NOTES

WARRANTY

Unitrol provides a 5-year limited warranty to cover all of this SOLUTION control. The warranty periods are determined using the date the control was shipped from Unitrol 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 personnel that has not been authorized in advance and in writing by an officer of Unitrol.
2. All costs for freight, to and from Unitrol, 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 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 sizing charts on current Unitrol price lists, that were mechanically or electronically altered by customer, or that were physically damaged after shipment from Unitrol.
6. Damages to a control by lightning, flood, or mechanical damage are excluded from this warranty.
7. Unitrol assumes no liability for damage to other equipment or injury to personnel due to a failure in the Unitrol control.
8. Unitrol shall not be responsible for any consequential damages of whatever kind.
9. Any expense involving alteration or installation of a Unitrol 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 WARRANTY, WRITTEN OR IMPLIED, COVERS THIS CONTROL UNLESS IN WRITING AND SIGNED BY AN OFFICER OF UNITROL PRIOR TO SHIPMENT OF PRODUCT.

Address all warranty questions to:

Unitrol Electronics, Inc.
702 Landwehr Road
Northbrook, Illinois 60062
Phone: 847-480-0115
FAX: 847-480-0932
info@unitrol-electronics.com

SOLUTION #9180

TABLE OF CONTENTS

SOLUTION #9180
RESISTANCE WELDING CONTROL SYSTEM

OPERATING SPECIFICATION CHART

STANDARD FUNCTIONS

NAME	OPERATION	RANGE	APPLICATION
SCHEDULE MEMORY	INSTANT RECALL OF COMPLETE WELD SCHEDULES	75	INSTANT SET-UP OF REPETITIVE JOBS
COUNTER	COUNTS WELDS OR PARTS	0-65,500	CONTROL OF PRODUCTION
DUAL PROGRAM	USES ANY OF THE 75 WELD PROGRAMS	-	WELDING OF VARIOUS THICKNESS COMBINATIONS
LANGUAGES	5 FOREIGN LANGUAGES FOR OPERATOR USE	5	EASY USE FOR FOREIGN SEEKING OPERATORS
WATER SAVER DRIVER	TURN WATER OFF 1 MIN. AFTER LAST WELD	1 MINUTE	
SQUEEZE	DWELL BEFORE FIRING	0-99 CY	ALLOWS TIPS TO FULLY CLOSE BEFORE WELDING
WELD	MAIN HEAT & WELD TIME	0-99 CY. 0-99% HEAT*	ALL PROGRAMS
HOLD	DWELL AFTER WELDING	0-99 CY.	ALLOWS NUGGET TO COOL
PREHEAT	SETTING BEFORE UPSLOPE	0-99 CY. 0-99% HEAT*	TO PREHEAT PARTS FOR FIT-UP PROBLEMS
UPSLOPE	RAMPS CURRENT UPWARD TO WELD HEAT %	0-99 CY. 0-99 INIT. %*	GALVANIZED AND COATED METAL; PROJECTIONS
DOWNSLOPE	RAMPS CURRENT DOWNWARD FROM WELD HEAT %	0-99 CY. 0-99 FINAL %*	ALUMINUM; HIGH CARBON STEEL
POSTHEAT	SETTING AFTER DOWNSLOPE	0-99 CY. 0-99% HEAT*	REDEFINES GRAIN STRUCTURE IN STEEL
IMPULSATION	REPEATS WELD SEQUENCE WITHOUT OPENING TIPS	0-99 PULSES 0-99 INTERPULSE	HEAVY METAL WELDING
QUENCH & TEMPER	COOL AND REHEAT AT END OF WELDING CYCLES	0-99 CY. HEAT 0-99% HEAT* 0-99 CY. COOL	REDUCES BRITTLENESS IN HIGH CARBON STEELS
REPEAT MODE	CONTROLS OPENING AND CLOSING OF TIPS WHILE INITIATION IS CLOSED	0-9.9 SECONDS	ALLOWS "AUTOMATIC" RUN OF WELDER
AVC	AUTO VOLTAGE COMP.	+/- 1%	MAINTAINS WELDER OUTPUT

* HEAT% settings convert to 0-99,990A when in CONSTANT CURRENT mode (option)

STANDARD INITIATION MODES

1. MOMENTARY
2. HOLDING
3. SINGLE STAGE
4. DOUBLE STAGE
5. TWO SWITCH **ANTI-TIEDOWN**

OPTIONAL FUNCTIONS

NAME	OPERATION	RANGE	APPLICATION
PRESSURE TRANSDUCER	STARTS WELD WHEN PRESSURE IS REACHED	1-99 psi. KEYPAD SET	PRECISION TIP PRESSURE FOR CONSISTENT WELDS
CONSTANT CURRENT	CONSTANT CURRENT UPPER/LOWER LIMITS	0-99,OOOA	MAINTAINS HEAT LEVEL AND MONITORS RESULTS
PRINTER	RECORDS WELD SCHEDULE WELD CURRENT/FORCE	0-60 KA 0-9,000 LBS	PRODUCTION CONTROL

ELECTRICAL SPECIFICATIONS

VOLTAGE RANGE=208, 230, 380, 460, 575. FREQUENCY=60 /50 Hz. (field selectable

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 power supply cabinet being sure that the cabinet door will clear all welder components when open. It is usually an advantage to locate this cabinet as close to eye level as possible for easy installation and servicing.

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

   For 9180M series controls, side mounting brackets are supplied with the system. You can mount the control from the left or right side as desired. Mount these brackets using the screws presently holding the side panel in place. Alternately, by drilling holes in the four foot pads on bottom of this enclosure, you can mount the control to the top surface of the welder or to a table top.

4. 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. **IT IS IMPORTANT THAN NO METAL CHIPS ENTER ANY OF THE ELECTRONIC COMPONENTS IN THE CABINET! PROTECT POWER SUPPLY AND CONTACTOR DURING THESE DRILLING AND INSTALLATION OPERATIONS. WHEN COMPLETE, REMOVE ALL CHIPS FROM THIS CABINET BEFORE APPLYING POWER.**

5. Drill or punch an access hole to handle the foot pedal or palm buttons at a convenient location in the bottom of the cabinet. **OBSERVE THE CAUTIONS IN THE STEP ABOVE.** After cleaning interior of all chips, install liquid tight or rigid conduit at all locations. Consult local codes for proper wire size. Wire should be sized for a maximum of 50% duty cycle load.

6. Connect power wires as shown in the WIRING HOOK-UP DIAGRAM shown on page I-5 of this book. Be sure 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.

   For 9180M series controls, remove the four outer screws on the control face plate. Carefully rotate the front panel from the top to expose the wiring terminals. A bracket is provided to prevent the panel from going more than 90^{o}.

7. Connect foot pedal, palm buttons, or machine contacts per WIRING HOOK-UP DIAGRAM page I-5. If limit switch, pressure switch, and/or transformer thermostat is used, connect per WIRING HOOK-UP DIAGRAM. If any of these are not being used, install jumpers as shown (usually supplied from 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 #1 and #2 with jumpers between #3 and #4. If the thermostat contacts CLOSE on TEMPERATURE RISE (unusual), connect thermostat wires to #3 and #4, and jumper #1 and #2.

8. If system uses a water cooled SCR contactor, connect water hoses to fittings under cabinet. In/out direction of water is not important unless the system has been supplied with the #9181-28 water flow switch.

****

For models 9180M, 9180D, 9180L, and 9180R, skip to step #12.

****

9. Select appropriate location for the SOLUTION control console. Be sure that the console face is clear of the worst anticipated location of parts to be welded, and is not in the direct path of weld flash. Use the supplied swivel bracket as shown on page I-3. Be sure to install the two washers as shown for proper operation.

10. Carefully plug control cable into the rear of console. Fasten with the two jack screws on the cable plug. **HAND TIGHTEN ONLY. DO NOT USE A SCREWDRIVER. DO NOT USE EXCESSIVE FORCE ON THESE JACK SCREWS AS DAMAGE WILL OCCUR.**

11. Route the cable to the power supply cabinet and push the excess cable into the large compression fitting supplied on the cabinet top. Be sure that there is enough of a loop at the console to allow full movement of the console. Tighten fitting.

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. If you have rotated the control out of the enclosure earlier, carefully rotate back and secure with the original four screws.

13. Connect the YELLOW wire on power supply board to a terminal that most closely matches your line voltage. **CAUTION: IF THE ACTUAL LINE VOLTAGE IS MORE THAN 20% HIGHER THAN THE TERMINAL MARKING, PERMANENT DAMAGE CAN OCCUR TO THE SYSTEM.**

14. If the factory circuit breaker is in this system, locate adjustment setting on breaker and set to the closest or higher range calculated from the following formula:

$$\text{SETTING} = \frac{\text{KVA}}{\text{LINE VOLTAGE}} \text{ X } 3{,}000$$

Where **KVA** is that shown on the welder nameplate.

As an example: **KVA=75**
Line voltage=460

$$\text{SETTING} = \frac{75}{460} \text{ x } 3{,}000 = .163 \text{ X } 3{,}000 = 489.13$$

The circuit breaker should be set to the nearest higher level.

Note that this circuit breaker has a MAGNETIC mechanism only to protect the SCR contactor against very fast and high current surges.

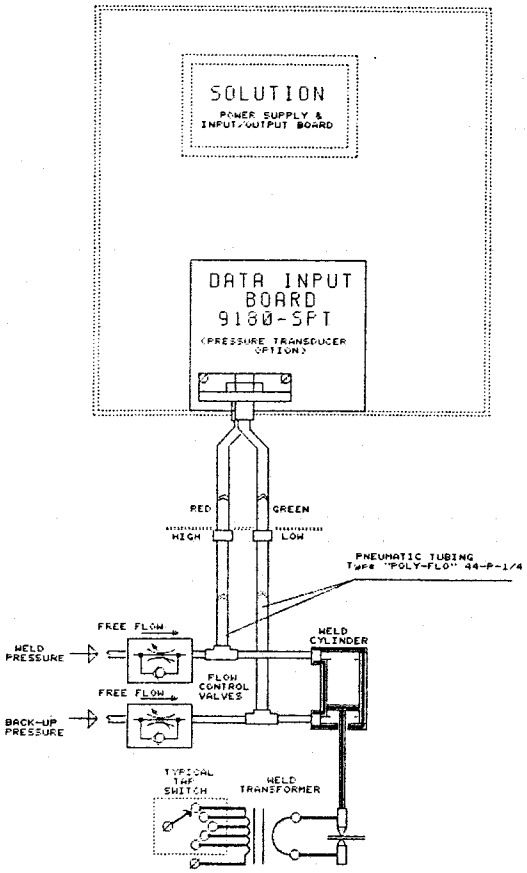
15. Turn power on and check the control module. If the system is working correctly, the control will go through the diagnostic program and finish with the read-out showing "PROGRAM # __" if the memory was cleared at the factory or previous installation, or will display, "PROGRAM ## READY" if program was left in the memory.

