service are excluded from this warranty.
4. No coverage, parts or labor, is offered for components that have failed on control **not** being used as specified in Unitrol Electronics published literature, technical sheets, and this direction book.
5. No warranty coverage will be made on controls that are being used contrary to specifications that are sized incorrectly compared to the published Unitrol Electronics sizing charts on current Unitrol Electronics price lists, that were mechanically or electronically altered by customer, or that were physically damaged after shipment from Unitrol Electronics.
6. Damages to a control by lightning, flood, or mechanical damage are excluded from this warranty.
7. Unitrol Electronics assumes no liability for damage to other equipment or injury to personnel due to a failure in the Unitrol Electronics control.
8. Unitrol Electronics shall not be responsible for any consequential damages of whatever kind.
9. Any expense involving alteration or installation of a Unitrol Electronics control where the control was manufactured to the specifications of the customer, or where a control is altered by the customer prior, during, or after installation will be covered under this warranty.

NO OTHER UNITROL ELECTRONICS INC. WARRANTY, WRITTEN OR IMPLIED, COVERS THIS CONTROL UNLESS IN WRITING AND SIGNED BY AN OFFICER OF UNITROL ELECTRONICS, INC. PRIOR TO SHIPMENT OF PRODUCT.

Address all warranty questions to:

Unitrol Electronics, Inc.
702 Landwehr Road
Phone: 847-480-0115
FAX: 847-480-0932
techsupport@unitrol-electronics.com

UNITROL ELECTRONICS SIMPLICITY CONTROL

For series 9160D, 9160M, 9160L

SCOPE: This microcomputer control system uses the latest in microelectronics to create an almost unlimited choice of operation. The simplicity in design means years of trouble free operation. The control comes in four cabinet styles:

This **SIMPLICITY** welding control is designed and produced in the USA.

FINAL INSPECTION BY: _____

MODEL NUMBER:
SYSTEM SERIAL NUMBER:
DATE OF MANUFACTURE:
SOFTWARE VERSION:
PRINTED CIRCUIT BOARD SERIAL NUMBER:
PRINTED CIRCUIT BOARD VERSION: 9160M-2

OPTIONS IN SYSTEM IF CHECKED BELOW

- 9181-01 FOOT PEDAL WITH CABLE
- 9161-01 UPSLOPE
- 9161-02 DOWNSLOPE
- 9161-03 PULSATION
- 9161-05 DUAL TIME / DUAL HEAT
- 9161-06 DUAL TIME/DUAL HEAT
- 9161-07 SEAM WELD
- 9161-11 QUENCH & TEMPER
- 9161-34W SOFT TOUCH, HEAVY RAM
- 9161-34Y SOFT TOUCH, LIGHT RAM
- 9161-34D VALVE UPSIZE TO ¾”
- 9181-34R SOFT TOUCH INSIDE ENCLOSURE
- 9181-34R4 SOFT TOUCH INSIDE ENCLOSURE, ENCLOSURE UPSIZE

UNITROL ELECTRONICS CORPORATION
NORTHBROOK, IL
847-480-0115

Direction book version: simplicity directions 8/14

NOTES

SIMPLICITY WELDING CONTROL 9160M, 9160D, 9160L

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INSTALLATION

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
INSTALLATION

1. Carefully unpack system and inspect for damage. Report any problems to the factory at once. If damage is obvious from outside of carton, report to carrier immediately.

2. Select location for cabinet being sure that the control face is clear of the worst anticipated location of parts to be welded and is not in the direct path of weld flash. It is usually an advantage to locate this cabinet as close to eye level as possible for easy use and servicing.

3. Install the SIDE MOUNT BRACKET set provided with this control by removing screws holding side panel to that side of the control and install the mounting brackets using the same screws through the side panel. Note that the center screws to the cabinet are not used with this bracket.

4. Drill welder to match the four mounting holes in the bracket. Install cabinet.

5. If installing a 9160M cabinet on a tabletop or on top of the welder and permanent location is desired, carefully drill holes in center of each boss on bottom of cabinet.

6. Drill or punch power cable hole either through the back, side or bottom of the cabinet. Drill or punch a second hole to handle the return cable to the welder transformer

CAUTION: IT IS IMPORTANT THAT NO METAL CHIPS ENTER ANY OF THE ELECTRONIC COMPONENTS IN THE CABINET! PROTECT CIRCUIT BOARDS AND SCR CONTACTOR DURING DRILLING AND INSTALLATION OPERATIONS. WHEN COMPLETE, REMOVE ALL CHIPS FROM THIS CABINET BEFORE APPLYING POWER.

Note: During wiring, remove four outer screws on the control's front panel and rotate the white faceplate forward for easy wiring. This panel has a built-in bracket to hold the circuit board in a horizontal position.

7. Drill or punch an access hole to handle the foot pedal or palm buttons at a convenient location in the cabinet. **OBSERVE THE CAUTIONS IN THE STEP ABOVE.** After cleaning interior of all chips, install liquid tight or rigid conduit at all locations.

8. Connect heavy power wires as shown in the WIRING HOOK-UP DIAGRAM on page 4 of this book. Be sure that an 18ga wire from L2 of the incoming power is connected to the terminal marked L2 on the bottom of the enclosure. Check that all connections are cleaned prior to insertion, and that all connectors are fully tightened. Loose connections will cause heating problems in the control, and eventually create intermittent welds.

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
INSTALLATION

9. **CONNECTING INITIATION SWITCHES**

Connect foot pedal, palm buttons, or machine contacts per WIRING HOOK-UP DIAGRAM page 4. Note that this system will support:

One or two single or double level foot switches

Or

Two double palm switches for anti-tiedown operation

NOTE 1: Use double level foot switch initiation for welders where the operator **cannot** place fingers or other body parts between the opened electrodes (typically less than 1/4" opening between electrodes).

NOTE 2: If using double palm switch anti-tiedown initiation, both switches **must** have two normally open switch contacts. These have to be wired as shown for anti-tiedown. **If any other wiring is done, the control will not function in the anti-tiedown mode and will not be safe to use for applications where space between the electrodes is large enough to allow operator's finger to enter this area.**

If two normally open switch contacts are not available, use a Unitrol Electronics #9161-56 ANTI-TIEDOWN INTERFACE board. This interface board can be used for either dry contact switches or solid-state switches.

10. If limit switch, pressure switch, and/or transformer thermostat is used, connect per WIRING HOOKUP DIAGRAM. If any of these are not being used, install jumpers as shown (usually supplied factory installed).

NOTE: The transformer overtemperature terminals (#1 - #4) allow for either normally open or normally closed contact configurations. If the thermostat contacts **OPEN** on TEMPERATURE RISE (typical), connect thermostat wires to points #3 and #4. If the thermostat contacts **CLOSE** on TEMPERATURE RISE (unusual), connect thermostat wires to terminals #1 and #2

11. If system uses a water-cooled SCR contactor, connect water hoses to ¼" NPT fittings at the front or rear of the cabinet. In/out direction of water is not important unless the system has been supplied with the #9181-28 water flow switch.

CAUTION: BE SURE PIPE FITTINGS THAT THREAD INTO THE ALUMINUM HEAT SINK PLATE ARE NON-METALLIC (PVC, NYLON, ETC.). DO NOT INSTALL BRASS, GALVANIZED, OR ANY OTHER METALLIC PIPE FITTINGS DIRECTLY INTO THE ALUMINUM HEAT SINK. OVER TIME, METALLIC FITTINGS TOUCHING THE ALUMINUM WILL CAUSE A HOLE TO FORM AT THE END OF THE THREADED HOLE AND WATER WILL FLOOD THE INSIDE OF THE CABINET.

12. Secure all wires inside power supply cabinet and check to be sure that connections are made correctly and that no loose strands of wire are at any terminal point.

13. Locate wire at lower right of circuit board marked COM., and connect to voltage terminal that most closely matches your supply.

14. Take a moment to try pulling all connected wires back from their terminal connections. Be sure that all connections are secure. If in doubt, unscrew the terminal, reinsert the wire, and tighten again. This can save much frustration later when the control is in use and becomes intermittent due to a loose connection. **Trust us on this!**

WARNING: SINCE HIGH VOLTAGE IS PRESENT, EXTREME CAUTION SHOULD BE TAKEN AT ALL TIMES POWER IS ON INSIDE CONTROL AND CABINET DOOR IS OPEN!

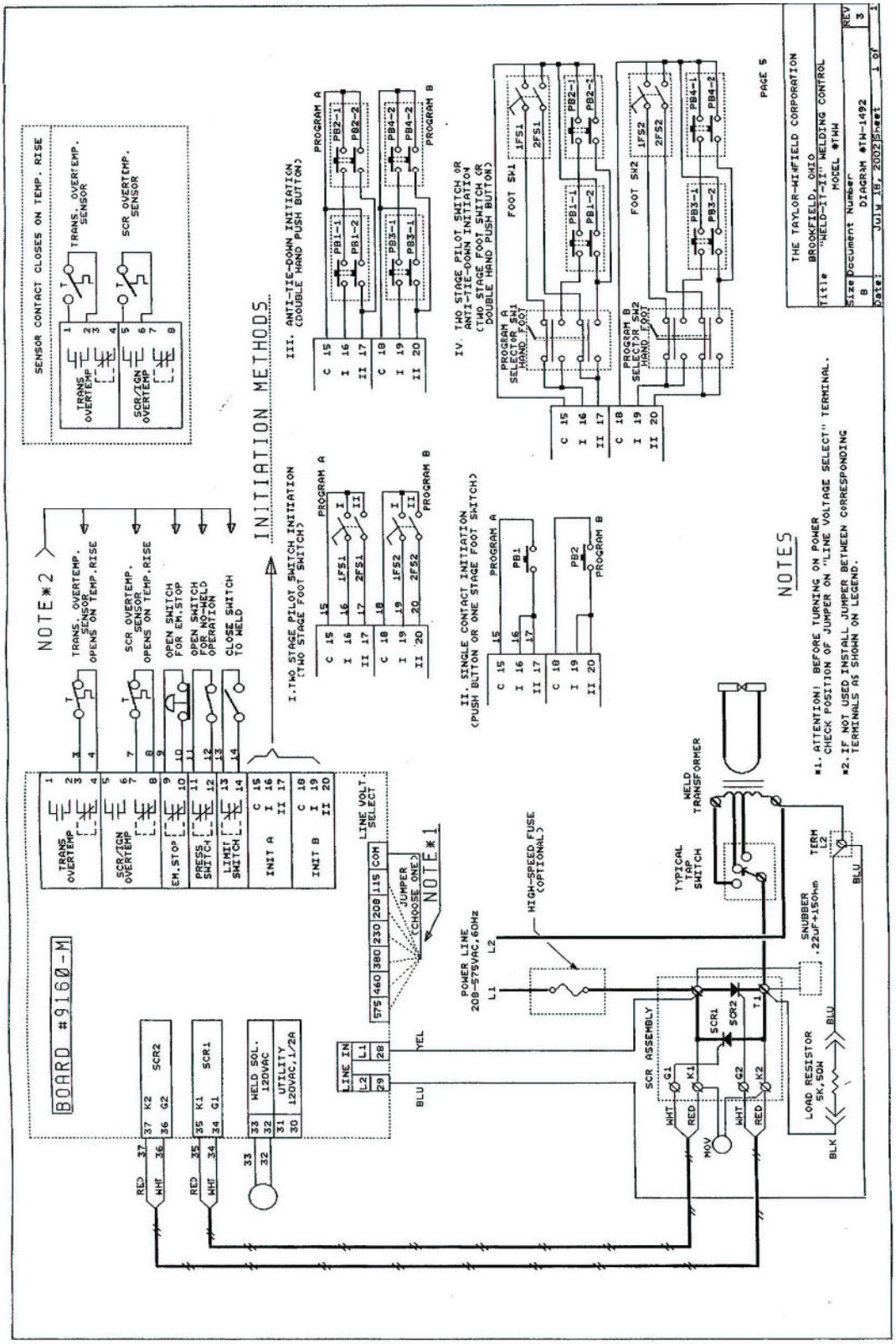
15. **LINE FREQUENCY SETTING:** This SIMPLICITY control can operate on 50Hz or 60Hz power. Unless specified in the order for this control, it has been set to 60Hz. **Before operating, check the slide switch located on the upper left corner of the circuit board. Be sure that it is in the position that matches your line frequency. 60Hz is standard for the U.S., Canada, Mexico, and most of South America. 50Hz is standard for most European, Asian, and Middle East countries.**

16. Turn power on and check that the green Power LED indicator on the front of the control is on. If not, check to be sure incoming power is on by carefully testing voltage across the two power lines.

17. System should now be ready for operation.

Contact the Unitrol Electronics service department at 847-480-0115 if installation assistance is needed.

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
INSTALLATION



SIMPLICITY WELDING CONTROL
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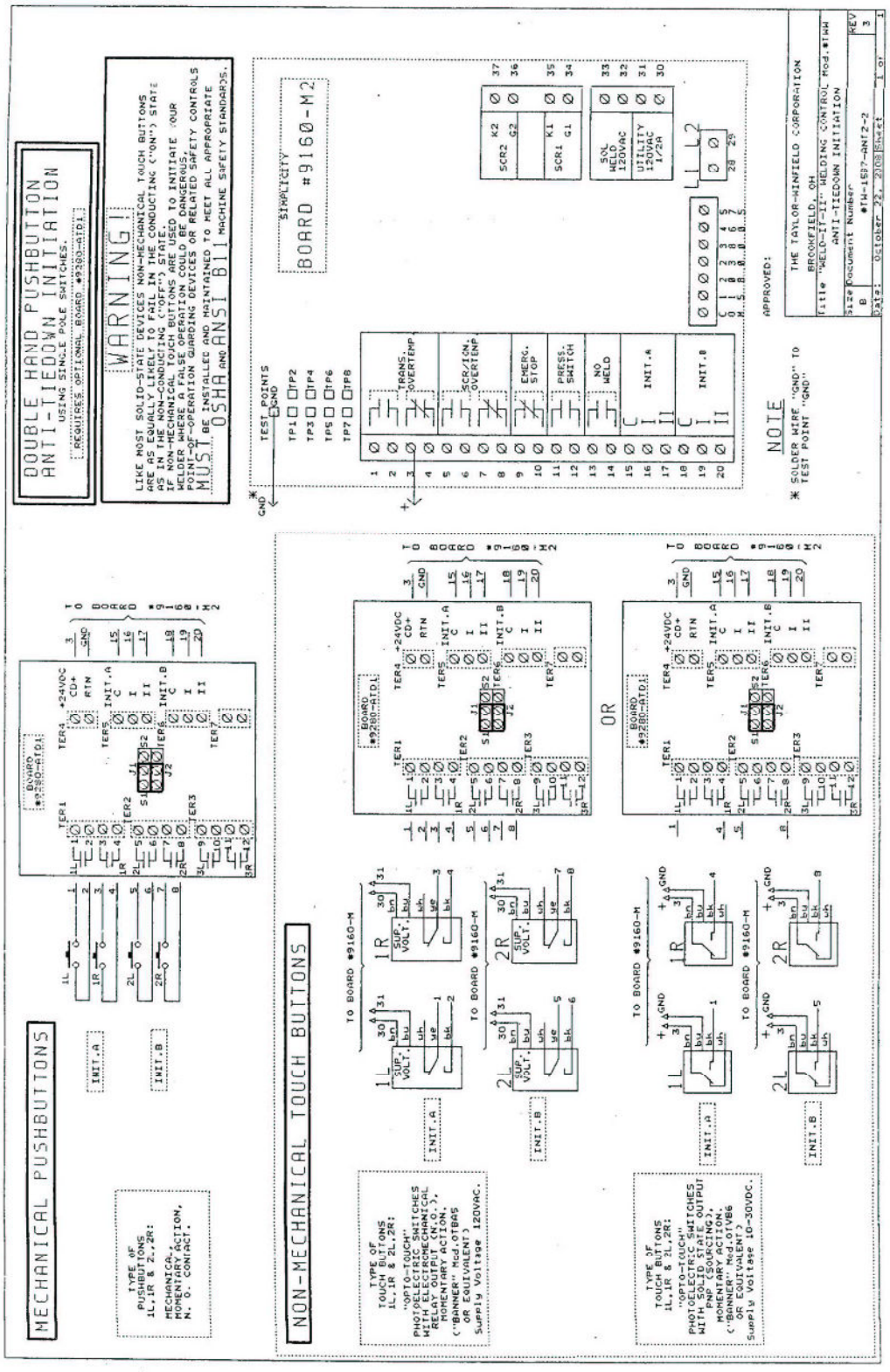
INSTALLATION



PASSIVE SAFETY SYSTEM WITH LOW PRESSURE ELECTRODE CLOSING

PURPOSE: To prevent fingers (or other body parts) sustaining permanent injury between moving resistance welder electrodes. This is especially important with welder operations that require small parts to be hand loaded between electrodes that have a clearance of are more than ¼".

TYPES OF WELDERS: There are **two** groupings of welders. Each requires a <u>different</u> package.

GROUP A:

1. **WELDERS WITH RAMS (HEADS) THAT FALL EASILY UNDER GRAVITY AND HAVE <u>MORE</u> THAN 50 LBS BETWEEN THE ELECTRODES WHEN AIR IS REMOVED FROM CYLINDER**
2. **WELDERS WITH RAMS THAT DO <u>NOT</u> FALL EASILY UNDER GRAVITY**
3. **ROCKER ARM WELDER**
4. **FIXTURE CYLINDER WELD HEADS**

<u>Use SOFT TOUCH option #9161-34G for all GROUP A type welders.</u>

Option #9161-34G consists of:

1. **#9281-34 SENSOR BOARD,** detects if metal is between electrodes before allowing high welding force to be applied.
2. **#9181-34A:** Dual precision regulators with gauges mounted in a NEMA-4 padlockable enclosure. Gauges are mounted on the enclosure door. This option secures the pressure settings that control the low force to be applied between the electrodes before application of full weld force.
3. **#9181-34B:** 5-way ½" solenoid valve with manifold, and ½" quick exhaust valve

CHOOSE THE APPROPRIATE PNEUMATIC INSTALLATION TO MATCH YOUR WELDER:

PNEUMATIC INSTALLATION

For press welders with <u>LIGHT RAMS</u> that do not fall easily under gravity, rocker arm welders, or for fixture cylinder weld heads:

For these welders, removing air from the welder will **<u>not</u>** cause the electrodes to close.

INSTALL pneumatic kit per **drawing #1964**. Be sure that only the components shown on this drawing are installed. Remove any other components such as flow control valves, etc. that may have been originally installed.

Three-way solenoid valve SV0 (or modified original 4-way valve as shown in drawing #1964) will be installed into one input port of a quick exhaust valve. This will be the WELD force solenoid valve. SV1, a 5-way dual-input pressure solenoid valve, will be installed into the other port of the shuttle valve and into the return of the air cylinder. This is the soft advance pressure valve.

ACTION: When 5-way solenoid valve SV1 is energized, air is exhausted from the back side of the cylinder, and low-pressure air is sent to the top of the cylinder to close the electrodes under low force. If the SOFT TOUCH sensor board detects continuity, relay contacts connected to terminals #11 and #12 on the SIMPLICITY control will close, and SV0 will be energized (SV1 remains energized). This will shift the quick exhaust valve and put full weld force on the electrodes.
See drawing #1964 for directions to adjust these components.

PNEUMATIC INSTALLATION

For press welders with <u>HEAVY RAMS</u> (weighing 50 lbs or more) that fall easily by their own weight:

For these welders, just the dead weight of the ram (weight when all air is exhausted from the cylinder and the ram falls by gravity) acting on the small surface of an electrode can cause major damage to an operator's finger. This scheme can counterbalance most of the ram's dead weight.

SOFT TOUCH WILL <u>NOT</u> OPERATE PROPERLY IF THE RAM DOES NOT FALL QUICKLY AND SMOOTHLY BY GRAVITY (WHEN AIR HAS BEEN REMOVED FROM THE CYLINDER).

BEFORE INSTALLATION OF THE SOFT TOUCH COMPONENTS, adjust the welder's ram bearings and lubricate as needed for smooth and fast gravity drop. On many older welders the cylinder cup seals and shaft seals have lost elasticity and need to be replaced.

Do not continue until this has been accomplished!

INSTALL pneumatic kit #9161-34G per drawing #1963. Be sure that only the components shown on this drawing are installed. Remove any other components such as flow control valves, etc. that may have been originally installed.

ACTION: When 5-way solenoid valve SV1 is energized, pressure on the underside of the cylinder piston will be exhausted until it falls below air pressure as set by the ADVANCE regulator. At this time the quick exhaust valve will shift to prevent the backpressure from going lower. If the ADVANCE regulator is set correctly, this "BUCKING PRESSURE" will almost completely balance the ram weight.

If the SOFT TOUCH sensor board detects continuity, If the SOFT TOUCH sensor board detects continuity, relay contacts connected to terminals #11 and #12 on the SIMPLICITY control will close, and SV0 will be energized (SV1 remains energized) to put full pressure into the top port of the welding cylinder and fully exhaust the back side.

See drawing #1963 for directions to adjust these components.

GROUP B:

WELDERS WITH RAMS (HEADS) THAT FALL EASILY UNDER GRAVITY AND HAVE LESS THAN 50 LBS BETWEEN THE ELECTRODES WHEN AIR IS REMOVED FROM CYLINDER

Use SOFT TOUCH option #9161-34H for GROUP B type welders.

Option #9161-34H consists of:

1. **#9281-34 SENSOR BOARD,** detects if metal is between electrodes before allowing high welding force to be applied.
2. **#9181-34T 3-way solenoid valve**
3. **#9181-34J Precision regulator** with gauge

PNEUMATIC INSTALLATION

For press welders with LIGHT RAMS (weighing less than 50 lbs) that fall easily by their own weight:

For these welders, just the dead weight of the ram (weight when all air is exhausted from the cylinder and the ram falls by gravity) acting on the small surface of an electrode can cause major damage to an operator's finger. This scheme can counterbalance most of the ram's dead weight.

SOFT TOUCH WILL NOT OPERATE PROPERLY IF THE RAM DOES NOT FALL QUICKLY AND SMOOTHLY BY GRAVITY (WHEN AIR HAS BEEN REMOVED FROM THE CYLINDER).

BEFORE INSTALLATION OF THE SOFT TOUCH COMPONENTS, adjust the welder's ram bearings and lubricate as needed for smooth and fast gravity drop. On many older welders the cylinder cup seals and shaft seals have lost elasticity and need to be replaced.

Do not continue until this has been accomplished!

INSTALL pneumatic kit #9161-34H per drawing #1965. Be sure that only the components shown on this drawing are installed. Remove any other components such as flow control valves, etc. that may have been originally installed.

ACTION: When 3-way solenoid valve SV1 is energized, pressure on the underside of the cylinder piston will be exhausted to let the welder head drop.

If the SOFT TOUCH sensor board detects continuity, If the SOFT TOUCH sensor board detects continuity, relay contacts connected to terminals #11 and #12 on the SIMPLICITY control will close, and SV0 will be energized (SV1 remains energized) to put full pressure into the top port of the welding cylinder.

HOW THE SYSTEM OPERATES:

The SOFT TOUCH board is wired to the WELD SOL. output. When the SIMPLICITY calls for the weld solenoid to turn on, the low pressure valve (SV1) wired to the SOFT TOUCH board will turn on to bring the electrodes closed under low force. If continuity between electrodes of this welding gun is detected within the maximum time set on the SOFT TOUCH board, the high pressure valve (SV2) will turn on to provide the full welding force between the electrodes.

WIRING AND SETTING SOFT TOUCH BOARDS

All wiring must match drawing 1492-2-ST2

If this SOFT TOUCH kit was factory installed in the SIMPLICITY cabinet, skip to step 7 below.