    If no display is present, check that line voltage is present and matches that selected in step 13 above. If some other phrase is displayed, check page 10 in DIRECTIONS FOR USE to find problem. Consult factory service department if difficulty is encountered at this point. Do not attempt to service control without proper information.

16. System should now be ready for operation.

DATA INPUT BOARD

PRESSURE TRANSDUCER OPTION



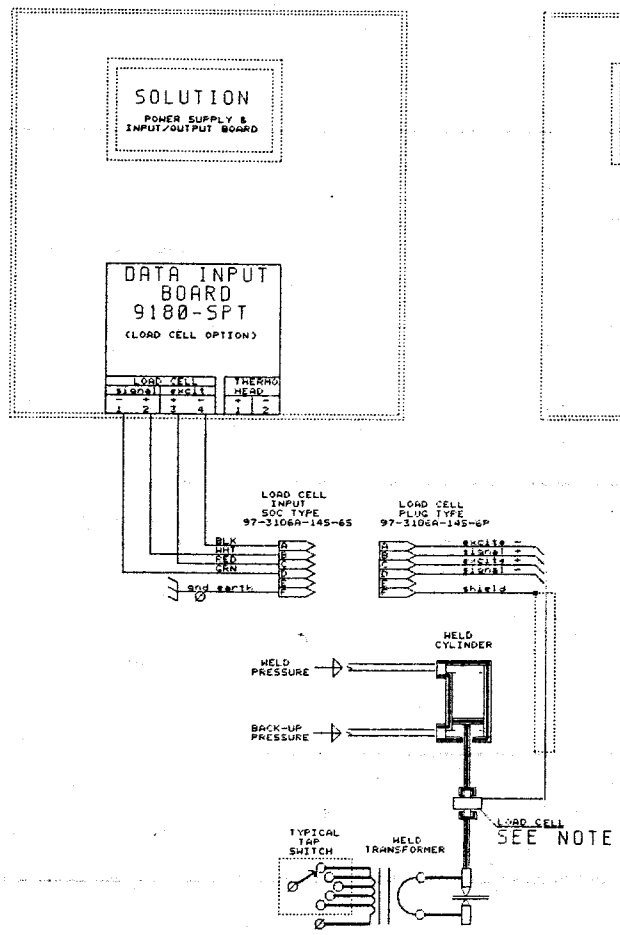
I. PRESSURE TRANSDUCER PNEUMATIC HOOK-UP DIAGRAM

NOTES

a) ATTENTION!
MAX PRESSURE = 100psi

b) TO USE PRESSURE TRANSDUCER SEE "SOLUTION" MANUAL "INITIAL SET-UP PROCEDURE" AND CHAPTER "SETTING TIP FORCE CALCULATOR"

LOAD CELL OPTION



II. LOAD CELL HOOK-UP DIAGRAM

NOTES

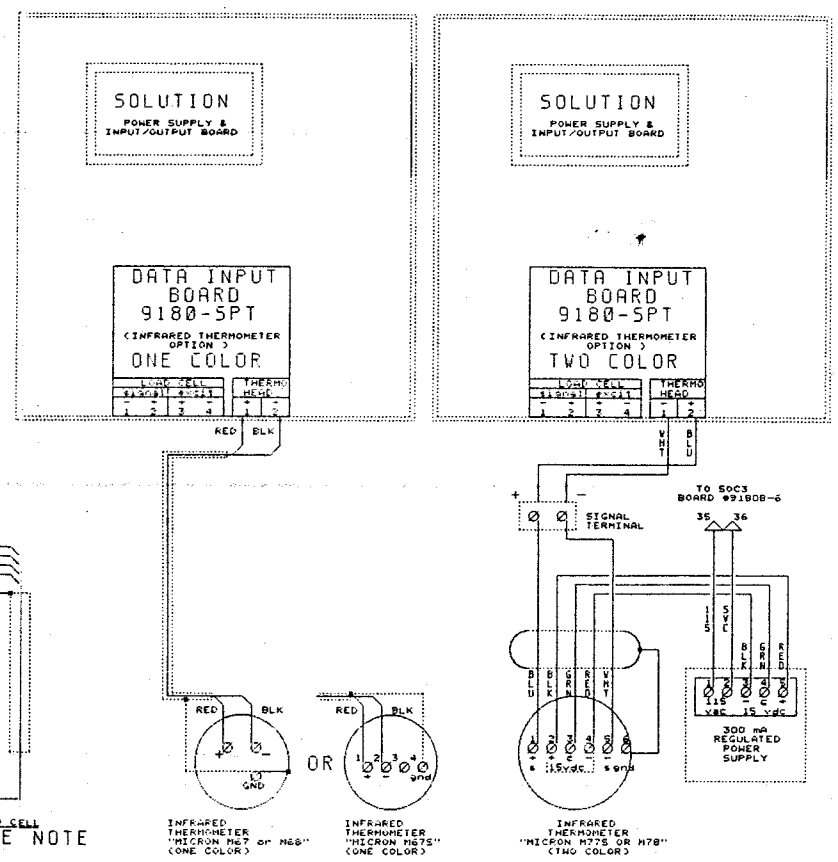
a) USE ONLY COMPRESSION TYPE LOAD CELLS.

c) TO USE LOAD CELL SEE "SOLUTION" MANUAL "INITIAL SET-UP PROCEDURE" AND CHAPTER "SETTING TIP FORCE CALCULATOR".

INFRARED THERMOMETER OPTION

a) ONE COLOR

b) TWO COLOR



III. INFRARED THERMOMETER HOOK-UP DIAGRAM

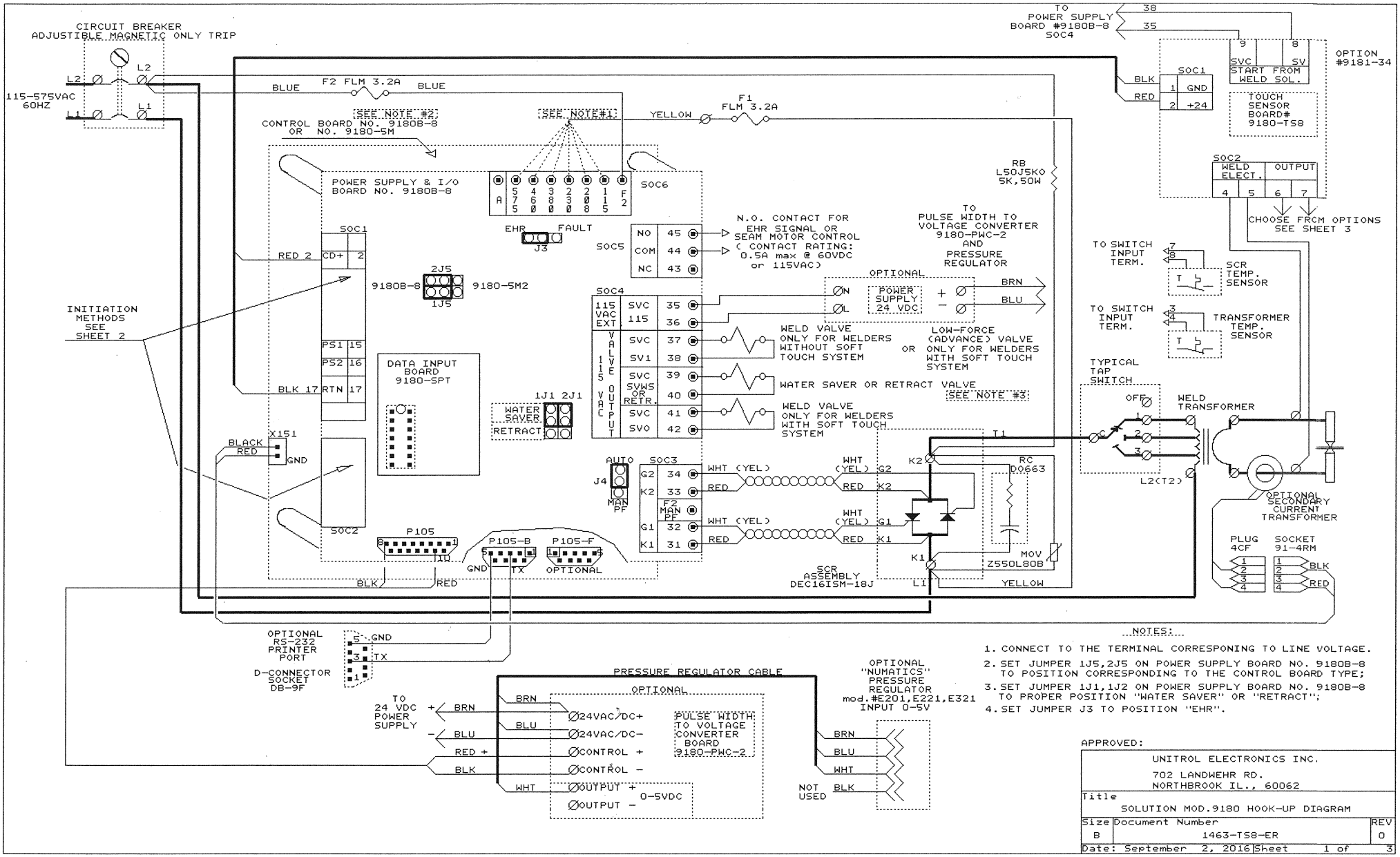
NOTES

a) ALL METAL PARTS OF THE INFRARED THERMOMETER: THERMOHEAD ENCLOSURE, FIBER OPTIC SHIELD AND LENS ASSEMBLY MUST BE ISOLATED FROM THE GROUND EARTH.

b) TO USE INFRARED THERMOMETER SEE MANUAL "TEMPERATURE FEEDBACK AND WELDING CONTROL"

APPROVED:

UNITROL ELECTRONICS INC.	
702 LANDWEHR RD. NORTHBROOK IL, 60062	
Title	DATA INPUT BOARD #9180-SPT SOLUTION HOOK-UP DIAGRAM
Size: C	Document Number: #1725-1
REV: 4	
Date: November 8, 2006	Sheet 1 of 1



NOTES:

1. CONNECT TO THE TERMINAL CORRESPONING TO LINE VOLTAGE.
2. SET JUMPER 1J5,2J5 ON POWER SUPPLY BOARD NO. 9180B-8 TO POSITION CORRESPONDING TO THE CONTROL BOARD TYPE;
3. SET JUMPER 1J1,1J2 ON POWER SUPPLY BOARD NO. 9180B-8 TO PROPER POSITION "WATER SAVER" OR "RETRACT";
4. SET JUMPER J3 TO POSITION "EHR".