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1. **FIELD INSTALLATION OF SOFT TOUCH BOARD:** If this SOFT TOUCH kit is being **field installed on an existing SIMPLICITY** control, drill 6 holes on the outside of the cabinet and facing the operator if possible using the paper template provided with this direction book. The location should allow adjustment of the potentiometer on front of the board without exposure to any high-voltage components.
2. **STATUS INDICATOR:**
    a. Install the red LED lens in the ¼" hole per the drawing on paper template.
    b. Install the SOFT TOUCH STATUS LIGHT CODES label in this kit below this red lens as shown on the template.
3. **MOUNT BOARD:** Mount the board from the inside of the cabinet using the four standoffs supplied. The LED on back of the board should align with the red lens installed in step #2 above.
4. **TIP DRESS SWITCH:** Install the single-pole toggle switch provided in this kit in the 15/32" diameter drilled above. Wire the two wires to terminals #14 and #15 with the switch CLOSED when the switch handle is DOWN. Closing of this switch will energize the LOW PRESSURE solenoid valve SV1 to bring the electrodes closed under low force.
5. **WIRING:**
    a. This board requires 24VDC for operation. Connect a light wire from terminal #2 (+24) on the SOFT TOUCH board to terminal #3 (TRANS OVERTEMP) on the SIMPLICITY board.
    b. Solder a second light wire to terminal #1 (GND) on the TOUCH SENSOR board, and connect the other end to TERMINAL #3 (TRANS OVERTEMP) on the SOLUTION board.

c. Connect wires from terminals #6 and #7 on the SOFT TOUCH SENSOR board to terminals #11 and #12 (PRESS SWITCH) on the SIMPLICITY board.

d. Connect wires from terminals #33 and #32 on the SIMPLICITY board to terminals #9 and #10 on the SOFT TOUCH SENSOR board.

e. Connect a wire from terminal #31 on the SIMPLICITY board to terminal #16 on the SOFT TOUCH SENSOR board.

f. Install the SNUBBER (white cylinder with blue and black wire) in this kit in a convenient location near the SCR contactor. Connect either of the wires to terminal K1 on the SIMPLICITY, and connect the remaining wire to terminal K2 on the SIMPLICITY. This will then have two wires in each of these terminals. The wires should be twisted together for a better connection.

6. **INSTALLING GROMMET AND SENSOR WIRES:**

   a. Drill a 5/16" diameter hole in the cabinet facing the front of the welder. Install the rubber grommet supplied with this kit.

   b. Pass two sensor wires supplied in this kit through the grommet and connect to terminals #4 and #5 on the SOFT TOUCH SENSOR BOARD.

START HERE IF SOFT TOUCH WAS FACTORY INSTALLED

7. **CONNECTING SENSOR WIRES:**

   a. Connect the wire from terminal #4 on the TOUCH SENSOR board to any convenient point on the upper electrode arm. **The best connection is made right on the transformer pad.** If possible, drill and tap into the upper transformer pad and use a crimp ring terminal on the wire. Try to make a connection to a point that **does not move** during welding and will not expose the sensor wire to metal in the welder throat. If this is not possible, use a hose clamp around the upper copper arm to make this connection. Try to find a location that has no movement during welding so that wire life will be maximized.

   b. Connect the remaining wire from terminal #5 on this same board to the **lower transformer pad** in the same way. If this is not possible, mechanically mount the wire at a point closest to the transformer.

8. **CONNECTING SOLENOID VALVES:**

   a. Wire the low-pressure solenoid SV1 to SOFT TOUCH board #1, terminals #10 and #11. These are marked LOW PRES. SOL. VALVE.

   b. Wire the high-pressure solenoid SV0 to SOFT TOUCH board #1, terminals #12 and #13. These are marked HIGH PRES. SOL. VALVE.

9. **SETTING BOARD DETECTION TIME:** Locate the four-section DIPswitch on the left side of each SOFT TOUCH board. This switch is marked: 1, .75, .5, and .25 seconds. Set the switches to a value that is about 3 to 4 times how long it will take for the electrodes to close. The on-board computer **adds** the value of these switches. For example, pushing

1 and .5 down to the left side will produce a detection time of 1.5 seconds. This setting is not critical. A typical setting is 1 second. Longer times might be needed for very long stroke cylinders.

INITIAL TUNING OF OPTION #9280-TS2 TOUCH SENSOR BOARDS

CAUTION: Follow the steps below carefully. Do not operate this welder unless all tests have been successfully completed as shown at the end of this section.

1. **SETTING THE SOFT TOUCH SENSOR BOARD:**
    a. Connect the positive lead of a digital meter to terminal #TP4 and the negative lead on #TP5 on TOUCH SENSOR board #1. It is important that you observe the + and – connection to your meter. You will be reading DC millivolts.
    b. If the welder has a tap switch, set it to the **highest** number. Setting to the highest tap switch position will ensure that the settings of the SOFT TOUCH board will work on all transformer tap positions.
    c. Locate the multi-turn potentiometer marked R7 on the right side of the board. Turn this pot until the value shown on the meter is approximately **+0.250V**. At this time the red LD1 on the board should be **OFF**.
2. **TESTING WITH ELECTRODES CLOSED:**
    a. Clean electrodes on welder
    b. Place two thicknesses of metal between the electrodes. This should be the thickest combination that will be welded on the welder.
    c. Close electrodes by turning ON the TIP DRESS switch wired to the SOLUTION control.
    d. Check the RED LED1 on the TOUCH SENSOR board. With the electrodes touching a conductive material, this LED should now be on. Measure the voltage as in step 6a above. It should be at least –0.150 volts DC. Adjust the same potentiometer to get this value. The red LD1 should now be ON. It is possible for this value measured when the electrodes are touching will be as low as –3.0 volts DC. This is normal. ***If you are not able to get the voltage to drop to at least –0.150VDC (-150mv) when the electrodes are closed on metal, see TROUBLE SHOOTING procedure at the end of this direction section.*** *The system will not operate correctly without this minimum voltage shift reading.*
    e. **TESTING SETTING:** Release the electrodes, and red LD1 should go off. At the same time, the voltage reading should go back to approximately +0.250 volts. If not, repeat step 1c above and try again.
3. **IF THE SYSTEM IS WORKING PROPERLY:**

a. Closing the welder initiation (foot switch or hand switches) will first turn yellow LED 5 (SVL) ON. This will energize solenoid valve SV1 to bring the electrodes together under low force.

b. If the electrodes see continuity between them, red LD1 will turn ON.

c. Yellow LED6 (SVH) will turn on to energize SV0 and put full welding force between the electrodes.

If the RED LED1 on the SOFT TOUCH board comes ON, but LED6 does not come on, check to be sure that the plug-in relay K1 on the SOFT TOUCH board is fully pushed into its socket.

d. Opening the TIP DRESS switch should release both solenoids and turn off all three LEDs. There should be no chattering or blinking of this LED when the electrodes are open.

4. The system should now be tuned to the welder.

SEQUENCE OF OPERATION

1. Close the foot or hand initiation switch to operate the SIMPLICITY control.
2. The SIMPLICITY sends 115V to terminals #9 and #10 on the SOFT TOUCH board.
3. The SOFT TOUCH board checks to be sure that all the following conditions are correct:
    a. The sensor is not already showing conductivity (ie. electrodes not already closed)
    b. SOFT TOUCH output relay does not have welded-together contacts
4. The SOFT TOUCH board looks for continuity between the electrodes.
    a. If it **is** detected within the maximum time set on the DIP switch of that board:
        i. RED LD1 (S.T. ON) will glow
        ii. HIGH PRESSURE output SVH will turn on to bring full electrode force to the welding electrodes
        iii. Yellow LED6 (SVH) will glow
        iv. The relay contact on the SOFT TOUCH board will close the PRESSURE SWITCH input terminal #11 and #12 to allow the welding sequence to continue
    b. If it is <u>not</u> detected within the maximum time set on the DIP switch of the SOFT TOUCH SENSOR board
        i. SVL output will turn off to release that low-pressure solenoid valve SV1
        ii. Yellow LED5 (SVL) will turn off
        iii. The YELLOW LED on the SIMPLICITY control will remain ON, but the control will not go through the welding sequence. The control will not allow another cycle until the initiation switch has been opened.
            1. The diagnostic red LED on the outside of the cabinet will flash rapidly and continuously until the initiation has been released.
5. **FAIL-SAFE STARTING SEQUENCE**:

If a SOFT TOUCH SENSOR board detects continuity (incorrect setup, etc.) when the SV valve input to that board is **not** turned ON, it will fault out and open the output to not allow any sequence to function.

TROUBLE SHOOTING SOFT TOUCH

A red LED is mounted on the back of the SOFT TOUCH board and is installed with a light pipe to show statue of that board on the front of the control. The following chart shows the six conditions detected by this LED:

SOFT TOUCH STATUS LIGHT CODES

A. STANDBY, NO FAULTS, slow continuous flash: ☼ ☼ ☼ ☼ ☼ ☼ ☼ ☼ ☼ ☼ ☼ ☼ ☼

B. SENSOR OPEN, DETECT TIME NOT REACHED, fast continuous flash: ☼☼☼☼☼☼☼☼

C. SENSOR CLOSED, SV INPUT ON, continuous on: ☼----------☼

D. SENSOR OPEN, DETECT TIME EXCEEDED, one flash: ☼ ☼ ☼ ☼ ☼ ☼ ☼

E. SENSOR CLOSED, SV INPUT OFF, two flashes: ☼☼ ☼☼ ☼☼ ☼☼

F. OUTPUT RELAY NOT RELEASING, three flashes: ☼☼☼ ☼☼☼ ☼☼☼ ☼☼☼ ☼☼☼

TROUBLE SHOOTING CHART

PROBLEM		SOLUTION
FLASH CODE	**CAUSE**	**WHAT TO CHECK OR DO**
A	Normal Standby condition	-
B	Normal condition after turn-on of low force SV1, waiting for sensor to detect metal	-
C	Normal condition if continuity was detected in time, and electrodes are still closed	-
D	1. Time set on DIP switch not long enough for cylinder stroke 2. Dirt on electrodes or part between electrodes 3. SOFT TOUCH not adjusted properly	1. Increase DIPswitch time. Remember that this time is the <u>addition</u> of all switches pushed down 2. Clean electrodes or check part being welded. 3. Adjust SOFT TOUCH potentiometer with tips open and transformer on HIGH tap, until voltage at TP4 (+) and TP5 (-) test points reads about +0.250 VDC. See INITIAL TUNING OF SENSOR BOARD.
E	1. SOFT TOUCH not adjusted properly 2. No voltage input on sensor input at terminals #4 and #5 on SOFT TOUCH board	1. Adjust SOFT TOUCH potentiometer with tips open and transformer on HIGH tap, until voltage at TP4 (+) and TP5 (-) test points reads about +0.250 VDC 2. Sensor wires disconnected at transformer or SOFT TOUCH board, transformer secondary shorted (insulation missing, etc.), or transformer primary disconnected from SCR or L2
F	Output relay K2 contacts shorted	Replace K2

PROBLEM	SOLUTION
When TIP DRESS switch is closed, electrodes do not close, or they start to close but to not travel all the way	1. For welders with HEAVY WEIGHT rams: a. ADVANCE PRESSURE setting is too high resulting in a lifting force greater than the ram weight. Reduce the ADVANCE PRESSURE regulator setting. Normally a setting of 2-4 psi is required for most welders. b. Flow control between quick exhaust and SV1 is open too far. Slowly close this flow control until the lifting force comes in when the electrodes touch. 2. For HEAVY WEIGHT and GRAVITY FALL rams, ram is not falling smoothly under gravity a. Ram bearings or slide is not adjusted or lubricated to allow ram to fall easily by gravity when air is removed from cylinder b. Welder cylinder piston cups or shaft seals are not flexible (replace) or need lubrication. 3. For LOW WEIGHT RAMS, ROCKER ARM WELDERS, or FIXTURE CYLINDERS: Not enough air pressure set on ADVANCE pressure regulator
When the foot switch is closed, the electrodes do not fully close, then go back up. STATUS LIGHT flashes fast and continuously.	The time DIP switch on SOFT TOUCH board is too short for the time it takes for the electrodes to close and see continuity through the metal. Increase the switch setting. Remember that the time is the **total** of all switches pushed down.
When the foot switch is closed, the electrodes **touch**, but then go back up without going through the welding sequence. STATUS LIGHT flashes fast and continuously.	1. The SOFT TOUCH board is not adjusted properly and the red LED on that board is not coming on when the electrodes touch. Adjust SOFT TOUCH potentiometer with tips open and transformer on HIGH tap, until voltage at TP4 (+) and TP5 (-) test points reads about +0.250 VDC. See INITIAL TUNING OF SENSOR BOARD.