APPROVED:

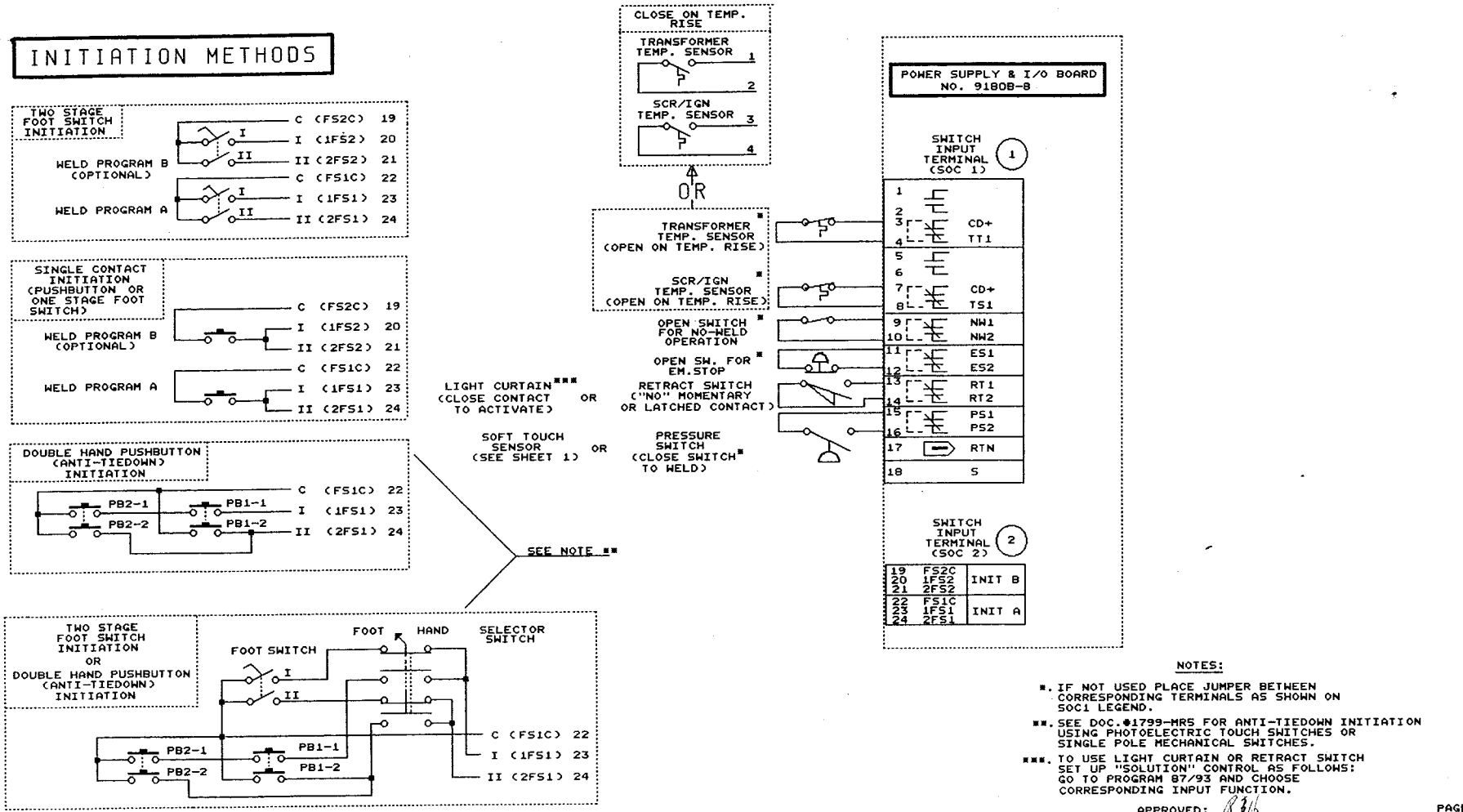
UNITROL ELECTRONICS INC.
702 LANDWEHR RD.
NORTHBROOK IL., 60062

Title: SOLUTION MOD.9180 HOOK-UP DIAGRAM

Size	Document Number	REV
B	1463-TS8-ER	0

Date: September 2, 2016 Sheet 1 of 3

INITIATION METHODS



NOTES:

*. IF NOT USED PLACE JUMPER BETWEEN CORRESPONDING TERMINALS AS SHOWN ON SOC1 LEGEND.

**. SEE DOC.#1799-MRS FOR ANTI-TIEDOWN INITIATION USING PHOTOELECTRIC TOUCH SWITCHES OR SINGLE POLE MECHANICAL SWITCHES.

***. TO USE LIGHT CURTAIN OR RETRACT SWITCH SET UP "SOLUTION" CONTROL AS FOLLOWS: GO TO PROGRAM 87/93 AND CHOOSE CORRESPONDING INPUT FUNCTION.

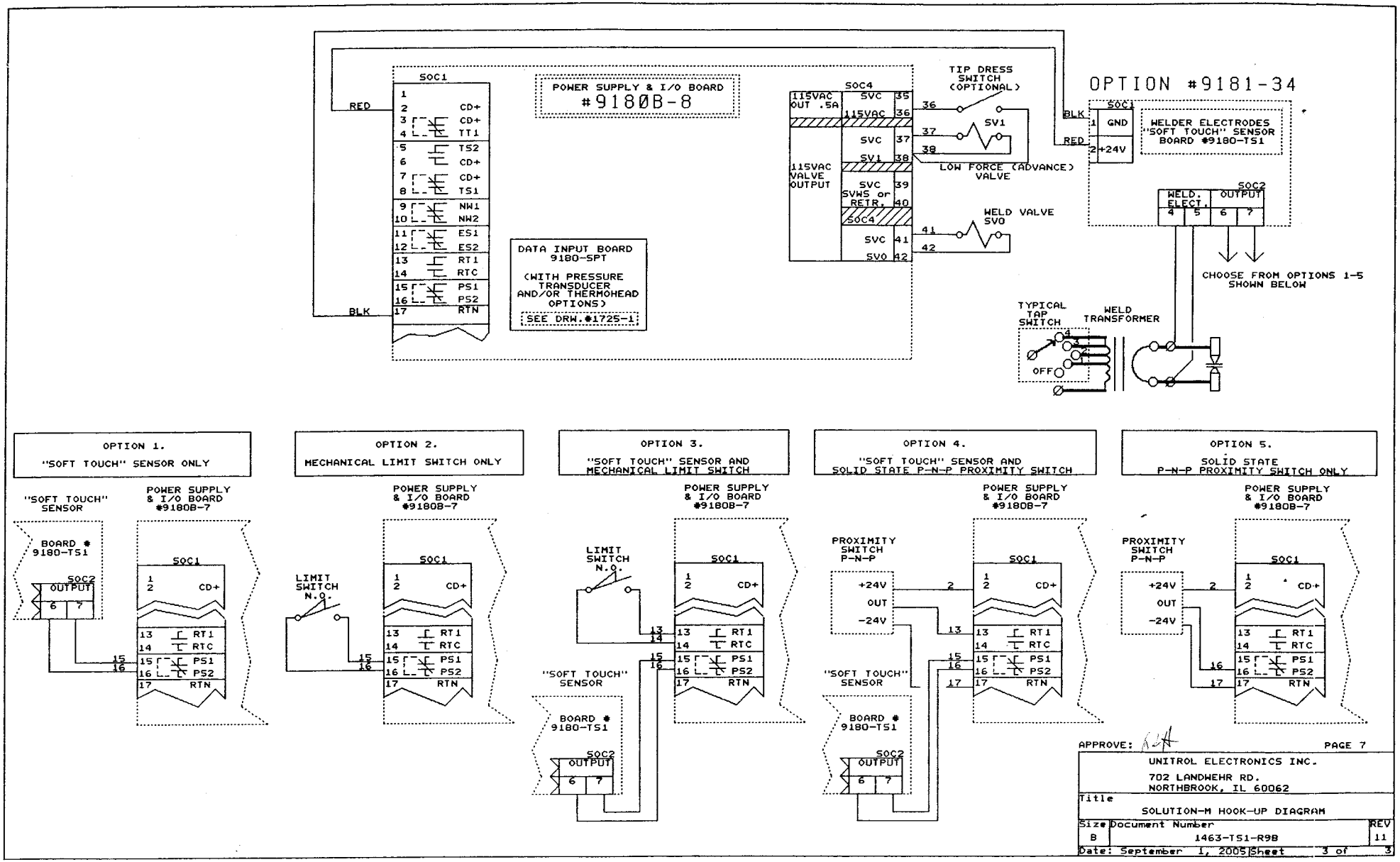
APPROVED:

UNITROL ELECTRONICS INC
702 LANDWEHR RD.
NORTHBROOK, IL. 60062

Title: SOLUTION-M HOOK-UP DIAGRAM

Size	Document Number	REV
B	1463-TS1-R9B	11

Date: September 1, 2005 Sheet 2 of 3



APPROVE: KH

UNITROL ELECTRONICS INC.
702 LANDWEHR RD.
NORTHBROOK, IL 60062

Title: SOLUTION-M HOOK-UP DIAGRAM

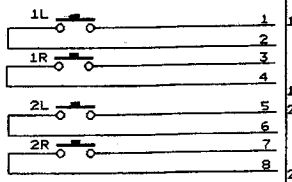
Size	Document Number	REV
B	1463-TS1-R9B	11

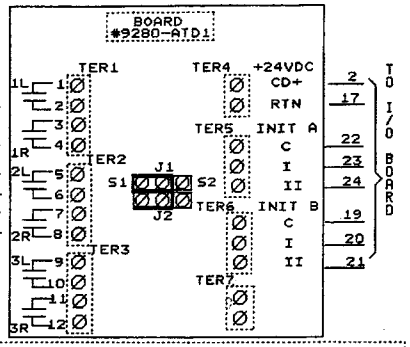
Date: September 1, 2005 Sheet 3 of 3

MECHANICAL PUSHBUTTONS

TYPE OF PUSHBUTTONS 1L,1R & 2L,2R:

MECHANICAL, MOMENTARY ACTION, N. O. CONTACT





DOUBLE HAND PUSHBUTTON ANTI-TIEDOWN INITIATION

USING SINGLE POLE SWITCHES

REQUIRES OPTIONAL BOARD #9280-ATD1

NON-MECHANICAL TOUCH BUTTONS

WARNING!

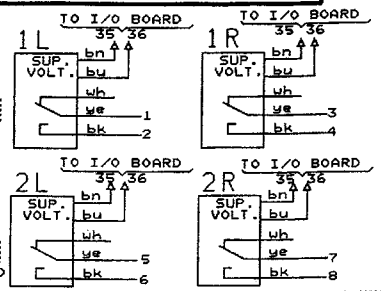
LIKE MOST SOLID-STATE DEVICES NON-MECHANICAL TOUCH BUTTONS ARE AS EQUALLY LIKELY TO FAIL IN THE CONDUCTING ("ON") STATE AS IN THE NON-CONDUCTING ("OFF") STATE.
IF NON-MECHANICAL TOUCH BUTTONS ARE USED TO INITIATE YOUR WELDER WHERE A FALSE OPERATION COULD BE DANGEROUS, POINT-OF-OPERATION GUARDING DEVICES OR RELATED SAFETY CONTROLS MUST BE INSTALLED AND MAINTAINED TO MEET ALL APPROPRIATE OSHA AND ANSI B11 MACHINE SAFETY STANDARDS.

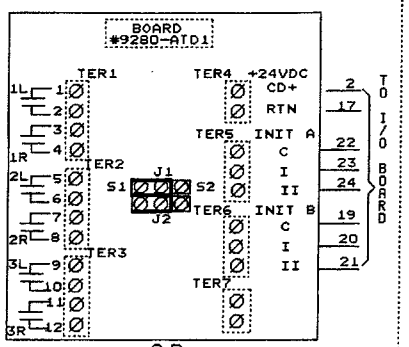
TYPE OF TOUCH BUTTONS 1L,1R & 2L,2R:

"OPTO-TOUCH" PHOTOELECTRIC SWITCHES WITH ELECTROMECHANICAL RELAY OUTPUT (N.O.), MOMENTARY ACTION. ("BANNER" Mod.OTBA5 OR EQUIVALENT) Supply Voltage 120VAC.

INIT. A

INIT. B (OPTIONAL)





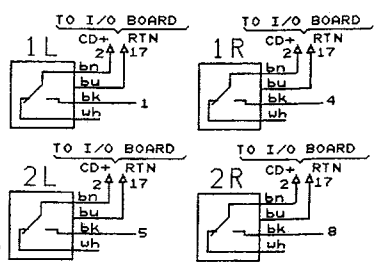
OR

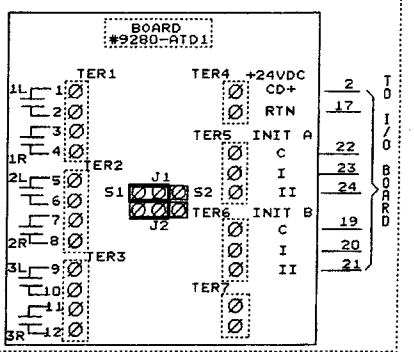
TYPE OF TOUCH BUTTONS 1L,1R & 2L,2R:

"OPTO-TOUCH" PHOTOELECTRIC SWITCHES WITH SOLID STATE OUTPUT PNP (SOURCING), MOMENTARY ACTION. ("BANNER" Mod.OTVB6 OR EQUIVALENT) Supply Voltage 10-30VDC.

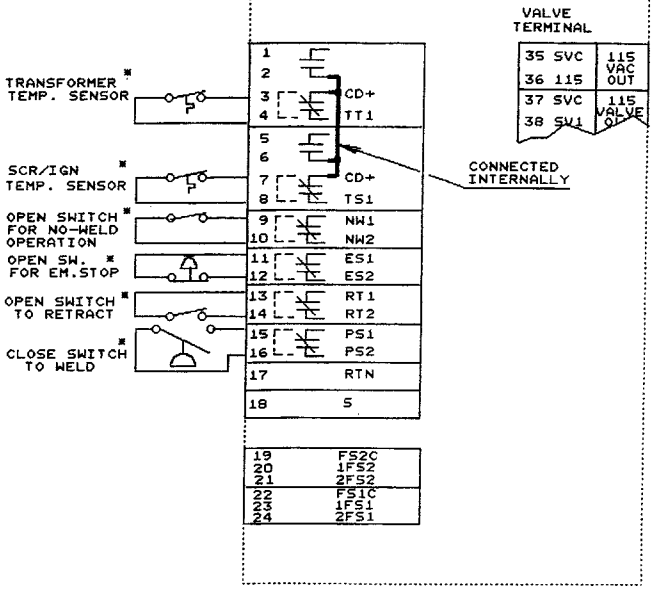
INIT.A

INIT.B (OPTIONAL)





POWER SUPPLY & I/O BOARD



NOTE:

* IF NOT USED PLACE JUMPER BETWEEN CORRESPONDING TERMINALS AS SHOWN ON THE INPUT TERMINAL LEGEND.

APPROVED: RPH

UNITROL ELECTRONICS INC.
702 LANDWEHR RD.
NORTHBROOK, IL 60062

Title	ANTI-TIEDOWN INTERFACE OPTION #9181-56	
Size B	Document Number 1799-MR7	REV 7
Date: February 11, 2002	Sheet 1 of 1	

SOFT TOUCH OPTION
9181-34 SERIES

OPERATOR SAFETY SYSTEM

SOFT TOUCH

BEFORE STARTING INSTALLATION, locate your welder type on the chart below and verify the correct SOFT TOUCH kit has been provided to match your welder.

TYPE OF WELDER ▼	**ELECTRODES CLOSE SMOOTHLY BY GRAVITY*** THEN, FORCE BETWEEN ELECTRODES IS **MORE THAN 50LBS**	ELECTRODES **DO NOT** CLOSE SMOOTHLY BY GRAVITY* IF A PRESS WELDER, RAM WEIGHS **LESS THAN 50LBS**	RAM WEIGHS **LESS THAN 50LBS** AND FALLS QUICKLY BY GRAVITY*
PRESS OR **PROJECTION** WITH 4-1/2" DIAMETER OR **SMALLER** STANDARD CYLINDER	1. **Pre-plumbed** (recommended for smoother installation) = **#9181-34W**. This includes all required valves.	1. **Pre-plumbed** (recommended for smoother installation) = **#9181-34Y**. This includes all required valves.	**#9181-34H**. This includes a parts kit that is easily installed.
PRESS OR **PROJECTION** WITH 5 DIAMETER OR **LARGER** STANDARD CYLINDER	**1. Pre-plumbed** (recommended for smoother installation) = **#9181-34W** + **#9181-34D**. This includes all required	1. **Pre-plumbed** (recommended for smoother installation) = **#9181-34Y + #9181-34D**. This includes all required valves.	**N/A**
ROCKER ARM WITH 4-1/2" DIAMETER OR **SMALLER** CYLINDER - **PRESS OR PROJECTION WELDER** WITH FIXTURE TYPE CYLINDER (NOT INTENSIFIER)	NA	**1. Pre-plumbed** (recommended for smoother installation) = **#9181-34Y**. This includes all required valves.	**NA**
ROCKER ARM WITH 5" DIAMETER OR **LARGER** CYLINDER	**NA**	**1. Pre-plumbed** (recommended for smoother installation) = **#9181-34Y + #9181-34D**. This includes all required valves.	**NA**
WELDERS WITH INTENSIFIER CYLINDERS	**NA**	**#9181-34I.** Uses existing 4-way and 3-way solenoid valve.	**NA**

*With air quickly exhausted from welder.

SOFT TOUCH

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".

Successful operation of a SOFT TOUCH system requires four things:

1. The SOFT TOUCH kit has to be selected to exactly match the requirements of the particular welder. Use the SOFT TOUCH SELECTION SHEET for this purpose. If you cannot match the welder with the chart, contact Unitrol for assistance.
2. For installation of the HEAVY WEIGHT #9181-34G and #9181-34W options, the system will not operate unless the ram can fall smoothly by gravity when air is removed from the cylinder. This often means adjusting the ram guides or cam rollers and lubricating the welding cylinder. In cases with older cylinders that have not been serviced in a long time (or ever), rebuilding the cylinder might be required to replace very stiff piston and shaft seals.
3. Material that will be welded does not contain coatings that will affect continuity reading. See below for more on this.
4. Once the control has been installed, directions for setting the SOFT TOUCH sensor board must be followed carefully. This only requires the use of a small screwdriver and a digital voltmeter.

FIRST CHECK MATERIAL TO BE WELDED

SOFT TOUCH depends on reading electrical continuity between the electrodes. If the material being welded has a coating that does not easily conduct electricity, the SOFT TOUCH sensor will not consistently see continuity, and the system will not operate successfully.

Material that might cause problem include HOT ROLLED STEEL (that has not been pickled), wire that has a drawing soap or wax coating, metal with oxide coatings, and rusty metal.

If in doubt, submit some sample coupons of the material being welded to Unitrol for evaluation before quoting a system.

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

GROUP A:

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

SOFT TOUCH

4. FIXTURE CYLINDER WELD HEADS

PNEUMATIC INSTALLATION, LIGHT RAMS
USE PRE-PLUMBED KIT 9181-34Y
For press welders with rams that do not fall easily under gravity, rocker arm welders or for welders using non-intensifier cylinders:

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

INSTALL pneumatic kit per **drawing #1964D-1**. 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 is 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 #15 and #16 on the SOLUTION 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 #1964D-1 for directions at the end of this section to adjust these components.

PNEUMATIC INSTALLATION OF INTENSIFIER TYPE CYLINDERS
USE KIT 9181-34I

INSTALL pneumatic kit per **drawing #2064**. 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 the 4-way solenoid valve SV1 is energized, air is exhausted from the return port and pushes fluid from the FLUID RESERVOIR to close electrodes under low force as set on the ADVANCE PRESSURE regulator. Energizing 3-way solenoid valve SV0 intensifies the force using pressure from the existing pressure regulator. See **drawing #2064** to adjust the regulators.

SOFT TOUCH

PNEUMATIC INSTALLATION
USE PRE-PLUMBED KIT 9181-34W

For press welders with HEAVY RAMS (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 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.

If all is working properly, the ram should "drop like a stone" when air is removed rapidly from the bottom port of the air cylinder.

Do not continue until this has been accomplished!

INSTALL pneumatic **kit #9181-34W** per **drawing #1963A-4**. 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 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, 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 #1964A-4 for directions at the end of this section 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 #9181-34H for GROUP B type welders.

Option #9181-34H consists of:

1. **#9181-34 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 #9181-34H** per **drawing #1965A-2**. 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, SV0 will be energized (SV1 remains energized) to put full pressure into the top port of the welding cylinder.

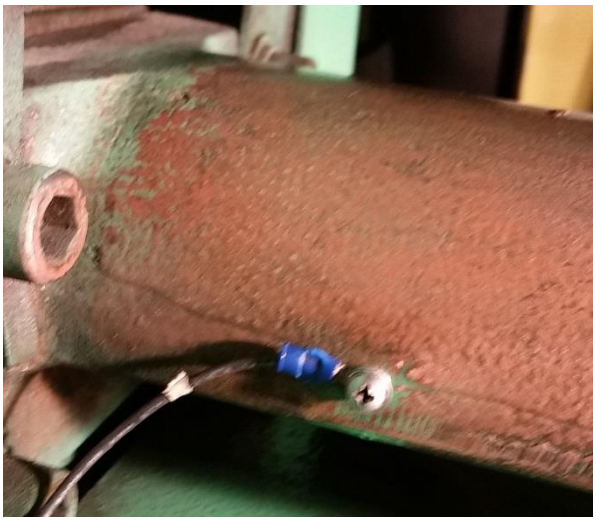
See drawing #1965A-2 at the end of this section for directions to adjust these components.

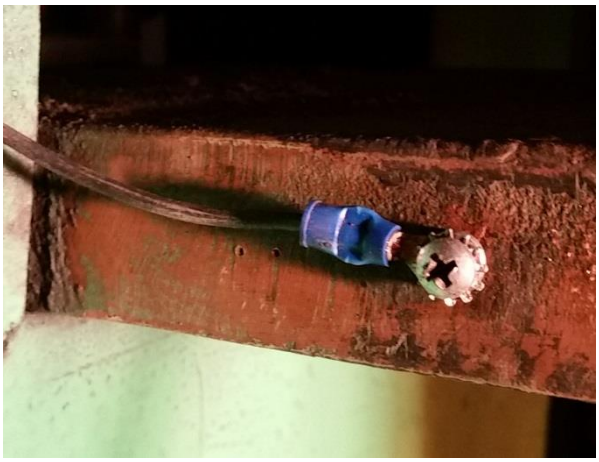
SOFT TOUCH

CONNECTING SENSOR WIRES

1. Connect one of the blue sensor wires coming from a strain relief on the welding control cabinet to a convenient location on the upper transformer pad of the welder, and the other to a place on the lower transformer pad. Route the wires so that they will not be touched by parts being welded. Trim the wire to eliminate excess wire.