PROBLEM	SOLUTION
There is a noticeable delay from when the foot switch is closed and when the welder ram starts to move.	1. The ram is mechanically sticking. Adjust ram bearings or cylinder cup seals and shaft seals. Check lubrication. 2. The air pressure on the bottom (lifting side) of the welder cylinder is too high. This requires that a lot of time is needed to exhaust this air before the ram starts to move. Lower the RETURN PRESSURE regulator until it is just able to pick up the ram smoothly.
Not able to read any voltage on SOFT TOUCH sensor board terminals #4 and #5	1. Be sure that the green LED on the SOFT TOUCH sensor board is on. If LED is not on, check input voltage to this board on terminals #1 and #2. It should read 20 – 24VDC. If not, check to be sure that these terminals are connected to is connected to terminal #3 and the GND test point on the SIMPLICITY board. 2. Check input **AC** voltage on terminals 41 and #5 to this board. This should be at least 25mv. If no voltage or lower voltage is present, check for welder insulation problems using information shown on page 13.
Voltage is read at SOFT TOUCH sensor board terminals #4 and #5, but the change from open to closed electrodes this voltage does not change, or changes less than a total swing of 0.3V (300mv).	Check input signal voltage at terminals TP2 and TP3 on SOFT TOUCH sensor board. If this voltage does not change more than 50mv from open to closed electrodes, see information on insulation problems on page 12.

TROUBLE SHOOTING SENSOR VOLTAGE PROBLEMS
HOW THE SENSOR WORKS

The SOFT TOUCH sensor board is designed to sense **continuity** between the welding electrodes. This is done by having a small voltage present between the open electrodes. When the electrodes close on metal, impedance of the welder secondary drops to a very low value. This will "short out" the small voltage between the electrodes. The SOFT TOUCH sensor board conditions and amplifies this voltage and knows when metal is in contact between the electrodes.

This whole affect depends on the welder secondary being properly insulted and finding a conductive path from the upper electrode to the lower electrode.

PROBLEMS WITH LOW ELECTRODE FORCE

Because operation of the SOFT TOUCH sensor board depends on detection of continuity between the electrodes, a reasonable force must exist where the electrodes touch the metal on both sides for good continuity to be measured. If the red LED on the SOFT TOUCH sensor

board does not turn on consistently, try increasing the electrode force during the SOFT TOUCH sequence.

On **HEAVY RAM** systems, **decrease** the ADVANCE PRESSURE regulator slightly.

On **LIGHT WEIGHT** ram systems, **increase** the ADVANCE PRESSURE regulator slightly.

PROBLEMS WITH COATED METAL

If metal between the electrodes is coated with an insulating material, the electrodes will not see continuity and the SOFT TOUCH system will not operate. This is just reality of continuity testing. Some materials that have had problem with this system have included metal with various oxide coatings (titanium oxide, silicon oxide, etc.) as well as polished material that has a thick wax finish. Problems are also found trying to use hot rolled steel that has not had the scale properly removed.

During normal spot welding, the high force of the electrodes is usually enough to break the oxide surface coating and make contact through the electrodes. These materials typically have a lot of expulsion when welded confirming that the surface must be “blown away” at the early part of each weld.

But the low voltage and low force of the SOFT TOUCH process will not always be able to establish a continuity path between the electrodes to let this function work.

ALTERNATIVE SENSOR INSTALLATION: Where these partially insulated materials are welded on this machine, the only way the system will operate is with the use of a LIMIT SWITCH or PROXIMITY SWITCH as the main sensor. The limit or prox switch will be mounted and adjusted in such a way that it will close when the electrodes are less than ¼” apart. While this is not as elegant as the continuity sensing of the SOFT TOUCH board, it will still provide protection in the pinch point area between the electrodes if set up correctly. Note that if the limit or prox switch is closed before the welding electrodes start to close, the system will not allow any movement and will display the fault.

A keylock selector switch can be installed to switch between the SOFT TOUCH sensor board on conductive material, and limit switch operation on poor conductive material. Contact the Unitrol service department for assistance in this switch installation.

TROUBLE SHOOTING INSULATION FAULTS IN WELDER

On all resistance welders, either the top or bottom electrode arm or holder is insulated from the welder frame. This is done using fiber sheets between plates, and fiber tubes and washers on bolts that connect the insulated components. If one of these insulators is missing, the secondary of the welder will be shorted, and the SOFT TOUCH system will **not** see the required change in voltage when the electrodes close on metal.

If these voltage changes are not seen by the SOFT TOUCH sensor board, **the SOFT TOUCH system will not be able to be used.**

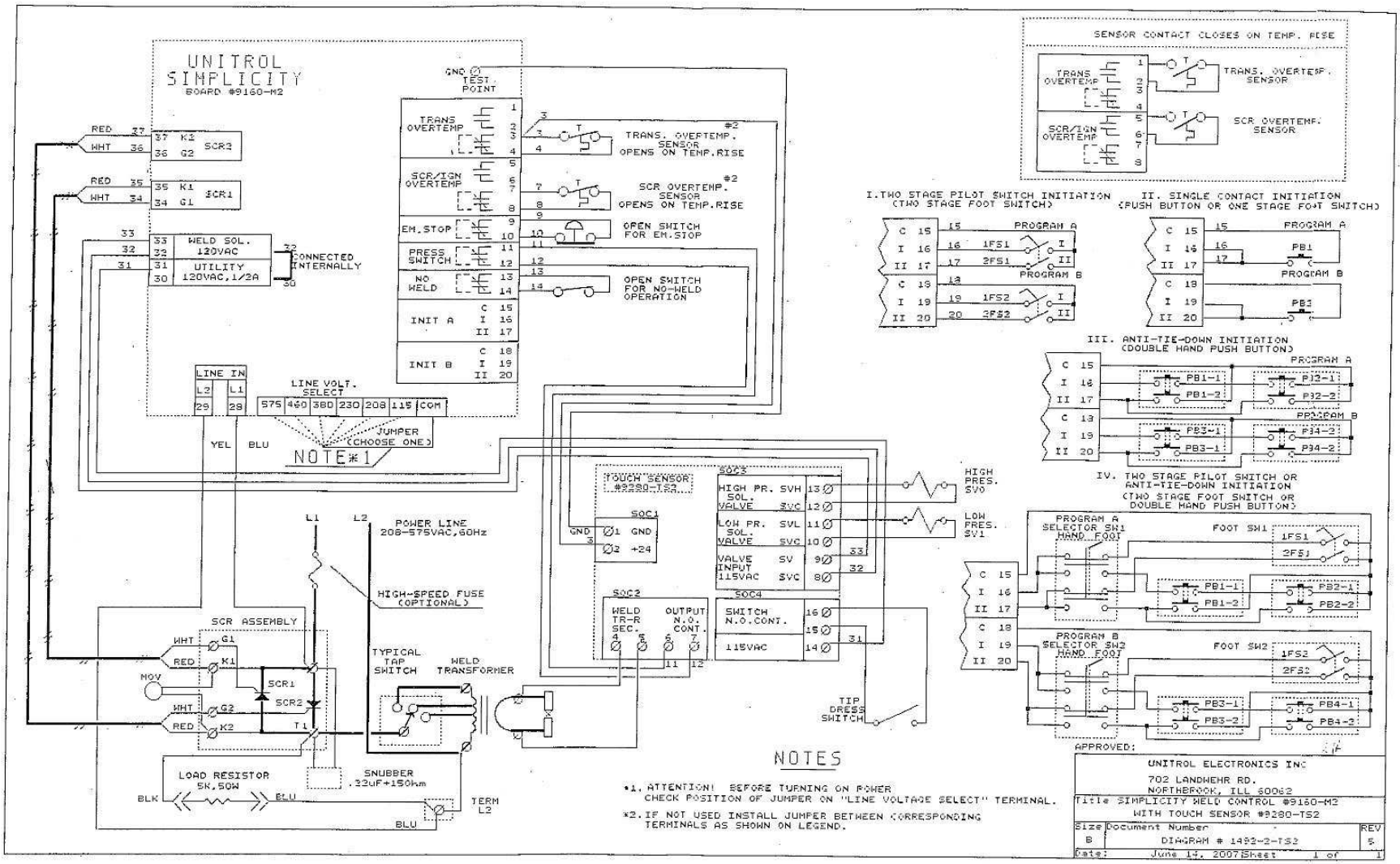
Because the welder transformer secondary is essentially one copper strip, putting a meter from electrode to electrode will not tell if the insulators are not properly installed. To do this, you will have to unbolt the flexible shunt that connects to the moving part of the welder secondary. On a press welder this is usually a stack of copper laminations. On some welders, this flexible connection consists of one or more flexible copper cables.

Remove the flexible connection and check from top to bottom electrode for continuity. If the welder is properly insulated, the resistance measured should be zero (totally open). If continuity is measured, check and repair insulation as needed so that this reading shows fully open (no resistance).

Once this has been accomplished, reconnect the flexible components and go through the voltage testing procedure. You should now see a good strong usable swing of voltage from positive to negative with open and then closed electrodes.

IF ALL ELSE FAILS

If you cannot reach these minimum conditions, contact the UNI*TROL* service department M-F between 9:00 – 5:00 CST at 847-480-0115 for further instructions. Try to make this call using a cell phone or landline phone at the welder so that testing can be done during that conversation.



NOTES

*1. ATTENTION! BEFORE TURNING ON POWER CHECK POSITION OF JUMPER ON "LINE VOLTAGE SELECT" TERMINAL.

*2. IF NOT USED INSTALL JUMPER BETWEEN CORRESPONDING TERMINALS AS SHOWN ON LEGEND.

APPROVED:

UNITROL ELECTRONICS INC
702 LANDWEHR RD.
NORTHBROOK, ILL 60062

Title SIMPLICITY WELD CONTROL #9160-M2
WITH TOUCH SENSOR #9280-TS2

Size	Document Number	REV
B	DIAGRAM # 1492-2-TS2	S

Date: June 14, 2007 Sheet 1 of 1

DIRECTIONS FOR USE

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
DIRECTIONS FOR USE

FOR USE WITH **SEAM WELD** CONTROLS (option #9161-07), skip to page 8.

TO TRY **SPOT WELD** CONTROL FOR THE FIRST TIME:

1. Turn power ON. The green **POWER** LED on the control front should be on.

2. Rotate the mode selector knob to **NO WELD**, and set the thumbwheels as follows:

   SQUEEZE = **30** cycles
   WELD TIME = **10** cycles
   WELD PERCENT = **45**
   HOLD TIME = **03** cycles
   REPEAT OFF TIME = **00** cycles
   UPSLOPE, DOWN SLOPE, IMPULSATION (options) =

   NOTE: All timing functions in this control are in CYCLES.
   For a 60Hz power line, 1 cycle = 1/60th second (16.666 ms).
   For a 50Hz power line, 1 cycle = 1/50th second (20 ms)

3. Set air pressure so that the tip force is great enough for this schedule.

   On welders smaller than 30 **KVA**, a tip force of 400 pounds is usually satisfactory. On welders 30 to 100 **KVA**, a force of 700 pounds is a reasonable setting for the first test firing.

4. Turn cooling water on (if any).

5. Initiate control to first foot switch level.

6. The yellow **SOLENOID** LED should glow, and the welder head should advance to close the copper tips. If a single initiation switch is being used, skip this step.

   NOTE 1: If you are using **double palm button anti-tiedown initiation**, both switches must be closed **within ½ second** for the system to operate. At that time, the yellow **SOLENOID** LED will glow, and the control will go through the full weld sequence.

   NOTE 2: If only **one** of the palm switches is closed without the other, **no** solenoid closure will occur and the welder will **not** go through the full weld sequence. This palm switch must be opened and then re-closed with the second palm switch (within ½ second) for the system to operate.