EXAMPLES OF SENSOR WIRE ATTACHMENT





SOFT TOUCH BOARD *AND* LIMIT SWITCH or PROXIMITY SWITCH:

This system is used to require closing of **both** a positional limit switch as well as detection of metal between the electrodes. It is typically used in applications where the part is not flat prior to welding and closes as electrode pressure is applied. It can also be used to give **redundant protection.**

INSTALLING LIMIT SWITCH or PNP PROXIMITY SWITCH:

1. **LIMIT SWITCH**: A normally open contact on the LIMIT SWITCH is wired to terminals #13 and #14 on the power supply board. If a factory jumper is already installed to these terminals, remove this jumper.
2. **PNP PROXIMITY SWITCH (must be PNP type)**:
    a. Connect the + input wire from the switch to CD+ anywhere on the terminal.
    b. Connect the 0 wire from the switch to terminal #17 (RTN).
3. Connect the output wire from either of the above switches to terminal #13 (RT1). If a factory jumper is already installed to this terminal, remove this jumper.
4. **ADJUSTMENT:** Adjust the switch so that it will close when the spacing between the electrodes is a maximum of ¼". When the switch closes, yellow LED DS4 power supply board should glow.

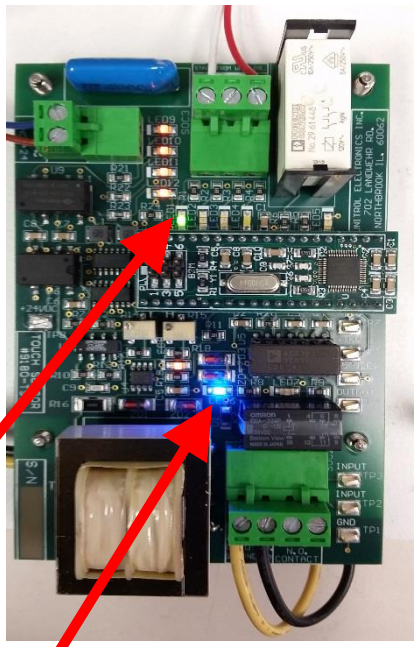
SOFT TOUCH

CHECKING OPERATION OF SENSOR BOARD TS-8

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

Your TS8 SOFT TOUCH board is self-calibrating and does not need to be adjusted or re-calibrated - EVER. Just turn it on and it should work properly.

Each time the welder is initiated, the TS8 board will re-establish a new baseline for that weld.



Turn power on to the welder and observe the TS-8 sensor board inside the control. After it initializes the system the green LD1 light should glow **solidly**.

If the electrodes are open, the BLUE LD6 light should glow as shown to confirm that the output relay of this board is open.

At this time, the yellow DS2 LED on the back of the power supply board of the welding control should be OFF. This is the input to the welding control to tell the control that there is no continuity at this time between the electrodes.

Turn on the TIP DRESS switch to close the electrodes on themselves. The RIGHT-HAND RED LD7 should glow and the yellow DS LED on the back of the power supply board of the welding control should be ON. This tells the welding control that continuity has been detected.

If these tests work, your SOFT TOUCH sensor board is now ready for production.

SETTING THE SOLUTION FOR USE WITH THE SOFT TOUCH FUNCTION

1. Press: **PROGRAM, 87, ENTER, 80**. The display will show the **SVO FUNCTION**.
2. If it is **not** set for **SENSOR DETECT =** 6, press: 1 to change, and then press: 6 to select **SENSOR DETECT.** This will select the SOFT TOUCH detection function.
3. The display will now alternately show: **SINGLE INPUT, CHANGE 1=YES, 0=NO.**
    a. If you are using just the SOFT TOUCH SENSOR (without the LIMIT SWITCH), push 0.
    b. If you are using both a LIMIT SWITCH ***and*** the SOFT TOUCH SENSOR board, press 1 to change. The display will briefly show **DUAL INPUT**.
4. The display will now show: **MAX DETECT 000CY.** This is the **maximum** time allowed for detecting metal between the electrodes (and reaching the ram limit switch if in **DUAL INPUT** mode). Time is set in CYCLES. A CYCLES is $1/60^{th}$ of a second. A typical time is 45 cycles (3/4 sec). You can change this time up to 999 cycles (16.5 sec.) as desired. Then press **ENTER**.
5. The display will now show: **DETECT BLANK = 000**. This is the minimum time allowed for the sensor to register. For normal applications leave this number at 015.

    This blanking time is used on welders where it is possible for the electrodes to see continuity before they are fully closed. This can happen if:

    a. The part being welded is not flat
    b. Part of the material being welded can touch top and bottom electrode prior to full closure. This is particularly important when using this function on a transgun welder, or when the moving electrode can have the tendency to brush against a vertical flange on the part.
6. Select a time that will allow the electrodes to close under normal conditions. If continuity is detected **before** the end of this **BLANK** time, the system will just ignore that contact. A typical BLANK TIME is 10 cycles. The high-pressure valve will only be turned ON if:
    a. Continuity is detected **after** the **BLANK** time and
    b. Continuity is detected **before** the end of the **MAX DETECT** time. Note that the **DETECT** time starts when the welder has been initiated and is not affected by the **DETECT BLANK** time.

SOFT TOUCH

OPERATION SEQUENCE

1. Control is initiated
2. **FAIL-SAFE STARTING SEQUENCE**:
    a. **SINGLE INPUT**:
        i. If SOFT TOUCH SENSOR is connected to the PR2 input (terminal #16) is closed before the electrodes start closing, the display will show: **SENSOR CLOSED,** and reset the system without closing a solenoid valve.
    b. **DUAL INPUT**:
        i. If the limit switch or proximity switch connected RT1 input (terminal #13) is closed before the electrodes start closing, the display will show: **DEPTH SW. CLOSED** and not allow movement**.** This would indicate that either the adjustment is not correct, or that the LIMIT SWITCH is shorted.
        ii. If the SOFT TOUCH SENSOR board output is closed before the electrodes start closing, the display will show: **SENSOR CLOSED** and not allow movement. This would indicate that either the sensor board is not adjusted properly, or that the board has malfunctioned.
        iii. If **both** inputs are closed before the electrodes start closing, the display will show: **SEN+DEPTH CLOSED** and not allow movement.
3. **SEQUENCE AFTER WELDER IS INITIATED**:
    a. If the input (or inputs) is open at the time of initiation (normal condition), output SV1 is turned ON to energize the **SV1** solenoid valve and allow electrodes to close under low force.
    b. Control waits until inputs are closed
        i. For SINGLE INPUT, yellow **LED5** will glow
        ii. For DUAL INPUT, both yellow **LED4** and **LED5** will glow.
    c. If the input or inputs close after the **DETECT BLANK** time and before the end of the customer-set **MAX DETECT** time:
        i. Output **SV0** is turned ON (SV1 remains ON). This will put high welding force on the electrodes.
        ii. The normal welding sequence will now operate (check TIP FORCE, PRESSURE SWITCH closure, SQUEEZE TIME, WELD TIME, HOLD TIME, etc.)
        iii. Both solenoid valves will be released to open the electrodes.
        d. If the input or inputs do **not** close within the **MAX DETECT** time, **SV0** will not be turned on (no high force) and:
        i. SV1 is released to open electrodes
        ii. Program is reset
        iii. Display will show: **DETECT TIME OUT** until the next initiation. This requires opening and then closing of initiation before another sequence begins.

TROUBLE SHOOTING CHART

PROBLEM	SOLUTION
System does not work and there are no lights glowing on the SOFT TOUCH sensor board.	1. No power coming into this sensor board. Check voltage at terminals 2(+) and 1. These should be 22VDC – 26VDC. Check wiring to control.
Sensor board has some lights, but GREEN LD1 is not glowing solidly.	1. If it is flashing very **slowly**, check to be sure that the AC input voltage at INPUT terminals TP2 and TP3 is at least 25mvAC. If it is lower than this or at 0VAC, a. Check for welder insulation problems using information shown on page 19. b. The snubber module is faulty. This is the blue cylinder that is wired across the SCR contactor power tangs. Replace this part #9182-57 2. If it is flashing very **quickly**, contact Unitrol for instructions. Be sure you are at the welder with a voltmeter and a very small screwdriver when calling.
When TIP DRESS switch is closed, electrodes do not close, or they start to close but to not travel all the way	3. 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 0-4 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. c. Ram bearings or slide is not adjusted or lubricated to allow ram to fall easily by gravity when air is removed from cylinder d. Welder cylinder piston cups or shaft seals are not flexible (replace) or need lubrication. 4. For LOW WEIGHT RAMS, ROCKER ARM WELDERS, or FIXTURE CYLINDERS: Not enough air pressure set on ADVANCE pressure regulator

SOFT TOUCH

PROBLEM	SOLUTION
When the foot switch is closed, the electrodes do not fully close, then go back up, and the display shows: **DETECT TIME OUT** without going through the welding sequence.	1. The time set in PROGRAM 87/80 for DETECT TIME is too short for the time it takes for the electrodes to close and see continuity through the metal. Increase the MAX. DETECT TIME. 2. The welder ram needs adjustment to allow it to move more rapidly.
When the foot switch is closed, the electrodes **touch**, but the display shows: **DETECT TIME OUT** and the electrodes open up without going through the welding sequence	1. Electrodes are not clean or have picked up a coating from the previous welds. Clean electrodes. 2. If a LIMIT SWITCH or PROXIMITY SWITCH is being used as a **second** sensor, be sure that this switch is closing when the electrodes are touching. 3. The force between the electrodes is too LOW to make good contact and strong continuity between the electrodes. Increase electrode force slightly and be sure that force between electrodes is still below 50 pounds when the TIP DRESS switch is closed. 4. The snubber module is faulty. This is the blue cylinder that is wired across the SCR contactor power tangs. Replace this part #9182-57.
RT1 SWITCH OPEN is on display	Install a jumper between terminals #13 and #14
Display shows: **DEPTH SW. CLOSED** and will not respond to keypad or foot switch.	Control is in the DUAL SENSOR mode. 1. If you want to use the continuity and **also** a limit or proximity switch in the system, check limit switch or proximity switch that is wired to terminal #13. It should be OPEN when the electrodes are more than ¼" apart. 2. If you do **not** want to use the continuity and also a limit or proximity switch in the system, temporarily remove the jumper in terminal #13, reset mode in PROGRAM 87/80 to SINGLE mode, and then reinstall the jumper.