7. Press the foot switch further to the second level. After approximately 3/4 second, the yellow **SOLENOID** LED should go off and the welding tips will open. No welding will occur.

CAUTION: BEFORE PROCEEDING, BE SURE THAT PROTECTION, SUCH AS SAFETY GLASSES AND PROPER CLOTHING, ARE BEING WORN BY ALL PERSONNEL IN THE WELDING AREA

8. Rotate the mode setting knob to **SINGLE.**
9. Without any metal between the tips, press the foot switch to the first level. . Tips should close as the yellow **SOLENOID** LED glows.
    a. If single level initiation or double palm switch anti-tiedown initiation is being used, a short transformer hum should be heard. Skip to step 11.
10. Press the foot switch further until a short transformer hum is heard.
11. Tips should now release automatically even though the foot switch is still being pressed.
12. If all operates correctly, set control to desired welding schedule.
13. Test system on metal. If any of the above steps do not function properly, turn system off and carefully check all connections prior to contacting factory. Our service department will be happy to assist you on the phone should you experience difficulties. The number is 847-480-0114.

HALF CYCLE TIMING OPERATION

The SIMPLICITY II control is capable of operation in either FULL CYCLE or HALF CYCLE timing. **Setting the slide switch on the back of the circuit board to FULL CYCLE or HALF CYCLE makes this selection.**

In **FULL CYCLE** timing, each number selected on the WELD TIME thumb-wheels represents a full line cycle (or 1/60th of a second for 60Hz power, and 1/50th second for 50Hz power). **FULL CYCLE** timing is the normal position for typical welding and **SEAM WELDING** (9161-07 option).

In **HALF CYCLE** timing, each number selected on the WELD TIME thumb-wheels represents ½ line cycle. BI-POLAR OPERATION: Each time a weld is made the control will start in a polarity opposite of the last ½ cycle of the previous weld.

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
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HALF CYCLE timing is normally used for joining of the very small parts that require only ½ cycle of weld. **HALF CYCLE** timing can also be used for critical welding where, for example, 9 cycles is too long and 8 cycles is too short. By putting the control into **HALF CYCLE** timing, a choice of 17 (17 **half** cycles) will allow the control to operate between these two settings. This increases the precision of the timing system by a factor of 2.

OPERATING MODES

SINGLE MODE

This mode runs the welder through the complete weld cycle and then releases the welding solenoid (opens tips) even though the foot pedal (or initiation switch) is still closed. To make another weld, release the initiation switch and close again. This **ANTI-REPEAT** feature assures full operator control and the maximum speed of welder operation.

REPEAT MODE

This mode operates as above, except that after the tips are released, if the initiation switch is still closed, a time will elapse as chosen on the **REPEAT OFF TIME** thumbwheels, then the tips will close and welding sequence starting from SQUEEZE TIME will repeat. This function will continue until the initiation switch has been opened. At that time, the system will complete the current weld sequence and then open the electrodes. Note that this **REPEAT OFF TIME** is in line cycles.

Use of the **REPEAT** mode allows “automatic” operation of the welder without the need to open and close the initiation switch.

TO USE REPEAT set the desired dwell time between welds on the **REPEAT OFF TIME** thumbwheels and rotate the mode switch to **REPEAT**.

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
DIRECTIONS FOR USE

OPTIONS

UPSLOPE #9161-01

This function provides a controlled initial ramp of heat in each weld. Upslope is useful in various types of welding.

For joining of **galvanized** or other coated steels, UPSLOPE allows a controlled liquefying of the coating at the start prior to the final weld heat. In this way, the actual weld is done on virtually uncoated areas to eliminate expulsion of the coating and minimize coating of the electrodes. A recommended weld schedule is provided at the end of this book to illustrate this function.

Another application of UPSLOPE is in welding of parts that have **projections** such as weld nuts and component with stamped projections. In this application, a few cycles of UPSLOPE will allow the projections (especially multiple) to forge into the mating part in a controlled manner without excessive expulsion.

DOWNSLOPE #9161-02

This function provides a controlled lowering of the heat **after** the end of the last **WELD** cycle. It is useful in welding of materials that are subject to stress cracks when cooled rapidly such as **aluminum**. Typically the use of DOWNSLOPE cycles about ½ the number of **WELD** cycles and going to a **FINAL % HEAT** of about ½ the **WELD HEAT** works well.

PULSATION #9161-03

This option repeats the **WELD** sequence the number of times chosen by the QTY. thumbwheels (0-9) with a non welding time between the pulses as determined by the OFF thumbwheels (0-9 cycles). This function is useful in welding **near the edge of a part** as well as an alternate method of welding **galvanized** steel.

UPSLOPE/DOWNSLOPE #9161-05

This option combines the operations of **UPSLOPE (#9161-01)** and **DOWNSLOPE (#9161-02).**

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
DIRECTIONS FOR USE

DUAL HEAT/DUAL COUNT #9161-06

This option allows the use of two independent time and heat settings to be used on the welder. The option includes a **4** thumbwheel set for **WELD 2 TIME** and **WELD 2 PERCENT.** To use this set of thumbwheels on a weld, it is necessary to have a second initiation switch (foot, hand, or machine contact) connected to the control. This switch is connected as shown on the HOOK-UP diagram. The SQUEEZE TIME, HOLD TIME, and REPEAT TIME on the upper row of thumbwheels will be used for this WELD 2 sequence. To weld with the WELD 2 time and heat, close a switch connected to the PROGRAM B terminals.

SEAM WELD OPTION #9161-07

This optional function will supply either continuous or intermittent weld heat for use on seam welding. This control does not operate the seam wheel. The seam wheel can be turning continuously, or the 115V coil of a relay can be wired in parallel to the solenoid valve output and contacts of the relay used to operate a seam motor

This optional function will supply either continuous or intermittent weld heat for use on seam welding.

CONTINUOUS SEAM WELD HEAT: With the **COOL TIME** set to **00**, the control will weld with continuous heat (no **COOL TIME** between weld pulses) after going through **SQUEEZE TIME** or **WELD CURRENT DELAY** time. While during continuous seam heat welding the computer does **not** respond to the **WELD TIME** thumbwheel settings, it will not weld with **WELD TIME** set to **0**. As a matter of practice, set the **WELD TIME** thumbwheels to **01**. The sequence of operation after the second level initiation switch has been closed is:

1. Turn Solenoid Valve power on and go through **SQUEEZE TIME** or **WELD**
2. **CURRENT DELAY** time
3. Go through **UPSLOPE** (if option #9161-01 is in system)
4. Start weld cycles and continue until initiation is opened (see INITIATION options below)
5. Go through **DOWNSLOPE** (IF #9161-02 option is in system)
6. Go through **HOLD TIME**
7. Release solenoid valve power

INTERMITTENT SEAM WELD HEAT: With the **COOL TIME** set to a number **higher** than **00**, the control will operate as follows after the second level initiation switch has been closed:

1. Turn Solenoid Valve power on and go through **SQUEEZE TIME** or
2. **WELD CURRENT DELAY time**

3. Go through **UPSLOPE** (if option #9161-01 is in system)
4. Conduct the chosen number of **WELD TIME** cycles
5. Stop current flow for the selected number of **COOL TIME** cycles
6. Continue to sequence between 4 and 5 until initiation is opened (see INITIATION options below)
7. Go through **DOWNSLOPE** (if #9161-02 option is in system)
8. Go through **HOLD TIME**
9. Release solenoid valve power

INITIATION OPTIONS FOR SEAM WELD

SINGLE SEAM MODE

With the mode switch set to **SINGLE**, the control operates the welding transformer for as long as the initiation switch remains closed. Once the pedal (or initiation switch) has been released, the control finishes the last weld cycle, (and DOWNSLOPE if in system) then **HOLD TIME** and release the solenoid line.

REPEAT SEAM MODE

This mode of operation is useful when making seams on a very long part.

With the mode switch set to **REPEAT** / **RUN**, the control will

A. Start the welding operation when the second level initiation has been closed.

B. After weld heat starts, **release** the initiation switch, and the seam operation will continue.

C. At the end of the seam close the initiation switch **again**. The welding operation will finish the last weld cycle, (and **DOWNSLOPE** if in system) then **HOLD TIME**, and then release the solenoid valve.

TO TRY THE SEAM WELD SYSTEM FOR THE FIRST TIME:

CAUTION: BEFORE PROCEEDING, BE SURE THAT PROTECTION, SUCH AS SAFETY GLASSES AND PROPER CLOTHING, ARE BEING WORN BY ALL PERSONNEL IN THE WELDING AREA

1. Turn power ON. The green **POWER** LED on the control front should be **ON**.

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
DIRECTIONS FOR USE

2. Set the control mode switch to **NO WELD** and the other controls as follows (note: switch on back of control board should be set to FULL CYCLE.
   SQUEEZE = **25** cycles
   WELD TIME = **02** cycles
   WELD PERCENT = **65%**
   HOLD TIME = **10** cycles
   If options are installed on this control, set all other thumbwheels to 00

3. Set air pressure so that the tip force is great enough for this schedule. On welders smaller than 30 **KVA**, a tip force of 400 pounds is usually satisfactory. On welders 30 to 100 **KVA**, a force of 700 pounds is a reasonable setting.

4. Turn cooling water on (if any). Initiate control to the first foot switch level. The yellow **SOLENOID** LED should glow, and the welder head should advance to close the copper wheels. If a single initiation switch is being used, skip this step. At this same time, the seam motor should be rotating.

5. Press the foot switch further to the second level. The yellow **SOLENOID** LED should stay on until the imitation switch has been opened.

6. Set the mode knob to **SINGLE.**

7. With metal between the electrode wheels, press the foot switch to the first level. Wheels should close as the yellow **SOLENOID** LED glows, and the seam weld motor should be running (part moving).

8. Press the foot switch to the second level and welding heat should flow in smooth pulses.

9. Release the foot switch and the control should complete the last weld sequence, go through a short HOLD time and then open the wheels.

10. If all operates correctly, reset control to the desired welding schedule and test system on metal. If any of the above steps do not function properly, turn system off and carefully check all connections prior to contacting factory. Our service department will be happy to assist you on the phone should you experience difficulties. The number is 847-480-0114.

QUENCH & TEMPER OPTION #9161-11

This option adds the ability to stop heating after the weld has been completed for a selected time (QUENCH TIME), and then reheat the weld nugget at a low heat level (TEMPER TIME, TEMPER HEAT %). This function is used to anneal the weld zone nugget and increase ductility when welding high carbon content metal.

SERVICE

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
SERVICE

Note that all pilot lights mentioned below (green, yellow, and red) are located on the face of the control panel.

TROUBLE SHOOTING CHART

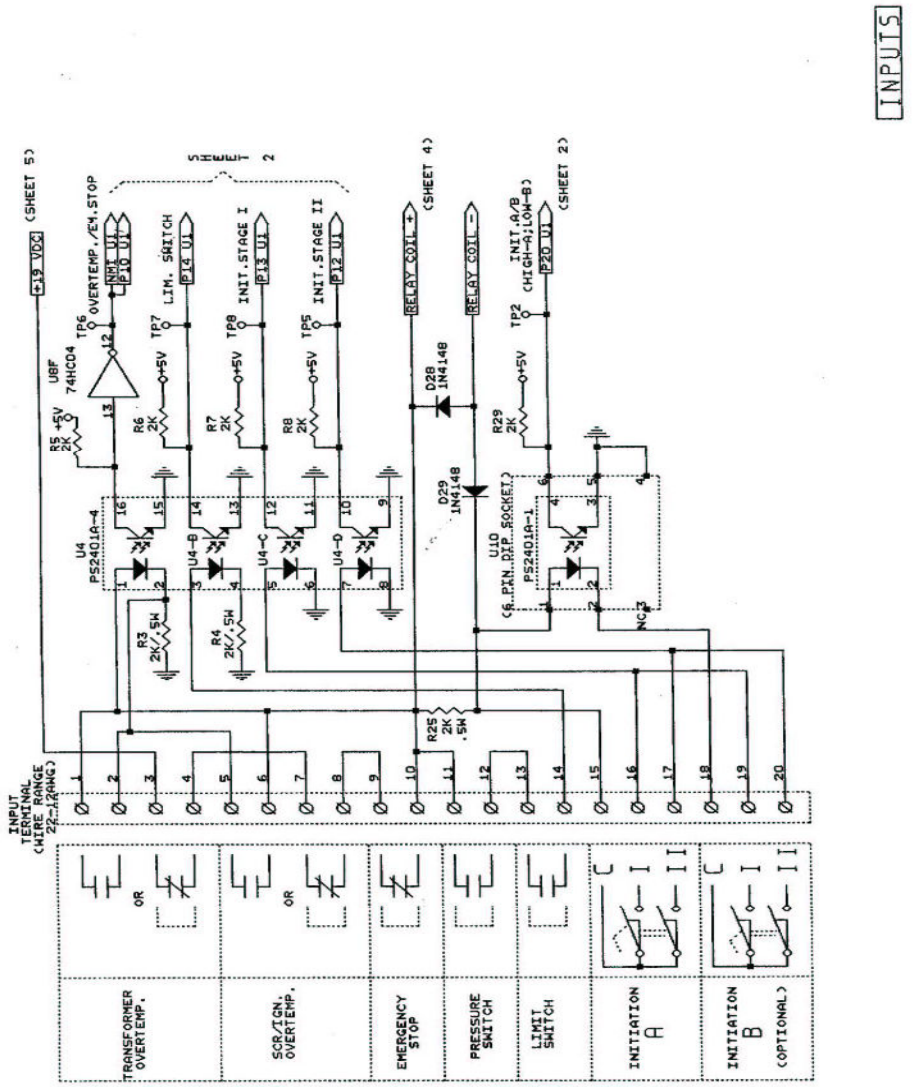
PROBLEM	PROBABLE REASON
No lights on front of the control. **No** operation of any kind.	1. No incoming power at terminals 28 and 29 2. Fuses F1 or F2 are blown. Check voltage selection jumper for correct position to match incoming voltage. 3. Circuit breaker or high-speed fuse open. On circuit breaker, check to be sure setting of rotary knob is correct per installation directions.
Green light is **ON** at the front of the control. **Yellow** light does **not** come on when the initiation switch is closed, and welding tips do **not** close.	1. **EMERGENCY STOP** switch connected to terminals 9 & 10 is open. If no ES switch is installed, be sure that a jumper is installed between terminals 9 & 10. 2. **No initiation signal** at terminals 15 & 16. Test by touching one wire of a wire jumper to 15 and other to 16. If the yellow light comes on and the solenoid valve closes, welder's initiation switch is not operating correctly. 3. **TRANSF. OVERTEMP THERMOSTAT** (if used) at terminals 3 and 4, or **SCR OVERTEMP** input to control is open. Check by temporarily jumping these two input terminal sets. If jumping 7 and 8 allows the control to operate, check and replace defective **SCR OVERTEMP** switch mounted on SCR contactor
Welding head goes **down** and **stays down** when control is initiated, but no welding occurs. Welding head releases when initiation switch is opened.	1. **No LEVEL-2** initiation is put into terminal 20. Check foot or hand switches. 2. **PRESSURE SWITCH** connected to terminals 11 & 12 is open, or jumper missing between these terminals.

SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
SERVICE

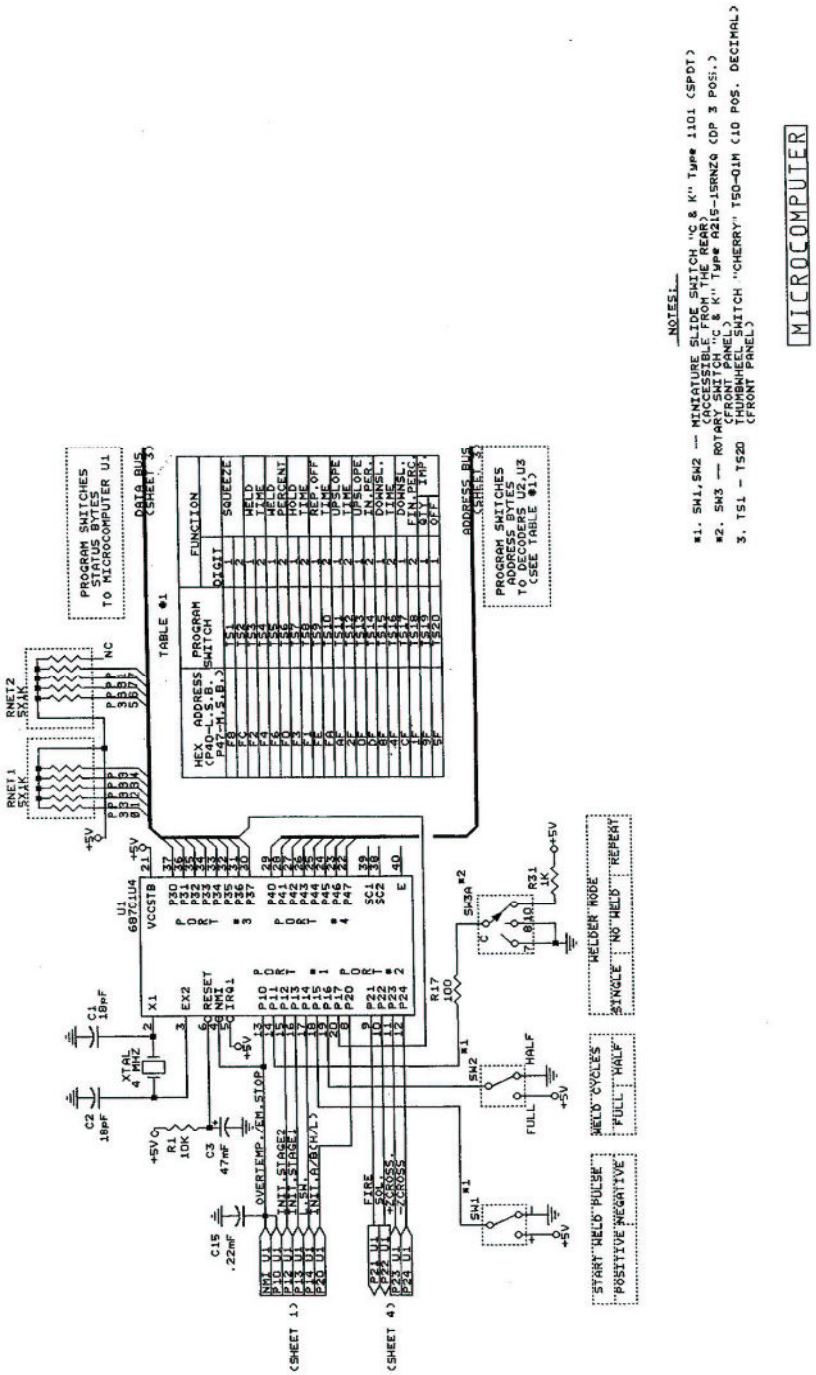
TROUBLE SHOOTING CHART (continued)

PROBLEM	PROBABLE REASON
Welding head goes **down** when control is initiated, but **immediately goes up** and no welding occurs even though the initiation switch remains closed.	1. Welding transformer primary windings are open. Check for bad transformer tap switch, open transformer winding, or disconnected wire at input to transformer. 2. **SCR contactor** is shorted. Turn power off, unwire wiring going to one large terminal on the SCR contactor, and check to see if there is a short between the two large terminals on the SCR contactor.
Welding head goes **down** when control is initiated, goes through SQUEEZE, WELD, & HOLD time, but **red WELD** light on panel does **not** come on and no weld occurs.	1. Selector switch in **NO WELD** position. Put in **SINGLE or REPEAT** position. 2. Check chips **U8, Q1, and relay K2** 3. Bad 3-position **SINGLE – NO WELD – REPEAT** switch.
Welding head goes **down** when control is initiated, goes through **SQUEEZE TIME, WELD, & HOLD, red** light comes on briefly, but no weld occurs.	1. Blown SCR gate fuses F3 or F4 2. Bad connection on welder secondary, dirt between electrodes, electrodes not touching metal under force 3. Bad **SCR contactor** (unlikely)

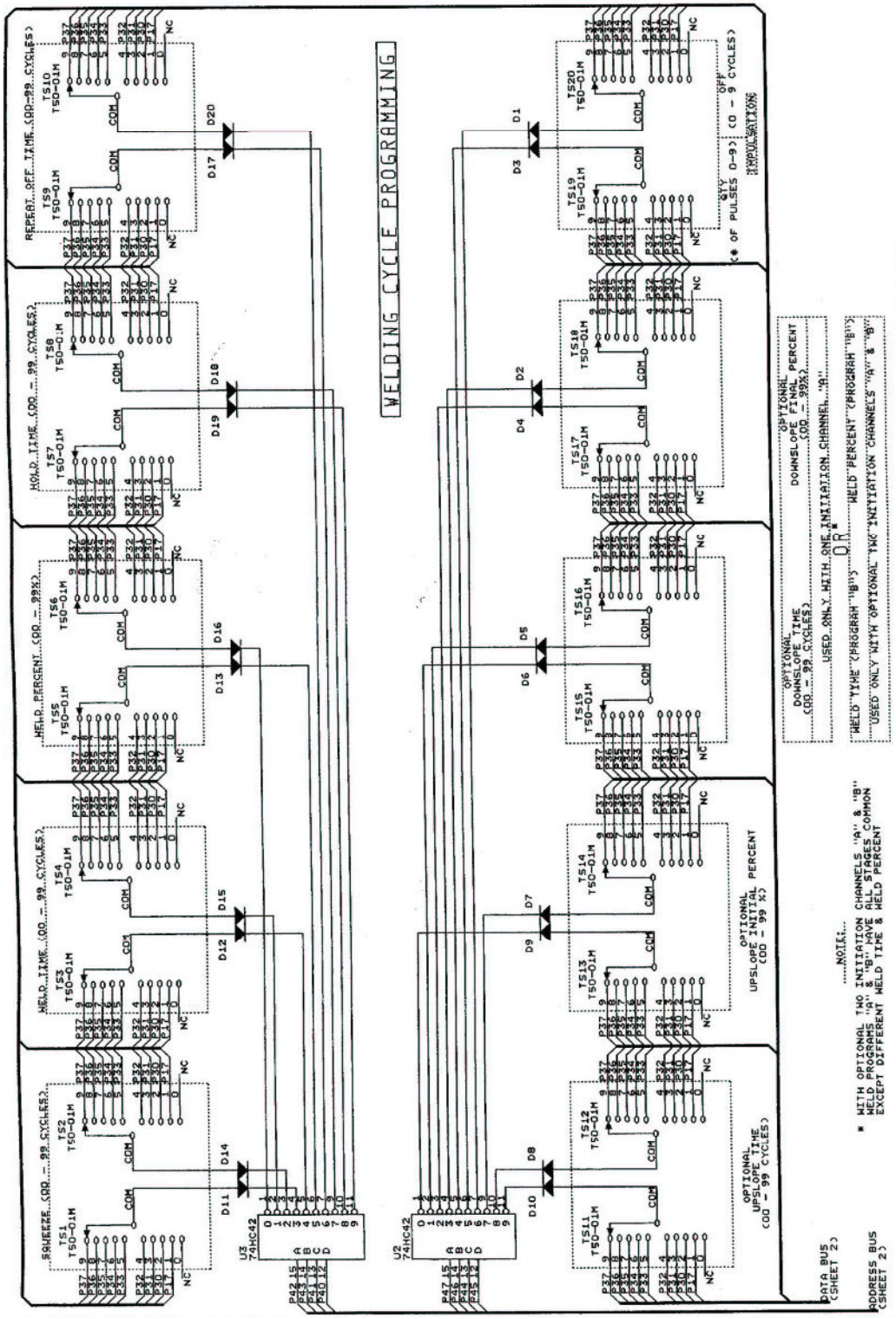
SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
SERVICE