SOFT TOUCH

PROBLEM	SOLUTION
Control will not respond to the foot switch or the keypad, the display shows: **SENSOR CLOSED** and electrodes are open.	Check red LED6 on SOFT TOUCH board to see if it is ON. If it is, power control off and see if it clears this fault. If this does not get the control operating, see the ADVANCED TROUBLE SHOOTING section.
Display shows: **SEN+DEPTH CLOSED** and will not respond to keypad or foot switch.	Both SOFT TOUCH board and limit switch are closed before the foot switch has been closed. Check both of the faults shown in the two boxes above.
There is a noticeable delay from when the foot switch is closed and when the welder's ram starts to move. OR It takes a higher-than-desired air pressure to get the electrodes to start closing.	1. For PRESS WELDERS, the ram is mechanically sticking. Adjust ram bearings or cylinder cup seals and shaft seals. Check lubrication. In older cylinders it is sometimes required to replace the piston seal and the shaft seal. 2. For PRESS and ROCKER ARM welders, check the air cylinder to see if it has a cushion on the cylinder. If it does, totally open up the adjustment of the cushion. 3. For PRESS AND ROCKER ARM welders, the back of the cylinder piston is flat and pushes against the inside of the welder piston housing to only allow a very small area for the air to act on the cylinder when it is fully up. See drawing 1964-1 on page 18 for a drawing of a disc that should be installed inside the air cylinder to increase this area. 4. The air pressure on the return 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 open the electrodes smoothly.

SOFT TOUCH

PROBLEM	SOLUTION
Not able to read any DC voltage on SOFT TOUCH sensor board OUTPUT terminals #4(+) and #1.	1. Be sure that the green LED1 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 – 26VDC. If not, check to be sure that these terminals are connected to CD+ and RTN on the power supply board. 2. Check input **AC** voltage on INPUT test points TP2 and TP3 on this board. This should be at least 20mv. If no voltage or lower voltage is present: a. Check for welder insulation problems using information shown on page 16. b. The snubber module is faulty. This is the blue cylinder that is wired across the SCR contactor power tangs. Replace this part #9182-57.

SOFT TOUCH

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 LED7 on the SOFT TOUCH sensor board does not turn on consistently, try increasing the electrode force during the SOFT TOUCH sequence. The force between the electrodes when the TIP DRESS switch is closed should be low enough to prevent indentation of a wood pencil of no more than 1/32".

On **HEAVY RAM (9181-34W)** systems, **decrease** the ADVANCE PRESSURE regulator slightly.

On **LIGHT WEIGHT (9181-34Y, 9181-34I)** 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 without the SOFT TOUCH system, 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. A SOFT TOUCH BYPASS KIT #9181-34BP is also available the will maintain the low-pressure advance but not utilize the continuity testing when working with insulated material. It can be used when welding problem material, and switched back for regular metal. The option has indicator lights showing when the continuity system is active or bypassed. Contact the Unitrol service department for more information on these two choices.

TROUBLE SHOOTING INSULATION FAULTS WITHIN 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 or has metal chips or powder bridging the conductive parts, 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 conductor that connects to the moving part of the welder secondary back to the welding transformer pad. 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.

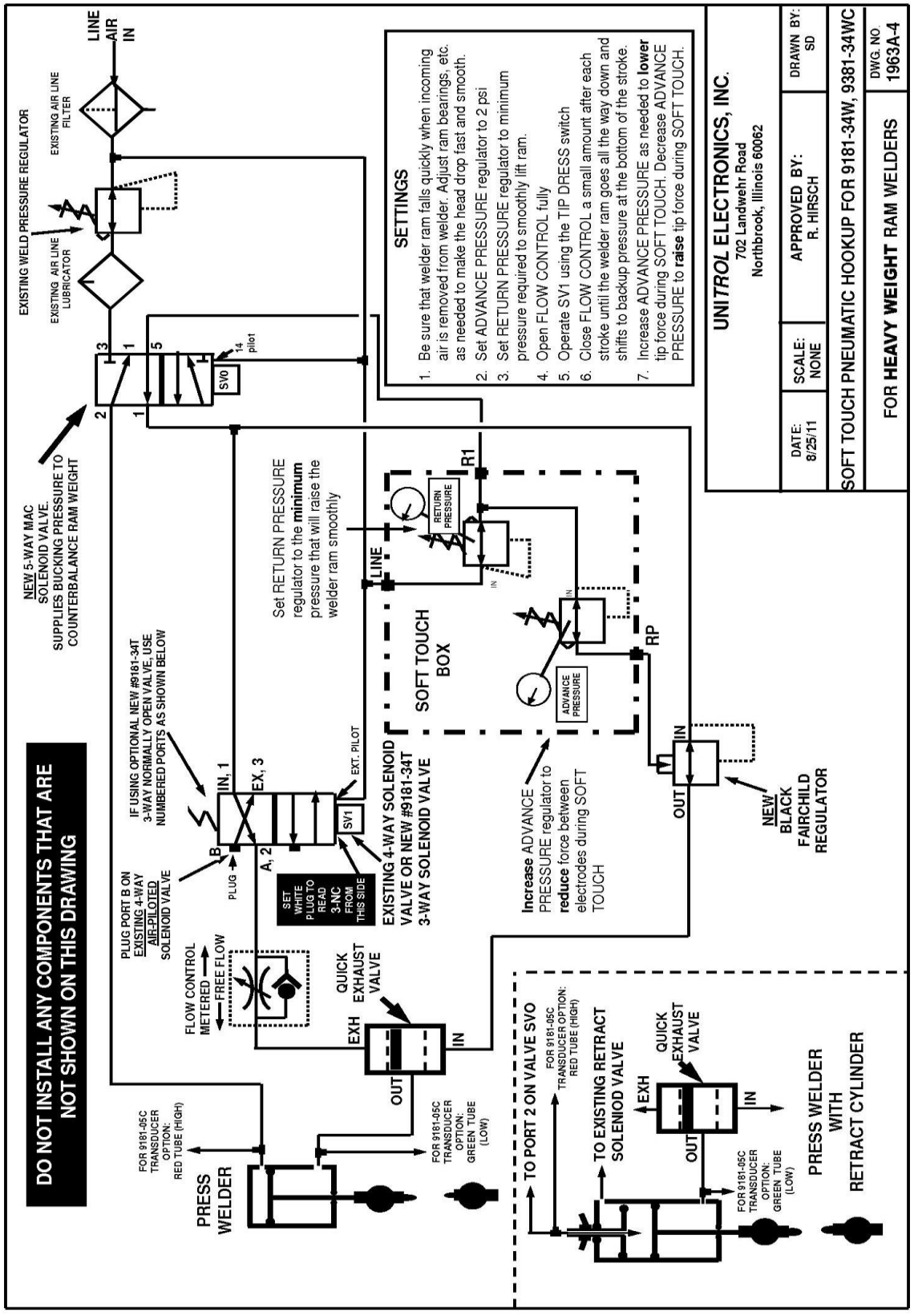
Remove the flexible connection and check from top to bottom electrode for continuity. If the welder is properly insulated, the resistance measured should be zero (totally open). If continuity is measured, check and repair insulation as needed so that the continuity reading shows fully open (no resistance).

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.

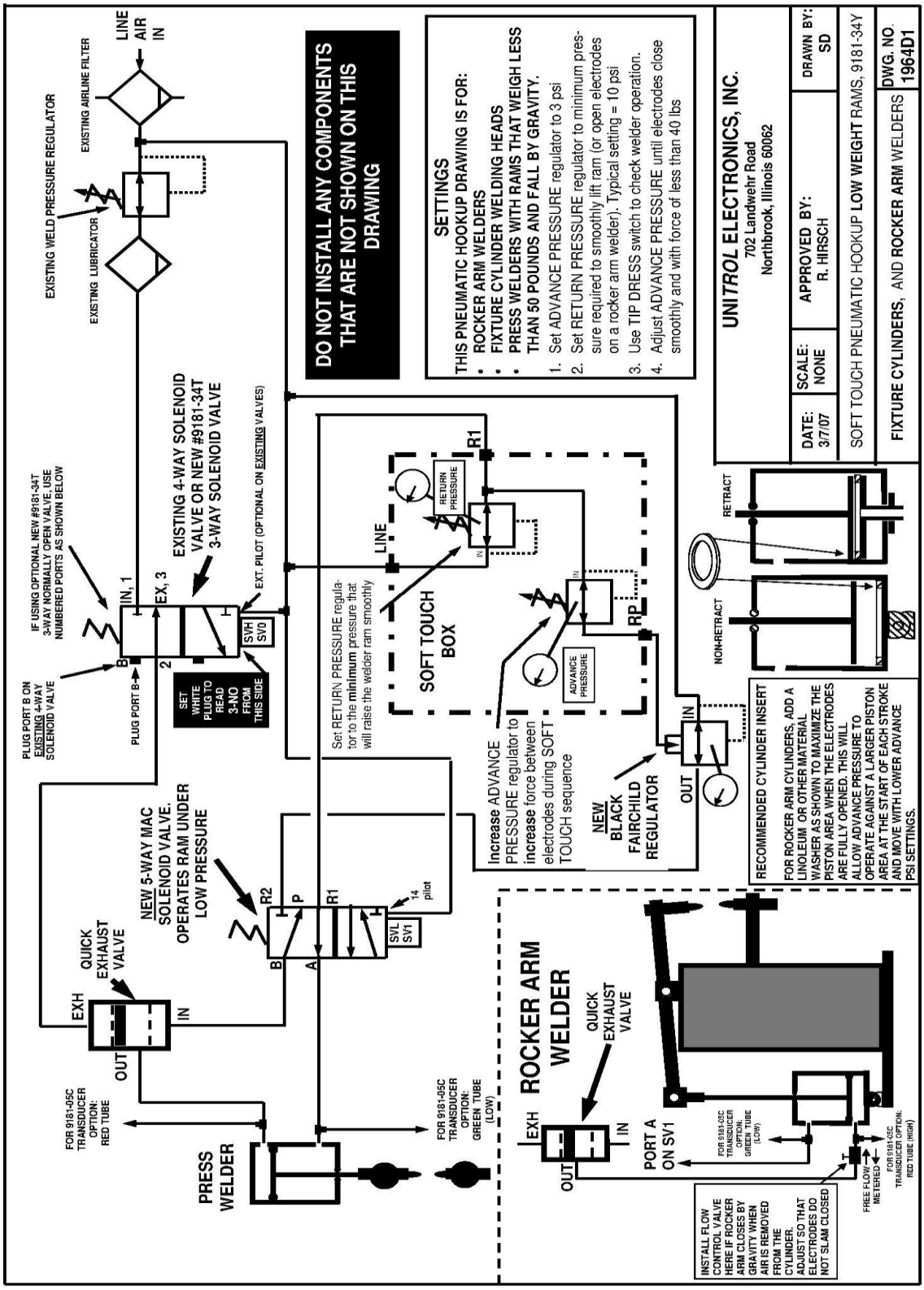
IF ALL ELSE FAILS

If you cannot reach these minimum conditions, contact the UNI*TROL* service department M-F between 9:00 – 5:00 CT 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.