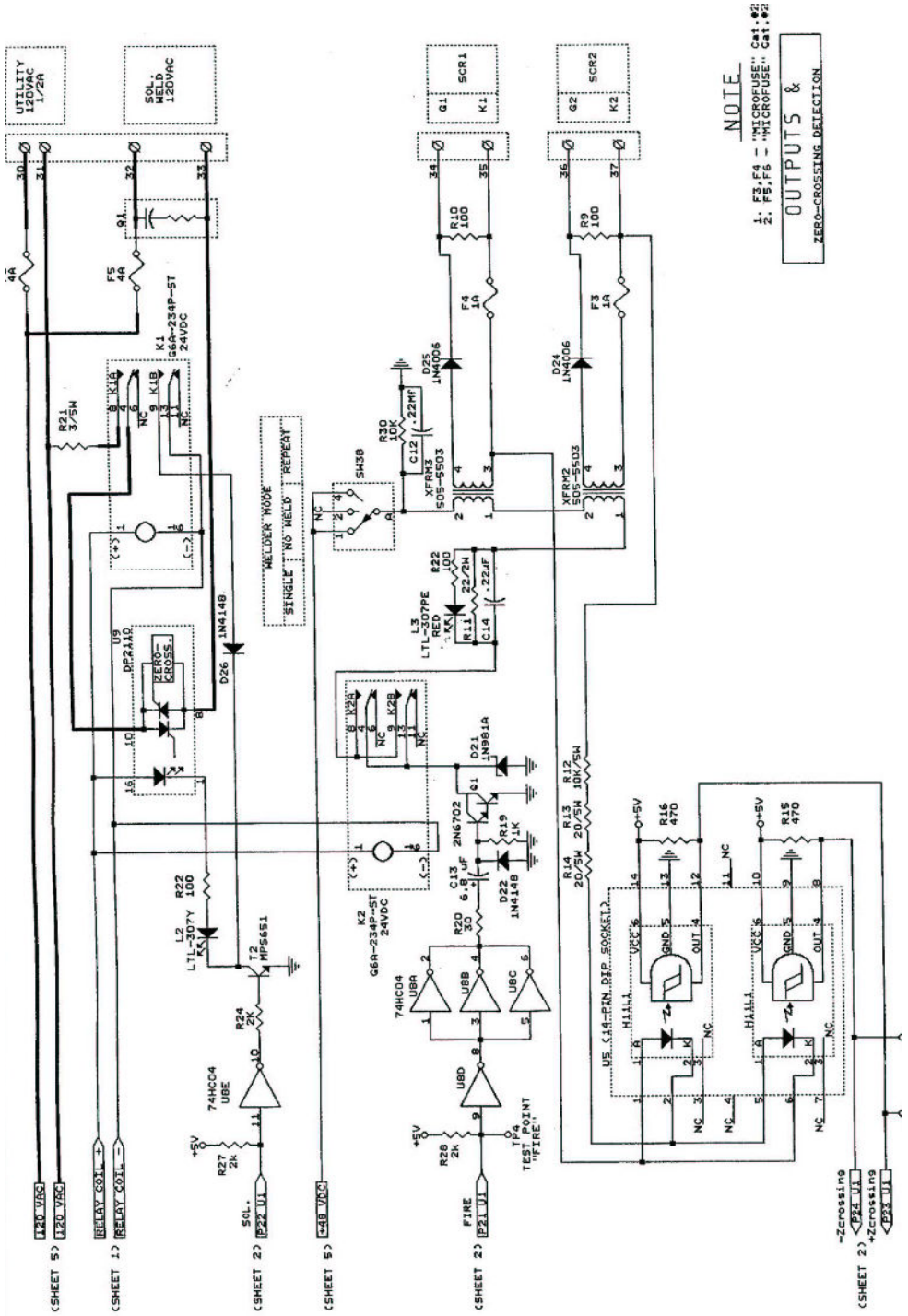
SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
SERVICE



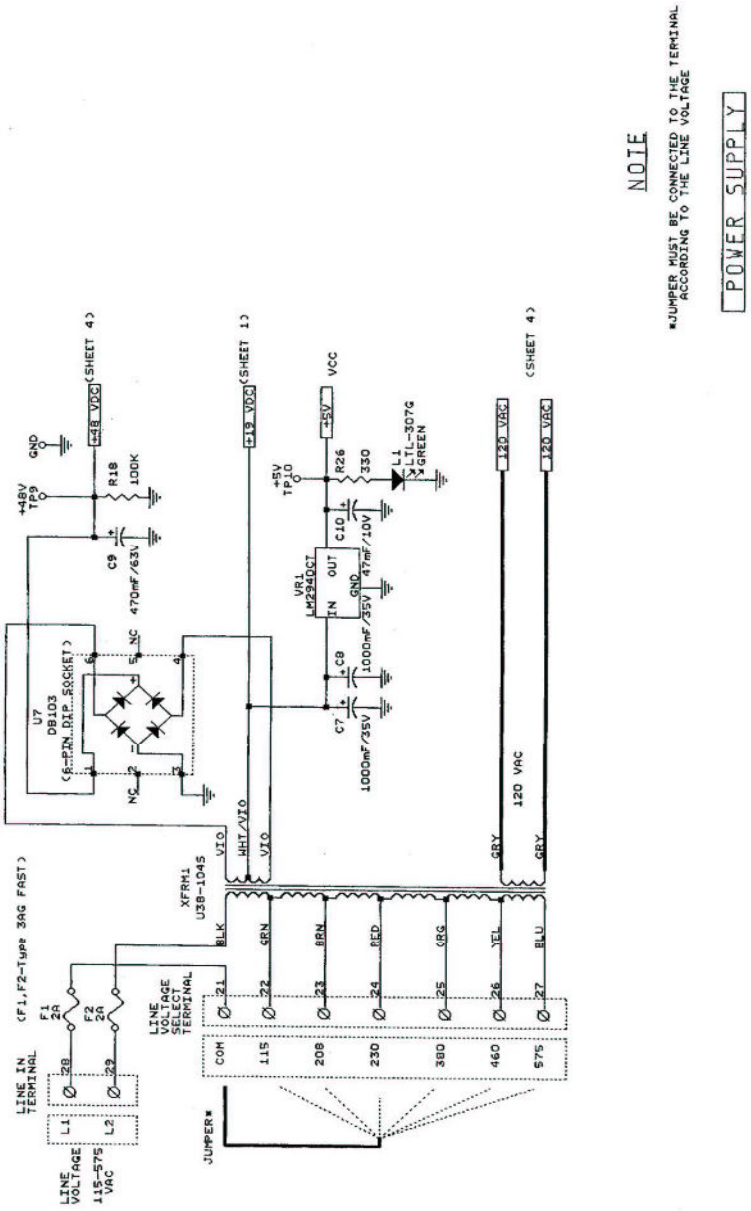
SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
SERVICE



SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
SERVICE



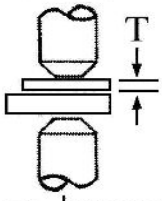
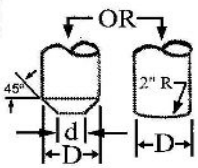
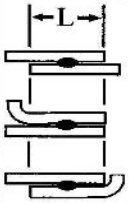
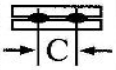
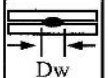
SIMPLICITY WELDING CONTROL
9160M, 9160D, 9160L
SERVICE



WELDING SCHEDULES

SIMPLICITY CONTROL
9160M, 9160D, 9160L
WELDING SCHEDULES

RECOMMENDED PRACTICES FOR SINGLE-PULSE SPOT WELDS IN LOW CARBON STEEL

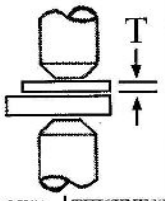
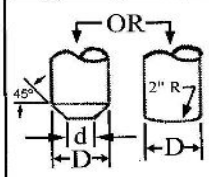
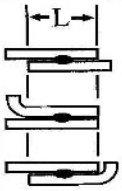
Thickness of Thinnest Outside Piece		Electrode Major Diameter and Shape		Net Electrode Force	Weld Time (Single pulse)	Welding Current*	Minimum Contacting Overlap	Minimum Weld Spacing	Diameter of Fused Zone	Minimum Tensile-Shear Strength
										
MFG GAUGE	THICKNESS Inch (mm)	D, MIN. Inch	d, MAX. Inch	POUNDS	CYCLES (60 HZ)	AMPERES (approx.)	INCH	INCH	INCH (approx.)	POUNDS
32	.010 (0.25)	1/2	1/8	200	4	4,000	3/8	1/4	.13	235
25	.021 (0.53)	1/2	3/16	300	6	6,100	7/16	3/8	.17	530
22	.030 (0.76)	1/2	1/4	400	8	8,000	7/16	1/2	.21	980
20	.036 (0.91)	1/2	1/4	500	10	9,200	1/2	3/4	.23	1,350
18	.048 (1.22)	1/2	1/4	650	12	10,300	9/16	7/8	.25	1,820
16	.060 (1.52)	5/8	5/16	800	14	11,600	5/8	1-1/16	.27	2,350
14	.075 (1.91)	5/8	5/16	1,100	21	13,300	11/16	1-3/8	.31	3,225
13	.090 (2.29)	5/8	3/8	1,300	25	14,700	3/4	1-5/8	.34	4,100
12	.105 (2.67)	5/8	3/8	1,600	29	16,100	13/16	1-13/16	.37	5,300
11	.120 (3.05)	5/8	7/16	1,800	30	17,500	7/8	2	.40	6,900

* **Starting values** shown are based on industry experience. Adjust these values as needed to reach required weld quality.

- Type of steel: **SAE 1008-1010**
- Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4"T"
- Material should be free from scale oxides, paint, grease, and heavy oil
- Electrode material: **RWMA CLASS 2**

SIMPLICITY CONTROL
9160M, 9160D, 9160L
WELDING SCHEDULES

RECOMMENDED PRACTICES FOR SINGLE-PULSE SPOT WELDS IN STAINLESS STEEL

Thickness of Thinnest Outside Piece		Electrode Major Diameter and Shape		Net Electrode Force	Weld Time (Single pulse)	Welding Current* FOR MATERIAL WITH TENSILE STRENGTH		Minimum Contacting Overlap	Minimum Weld Spacing[1]	Diameter of Fused Zone	Minimum Tensile-Shear Strength Ultimate Tensile Strength of Metal		
						Below (150 kpsi)	Above (150 kpsi)				From 70 to 90 kpsi	From 90 to 150 kpsi	150 kpsi & up
MFG. GAUGE	THICKNESS Inch (mm)	D. MIN. Inch	d. MAX. Inch	POUNDS	CYCLES (60 HZ)	AMPS (approx.)	AMPS (approx.)	INCH	INCH	INCH (approx.)	LBS	LBS	LBS
38	.006 (0.15)	3/16	3/32	180	2	2,000	2,000	3/16	3/16	.045	60	70	85
34	.008 (0.20)	3/16	3/32	200	3	2,000	2,000	3/16	3/16	.055	100	130	145
33	.009 (0.23)	3/16	1/8	230	3	2,000	2,000	3/16	3/16	.065	150	170	210
30	.012 (.030)	1/2	1/8	260	3	2,100	2,000	1/4	1/4	.076	185	210	250
29	.013 (0.33)	1/2	1/8	300	4	2,500	2,200	1/4	1/4	.082	240	250	320
28	.015 (0.39)	1/2	1/8	330	4	3,000	2,500	1/4	5/16	.088	280	300	380
26	.018 (0.46)	1/2	1/8	380	4	3,500	2,800	1/4	5/16	.093	320	360	470
25	.021 (0.53)	1/2	5/32	400	4	4,000	3,200	5/16	5/16	.100	370	470	500
24	.024 (0.60)	1/2	5/32	520	5	5,000	4,100	3/8	7/16	.120	500	600	680
22	.030 (0.76)	1/2	3/16	650	5	6,000	4,800	3/8	1/2	.130	680	800	930
21	.033 (0.84)	1/2	3/16	750	6	7,000	5,500	7/16	9/16	.150	800	920	1,100
20	.036 (0.91)	1/2	3/16	900	6	7,800	6,300	7/16	5/8	.160	1,000	1,270	1,400
19	.042 (1.07)	1/2	3/16	1,000	8	8,700	7,000	7/16	11/16	.180	1,200	1,450	1,700
18	.048 (1.22)	1/2	1/4	1,200	8	9,500	7,500	1/2	3/4	.190	1,450	1,700	2,000
17	.054 (1.37)	1/2	1/4	1,350	10	10,300	8,300	9/16	7/8	.210	1,700	2,000	2,450
16	.060 (1.52)	1/2	1/4	1,500	10	11,000	9,000	5/8	1	.220	1,950	2,400	2,900
15	.067 (1.70)	5/8	1/4	1,700	12	12,300	10,000	5/8	1-1/8	.250	2,400	2,800	3,550
14	.075 (1.91)	5/8	5/16	1,900	14	14,000	11,000	11/16	1-1/4	.275	2,700	3,400	4,000
13	.090 (2.29)	5/8	5/16	2,400	16	15,700	12,700	3/4	1-3/8	.285	3,550	4,200	5,300
12	.105 (2.67)	3/4	3/8	2,800	18	17,700	14,000	13/16	1-1/2	.290	4,200	5,000	6,400
11	.120 (3.05)	3/4	3/8	3,300	20	18,000	15,500	7/8	2	.300	5,000	6,000	7,600

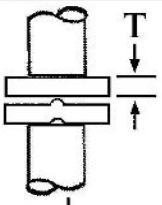
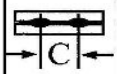
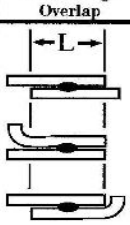
* **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.

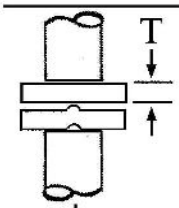
1. Minimum spacing shown is for the welding of two pieces. Increase spacing by 30% when welding three pieces. Smaller minimum spacing requires higher current. Electrode material: **RWMA CLASS 2 or CLASS 3**

- Type of steel: **AISI 301, 302, 303, 304, 308, 316, 317, 321, 349**
- Material should be free from scale oxides, paint, grease, and heavy oil
- Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4"T"

SIMPLICITY CONTROL
9160M, 9160D, 9160L
WELDING SCHEDULES

RECOMMENDED PRACTICES FOR PROJECTION WELDS IN LOW CARBON STEEL

DATA COMMON TO ALL CLASSES OF PROJECTION WELDS						WELDING SCHEDULE A FOR A SINGLE PROJECTION			
Thickness		Projection Size		Minimum Weld Spacing	Minimum Contacting Overlap	Weld Time	Net Electrode Force	Welding Current*	Minimum Tensile-Shear Strength
									
MFG. GAUGE	THICKNESS Inch (mm)	Diameter. Inch	Height. Inch	INCH	INCH	CYCLES (60 HZ)	POUNDS	AMPERES (approx.)	POUNDS
25	.021 (0.53)	.090	.025	0.38	0.25	3	150	4,400	370
23	.027 (0.69)	.090	.025	0.38	0.25	3	195	5,500	500
21	.033 (0.84)	.110	.035	0.50	0.38	3	240	6,600	700
19	.042 (1.07)	.110	.035	0.50	0.38	5	330	8,000	1,060
18	.048 (1.22)	.140	.038	0.75	0.50	8	400	8,800	1,300
16	.060 (1.52)	.150	.042	0.75	0.50	10	550	10,300	1,800
14	.075 (1.91)	.180	.048	0.88	0.50	14	800	1,800	2,425
13	.090 (2.29)	.210	.050	1.06	0.62	16	1,020	13,150	3,250
12	.105 (2.67)	.240	.055	1.25	0.75	19	1,250	14,100	3,850
11	.120 (3.04)	.270	.058	1.50	0.81	22	1,500	14,800	4,800
10	.135 (3.43)	.300	.062	1.63	0.88	24	1,650	15,300	5,500

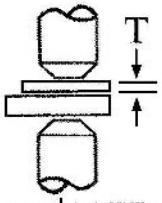
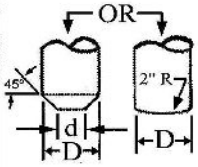
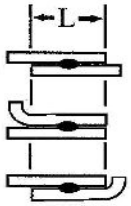
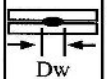
WELDING SCHEDULE B FOR 2 – 3 PROJECTIONS						WELDING SCHEDULE C FOR 4 OR MORE PROJECTIONS			
Thickness		Total Weld Time Do not mult. Per projection	Net Electrode Force per each projection	Welding Current* per each projection	Min. Tensile-Shear per each projection	Total Weld Time Do not mult. Per projection	Net Electrode Force per each projection	Welding Current* per each projection	Min. Tensile-Shear per each projection
									
MFG GAUGE	THICKNESS Inch (mm)	CYCLES (60 HZ)	POUNDS	AMPERES (approx.)	POUNDS	CYCLES (60 HZ)	POUNDS	AMPERES (approx.)	POUNDS
25	.021 (0.53)	6	150	3,850	325	6	80	2,900	290
23	.027 (0.69)	6	150	4,450	425	8	100	3,300	340
21	.033 (0.84)	6	150	5,100	525	11	125	3,800	425
19	.042 (1.07)	10	210	6,000	875	15	160	4,300	720
18	.048 (1.22)	16	270	6,500	1,100	19	220	4,400	875
16	.060 (1.52)	20	365	7,650	1,575	25	330	5,400	1,225
14	.075 (1.91)	28	530	8,850	2,150	34	470	6,400	1,750
13	.090 (2.29)	32	680	9,750	2,800	42	610	7,200	2,325
12	.105 (2.67)	38	830	10,600	3,450	50	740	8,300	2,900
11	.120 (3.04)	45	1,000	11,300	4,200	60	900	9,200	3,600
10	.135 (3.43)	48	1,100	11,850	4,850	66	1,000	9,900	4,250

* **Starting values** shown are based on industry experience. Adjust these values as needed to reach required weld quality.

- Material should be free from scale oxides, paint, grease and heavy oil
- Electrode Material: **RWMA CLASS 3 or 11**

SIMPLICITY CONTROL
9160M, 9160D, 9160L
WELDING SCHEDULES

RECOMMENDED PRACTICES FOR SPOT WELDS IN HIGH STRENGTH LOW ALLOY (HSLA) STEEL

Thickness of Thinnest Outside Piece[1]		Electrode Major Diameter and Shape[2]		Net Electrode Force	Weld Time (Single pulse)	Welding Current*	Minimum Contacting Overlap	Minimum Weld Spacing	Diameter of Fused Zone	Minimum Tensile-Shear Strength
										
MFG GAUGE	THICKNESS Inch (mm)	D. MIN. Inch	d. MAX. Inch	POUNDS	CYCLES (60 HZ)	AMPERES (approx.)	INCH	INCH	INCH (approx.)	POUNDS
32	.010 (0.25)	1/2	1/8	250	4	4,000	3/8	1/4	.14	680
25	.021 (0.53)	1/2	3/16	490	6	6,100	7/16	3/8	.18	690
22	.030 (0.76)	1/2	1/4	560	8	6,700	7/16	1/2	.18	1,270
20	.036 (0.91)	1/2	1/4	720	10	8,000	1/2	3/4	.25	1,750
18	.048 (1.22)	1/2	1/4	910	12	9,700	9/16	7/8	.25	2,360
16	.060 (1.52)	5/8	5/16	1,200	17	12,000	5/8	1-1/16	.25	3,050
14	.075 (1.91)	5/8	5/16	1,550	21	12,500	11/16	1-3/8	.31	4,190
13	.090 (2.29)	5/8	3/8	1,730	27	13,200	3/4	1-5/8	.31	5,330
12	.105 (2.67)	5/8	3/8	1,900	32	13,900	13/16	1-13/16	.35	6,890
11	.120 (3.04)	5/8	7/16	2,300	42	15,100	7/8	2	.35	8,970

* **Starting values** shown are based on experience of member companies. Adjust this value as needed to reach required weld quality. When using radiussed electrodes, increase welding current approximately 10% over values shown.

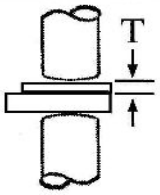
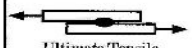
1 Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4"T"

2 Electrode material: **RWMA CLASS 2**

• Material should be pickled or otherwise cleaned to obtain a surface contact resistance not exceeding 200 microhms

SIMPLICITY CONTROL
9160M, 9160D, 9160L
WELDING SCHEDULES

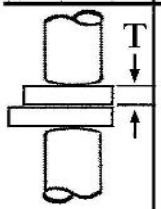
RECOMMENDED PRACTICES FOR SPOT WELDING ALUMINUM ALLOYS ON SINGLE PHASE MACHINES

Thickness of Thinnest Outside Piece	Electrode Major Diameter and Shape		Net Electrode Force	Weld Time (Single pulse)	Welding Current*	Diameter of Fused Zone	Minimum Tensile-Shear Strength		
									
THICKNESS Inch (mm)	D. MIN. Inch	R. MAX. Inch	POUNDS	CYCLES (60 HZ)	AMPS (approx.)	INCH (approx.)	From 19.5 to 28 kpsi LBS	From 28 to 56 kpsi LBS	56 kpsi & up LBS
.016 (0.40)	5/8	1-Flat	320	4	15,000	.110	95	130	145
.020 (0.51)	5/8	1-Flat	340	5	18,000	.125	135	175	190
.025 (0.64)	5/8	2-Flat	390	6	21,800	.140	195	235	250
.032 (0.81)	5/8	2-Flat	500	6	26,000	.160	280	315	350
.040 (1.02)	5/8	3-Flat	600	8	30,700	.180	400	415	460
.050 (1.27)	5/8	3-Flat	660	8	33,000	.210	550	590	640
.063 (1.60)	5/8	3-Flat	750	10	35,900	.250	755	835	920
.071 (1.80)	5/8	4-4	800	10	38,000	.275	875	980	1,130
.080 (2.03)	7/8	4-4	860	10	41,800	.300	1,035	1,155	1,400
.090 (2.29)	7/8	6-6	950	12	46,000	.330	1,175	1,355	1,700
.100 (2.54)	7/8	6-6	1,050	15	56,000	.360	1,270	1,600	2,050
.125 (3.18)	7/8	6-6	1,300	15	76,000	.425	1,400	2,170	2,830

* **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.

- This table is for commercial welding. See table below for single phase welding to meet more rigid requirements.
- Table is for alloys: **2014-T3-T4-T6, 2024-T3-T4, and 7075-T6**. Somewhat lower values can be used for alloys such as **5053, 6061, 6009, 6010, 5182, and 2036**
- Electrode material: **RWMA CLASS 1**

RECOMMENDED PRACTICES FOR SPOT WELDING ALUMINUM ALLOYS ON SINGLE PHASE MACHINES WITH SLOPE

Thickness of Thinnest Outside Piece	Electrode Major Diameter and Shape		Net Electrode Force		Heat Time			Current*			Minimum Tensile Shear Strength	Diameter of Fused Zone
												
THICKNESS Inch (mm)	D. MIN. Inch	R. MAX. Inch	WELD POUNDS	FORGE POUNDS	UPSLOPE CYCLES (60 HZ)	WELD HEAT CYCLES (60 HZ)	DOWN SLOPE CYCLES (60 HZ)	INITIAL AMPS (approx.)	WELD AMPS (approx.)	FINAL AMPS (approx.)	POUNDS	POUNDS
.016 (0.40)	7/8	3	500	1,200	1	0	1	5,500	17,700	0	167	.134
.020 (0.51)	7/8	3	500	1,200	1	1	2	8,500	19,800	11,300	228	.143
.040 (1.02)	7/8	3	700	1,600	1	2	5	10,800	28,300	10,600	578	.156
.063 (1.60)	7/8	6	1,180	2,750	3	5	11	16,850	34,500	18,700	1,126	.281
.090 (2.29)	7/8	6	1,700	4,300	4	8	17	17,700	46,500	33,200	2,039	.334

* **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.

- Table is for alloys: **2014-T3-T4-T6, 2024-T3-T4, and 7075-T6**. Somewhat lower values can be used for alloys such as **5053, 6061, 6009, 6010, 5182, and 2036**
- Electrode material: **RWMA CLASS 1**
- This table is for more rigid welding requirements. See table above for single phase welding to meet less rigid commercial requirements.

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