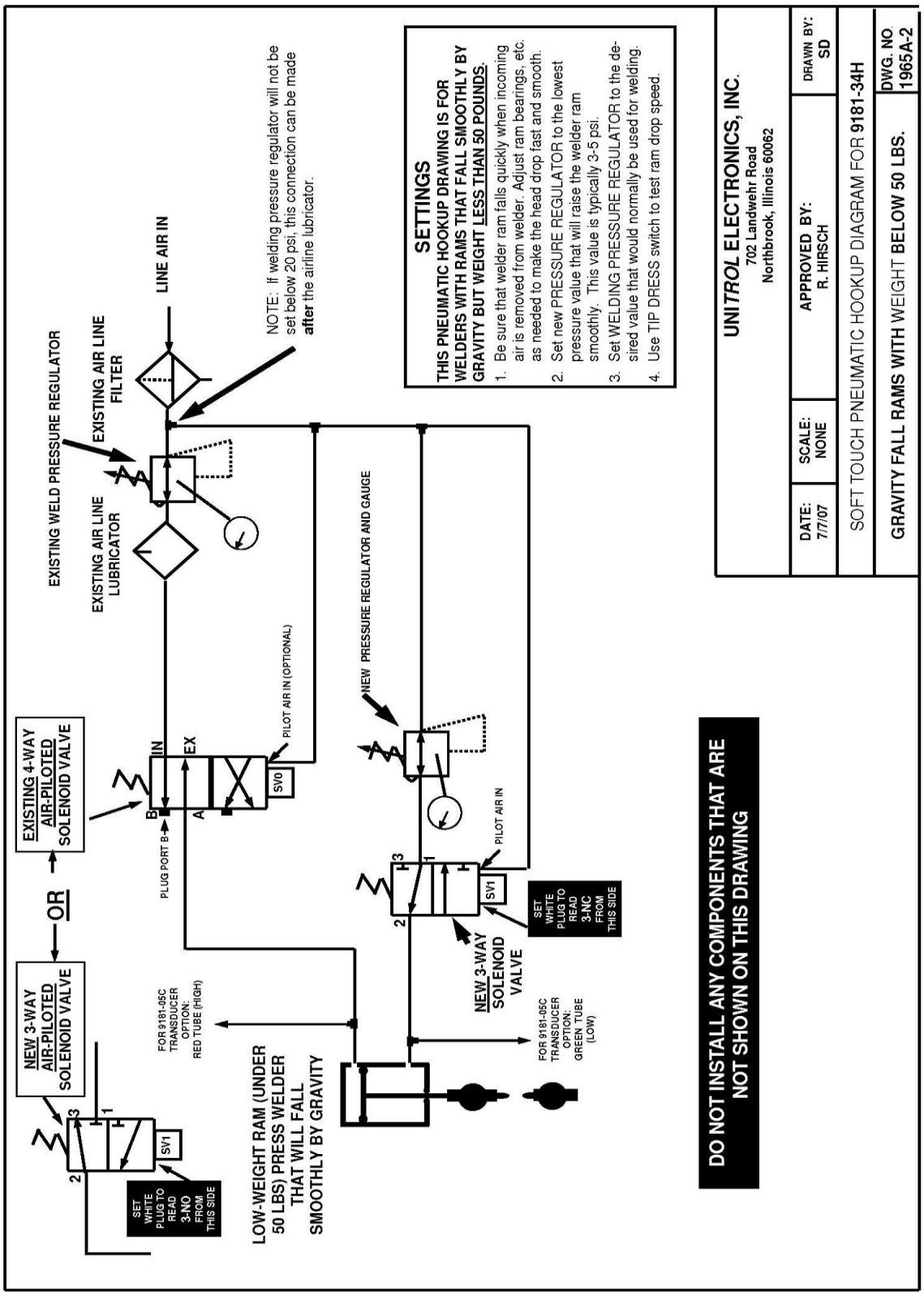
SOFT TOUCH


DO NOT INSTALL ANY COMPONENTS THAT ARE NOT SHOWN ON THIS DRAWING
EXISTING WELD PRESSURE REGULATOR
EXISTING AIR LINE LUBRICATOR
EXISTING AIR LINE FILTER
LINE AIR IN
NEW 5-WAY MAC SOLENOID VALVE. SUPPLIES BUCKING PRESSURE TO COUNTERBALANCE RAM WEIGHT
SV0
14 pilot
SETTINGS
1. Be sure that welder ram falls quickly when incoming air is removed from welder. Adjust ram bearings, etc. as needed to make the head drop fast and smooth.
2. Set ADVANCE PRESSURE regulator to 2 psi
3. Set RETURN PRESSURE regulator to minimum pressure required to smoothly lift ram.
4. Open FLOW CONTROL fully
5. Operate SV1 using the TIP DRESS switch
6. Close FLOW CONTROL a small amount after each stroke until the welder ram goes all the way down and shifts to backup pressure at the bottom of the stroke.
7. Increase ADVANCE PRESSURE as needed to lower tip force during SOFT TOUCH. Decrease ADVANCE PRESSURE to raise tip force during SOFT TOUCH.
UNITROL ELECTRONICS, INC.
702 Landwehr Road
Northbrook, Illinois 60062
DATE: 8/25/11
SCALE: NONE
APPROVED BY: R. HIRSCH
DRAWN BY: SD
SOFT TOUCH PNEUMATIC HOOKUP FOR 9181-34W, 9381-34WC
FOR HEAVY WEIGHT RAM WELDERS
DWG. NO. 1963A-4
IF USING OPTIONAL NEW #9181-34T 3-WAY NORMALLY OPEN VALVE, USE NUMBERED PORTS AS SHOWN BELOW
PLUG PORT B ON EXISTING 4-WAY AIR-PILOTED SOLENOID VALVE
PLUG
SET WHITE PLUG TO READ 3-NC FROM THIS SIDE
EXT. PILOT
SV1
EXISTING 4-WAY SOLENOID VALVE OR NEW #9181-34T 3-WAY SOLENOID VALVE
Set RETURN PRESSURE regulator to the minimum pressure that will raise the welder ram smoothly
RETURN PRESSURE
R1
SOFT TOUCH BOX
ADVANCE PRESSURE
RP
Increase ADVANCE PRESSURE regulator to reduce force between electrodes during SOFT TOUCH
NEW BLACK FAIRCHILD REGULATOR
FLOW CONTROL METERED FREE FLOW
QUICK EXHAUST VALVE
EXH
IN
OUT
FOR 9181-05C TRANSDUCER OPTION: RED TUBE (HIGH)
FOR 9181-05C TRANSDUCER OPTION: GREEN TUBE (LOW)
PRESS WELDER
TO PORT 2 ON VALVE SV0
TO EXISTING RETRACT SOLENIOD VALVE
PRESS WELDER WITH RETRACT CYLINDER

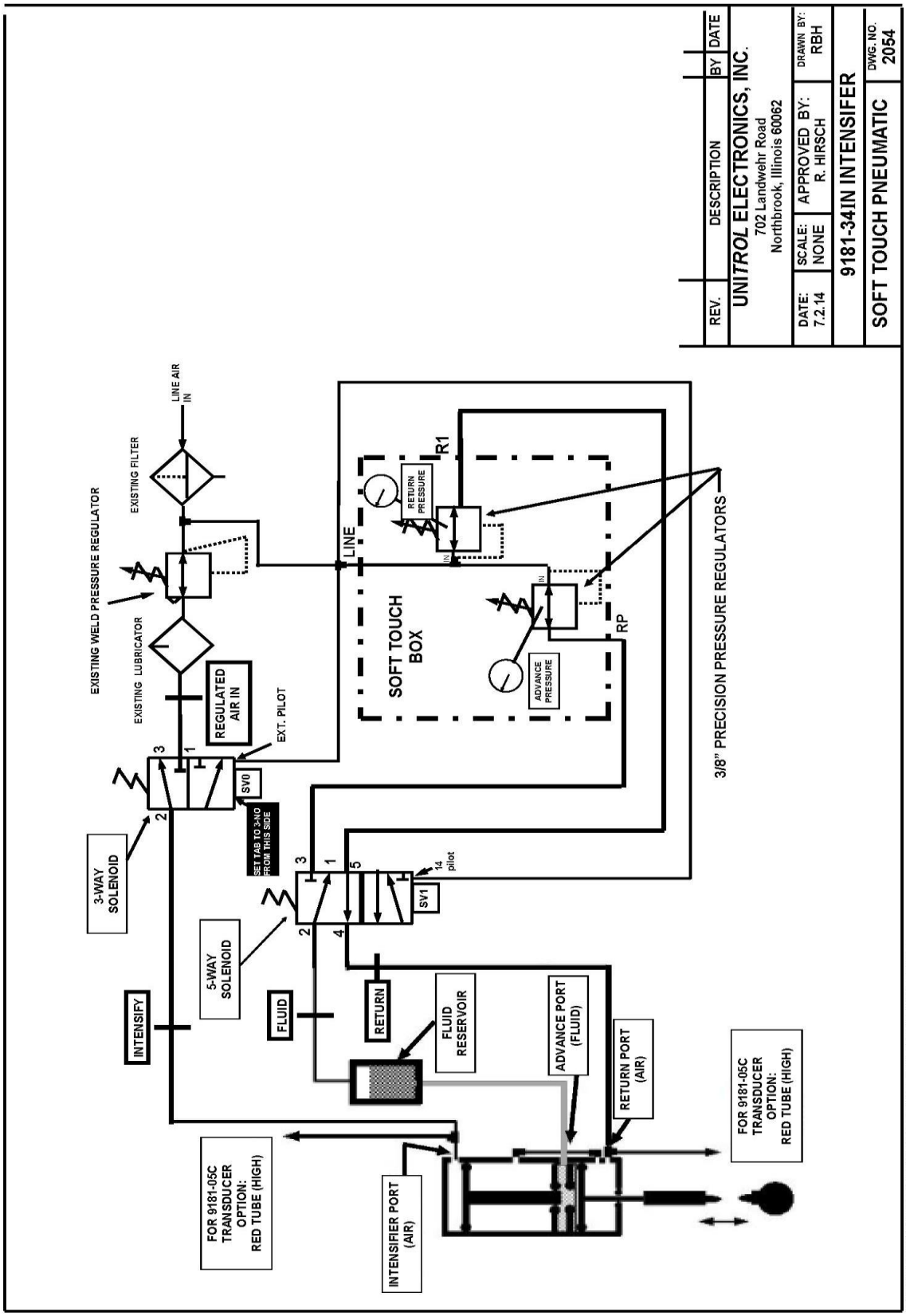
SOFT TOUCH


DO NOT INSTALL ANY COMPONENTS THAT ARE NOT SHOWN ON THIS DRAWING
SETTINGS
THIS PNEUMATIC HOOKUP DRAWING IS FOR:
• ROCKER ARM WELDERS
• FIXTURE CYLINDER WELDING HEADS
• PRESS WELDERS WITH RAMS THAT WEIGH LESS THAN 50 POUNDS AND FALL BY GRAVITY.
1. Set ADVANCE PRESSURE regulator to 3 psi
2. Set RETURN PRESSURE regulator to minimum pressure required to smoothly lift ram (or open electrodes on a rocker arm welder). Typical setting = 10 psi
3. Use TIP DRESS switch to check welder operation.
4. Adjust ADVANCE PRESSURE until electrodes close smoothly and with force of less than 40 lbs
UNITROL ELECTRONICS, INC.
702 Landwehr Road
Northbrook, Illinois 60062
DATE: 3/7/07
SCALE: NONE
APPROVED BY: R. HIRSCH
DRAWN BY: SD
SOFT TOUCH PNEUMATIC HOOKUP LOW WEIGHT RAMS, 9181-34Y
FIXTURE CYLINDERS, AND ROCKER ARM WELDERS
DWG. NO. 1964D1
EXISTING WELD PRESSURE REGULATOR
EXISTING AIRLINE FILTER
LINE AIR IN
EXISTING LUBRICATOR
IF USING OPTIONAL NEW #9181-34T 3-WAY NORMALLY OPEN VALVE, USE NUMBERED PORTS AS SHOWN BELOW
EXISTING 4-WAY SOLENOID VALVE OR NEW #9181-34T 3-WAY SOLENOID VALVE
EXT. PILOT (OPTIONAL ON EXISTING VALVES)
PLUG PORT B ON EXISTING 4-WAY SOLENOID VALVE
PLUG PORT B
SET WHITE PLUG TO READ 3-NO FROM THIS SIDE
SOFT TOUCH BOX
RETURN PRESSURE
ADVANCE PRESSURE
Set RETURN PRESSURE regulator to the minimum pressure that will raise the welder ram smoothly
Increase ADVANCE PRESSURE regulator to increase force between electrodes during SOFT TOUCH sequence
NEW BLACK FAIRCHILD REGULATOR
RETRACT
NON-RETRACT
RECOMMENDED CYLINDER INSERT
FOR ROCKER ARM CYLINDERS, ADD A LINOLEUM OR OTHER MATERIAL WASHER AS SHOWN TO MAXIMIZE THE PISTON AREA WHEN THE ELECTRODES ARE FULLY OPENED. THIS WILL ALLOW ADVANCE PRESSURE TO OPERATE AGAINST A LARGER PISTON AREA AT THE START OF EACH STROKE AND MOVE WITH LOWER ADVANCE PSI SETTINGS.
NEW 5-WAY MAC SOLENOID VALVE. OPERATES RAM UNDER LOW PRESSURE
QUICK EXHAUST VALVE
FOR 9181-05C TRANSDUCER OPTION: RED TUBE
FOR 9181-05C TRANSDUCER OPTION: GREEN TUBE (LOW)
PRESS WELDER
ROCKER ARM WELDER
PORT A ON SV1
INSTALL FLOW CONTROL VALVE HERE IF ROCKER ARM CLOSES BY GRAVITY WHEN AIR IS REMOVED FROM THE CYLINDER. ADJUST SO THAT ELECTRODES DO NOT SLAM CLOSED
FREE FLOW
METERED
FOR 9181-05C TRANSDUCER OPTION: RED TUBE (HIGH)

SOFT TOUCH


EXISTING WELD PRESSURE REGULATOR
EXISTING AIR LINE FILTER
LINE AIR IN
EXISTING AIR LINE LUBRICATOR
NOTE: If welding pressure regulator will not be set below 20 psi, this connection can be made after the airline lubricator.
SETTINGS
THIS PNEUMATIC HOOKUP DRAWING IS FOR WELDERS WITH RAMS THAT FALL SMOOTHLY BY GRAVITY BUT WEIGHT LESS THAN 50 POUNDS.
1. Be sure that welder ram falls quickly when incoming air is removed from welder. Adjust ram bearings, etc. as needed to make the head drop fast and smooth.
2. Set new PRESSURE REGULATOR to the lowest pressure value that will raise the welder ram smoothly. This value is typically 3-5 psi.
3. Set WELDING PRESSURE REGULATOR to the desired value that would normally be used for welding.
4. Use TIP DRESS switch to test ram drop speed.
EXISTING 4-WAY AIR-PILOTED SOLENOID VALVE
NEW 3-WAY AIR-PILOTED SOLENOID VALVE
OR
PLUG PORT B
IN
EX
SV0
PILOT AIR IN (OPTIONAL)
NEW PRESSURE REGULATOR AND GAUGE
PILOT AIR IN
SV1
SET WHITE PLUG TO READ 3-NC FROM THIS SIDE
SET WHITE PLUG TO READ 3-NO FROM THIS SIDE
NEW 3-WAY SOLENOID VALVE
FOR 9181-05C TRANSDUCER OPTION: RED TUBE (HIGH)
FOR 9181-05C TRANSDUCER OPTION: GREEN TUBE (LOW)
LOW-WEIGHT RAM (UNDER 50 LBS) PRESS WELDER THAT WILL FALL SMOOTHLY BY GRAVITY
DO NOT INSTALL ANY COMPONENTS THAT ARE NOT SHOWN ON THIS DRAWING
UNITROL ELECTRONICS, INC.
702 Landwehr Road
Northbrook, Illinois 60062
DATE: 7/7/07
SCALE: NONE
APPROVED BY: R. HIRSCH
DRAWN BY: SD
SOFT TOUCH PNEUMATIC HOOKUP DIAGRAM FOR 9181-34H
GRAVITY FALL RAMS WITH WEIGHT BELOW 50 LBS.
DWG. NO 1965A-2

SOFT TOUCH


REV.
DESCRIPTION
BY
DATE
UNITROL ELECTRONICS, INC.
702 Landwehr Road
Northbrook, Illinois 60062
DATE: 7.2.14
SCALE: NONE
APPROVED BY: R. HIRSCH
DRAWN BY: RBH
9181-34IN INTENSIFER
SOFT TOUCH PNEUMATIC
DWG. NO. 2054
EXISTING WELD PRESSURE REGULATOR
EXISTING FILTER
LINE AIR IN
EXISTING LUBRICATOR
REGULATED AIR IN
EXT. PILOT
SV0
SET TAB TO 2-NO FROM THIS SIDE
3-WAY SOLENOID
LINE
R1
RETURN PRESSURE
SOFT TOUCH BOX
RP
ADVANCE PRESSURE
3/8" PRECISION PRESSURE REGULATORS
14 pilot
SV1
5-WAY SOLENOID
INTENSIFY
FLUID
RETURN
FLUID RESERVOIR
ADVANCE PORT (FLUID)
RETURN PORT (AIR)
FOR 9181-05C TRANSDUCER OPTION: RED TUBE (HIGH)
INTENSIFIER PORT (AIR)
FOR 9181-05C TRANSDUCER OPTION: RED TUBE (HIGH)
DRAWINGS/SOFT TOUCH INTENSIFIER 9181-34IN, 7.2.14

SOFT TOUCH

ADVANCED TROUBLE SHOOTING

PROBLEM: DETECT TIME OUT happens often. Detect board is being continually adjusted.

CAUSED BY: Not enough change between closed and open voltage readings in the SOFT TOUCH sensor board.

To confirm this do the following tests:

1. Turn power **ON** to the welder.
2. Set a volt meter to read AC line voltage. Read voltage across the two large terminals on the SCR contactor. This voltage should be about the same as the line voltage going into the welding control. If it is much lower or missing altogether, check to be sure that if the welding transformer has a TAP switch that this switch is set to a number **other than OFF or 0**. If this voltage is **not** present, contact Unitrol for help before doing any of the next steps.
3. Be sure the electrodes are open (tip dress switch should be **OFF**).
4. Set a voltmeter to AC. If it is NOT auto-ranging, set it to read under 10 volts AC.
5. With power turned **ON** to the welder, measure voltage at SENSOR INPUT test points TP2 and TP3 on the lower right edge of the SOFT TOUCH sensor board. The voltage should be at least 50mvAC (.05 volts AC). It may be as high as 1 volt or more.
6. Read the same voltage between the upper and lower electrodes. It should reasonably match the voltage measured at test points TP2 and TP3. If it does **not**, check connection of the blue sensor wires that come from the sensor board terminals 4 and 5 (marked WELD ELECT.) to the welder secondary to see if there is a loose connection or possibly a point where the wire has been abraded and is grounding out to the welder frame.
7. If the voltage read at test points TP2 and TP3 is **greater** than 50mvAC, **skip** to step 15.
8. If the voltage read at test points TP2 and TP3 is **less** than 50mv (0VAC to 50mvAC), **turn power off** to the welder and **lock out the power disconnect** to the welder.
9. Disconnect the upper cable or laminated shunt that goes to the moving part of the welder and be sure the loose end is not touching the moving part of the welder. This should electrically isolate the upper ram (on a press welder) or arm (on a rocker arm welder) from the lower electrode.
10. Measure the resistance from the upper to lower electrode. If there is **some** resistance measured (even in the KΩ range) skip to step 12.

11. If it is totally open (infinite resistance – meter does not move) then the moving part of the welder is properly insulated. In this case

    a. Reconnect the cable or laminated shunt to the moving part of the welder

    b. Install a second blue snubber (blue cylinder with two wire leads on one end marked STRC) **across** the SCR main terminals to increase the voltage signal measured with open electrodes. Leave the original snubber in place. There are 6-32 tapped holes in the SCR switch tangs for this purpose.

        i. Note that if the voltage read in step 6 above was 0VAC, this would indicate a bad snubber. In this case, remove the original snubber and install a new one.

    c. Turn power to the welder **ON**.

    d. Measure AC voltage between test points TP2 and TP3. The voltage should be about double the original measurement before the new snubber was added.

    e. Skip to step 13.

12. If it is **not totally open** and has some reading, even in the KΩ range, then there is some conductive path that will cause SOFT TOUCH readings to be very low and make the system very sensitive requiring constant adjustments of the sensor board. You have to find what is causing this conductive path and remove it so that the SOFT TOUCH system will work properly. Check the following:

    a. Check all points of connection to the moving part of the welder to see if an insulator is missing, cracked, or if there is a build-up of metal powder or shavings that bridge the insulation.

        i. Note that in some rocker arm welder designs the upper rocker arm is the path to ground, and the lower fixed arm is insulated from the frame.

    b. See if there is a buildup of grease that has some metal powder covering the insulated connection.

    c. Check to see if some component is attached to the moving part and the fixed part of the welder. This can be a metallic cable, an electrical wire, a steel wire of any kind, etc.

    d. On some press welders the upper crown is insulated from the frame to insulate the upper electrode from the welder frame. If an electrical component is mounted on the insulated upper frame, and the enclosure of this frame is connected to ground by wire or metallic cable (BX, etc.), this will establish a partial path to cause the problem with SOFT TOUCH. In this case this enclosure has to be insulated from the upper frame.

ADVANCED TROUBLE SHOOTING

e. If a Grounding Reactor is installed across the welder secondary, remove one wire to the Grounding Reactor and see if this eliminates the resistance read earlier. If it does, contact Roger Hirsch at Unitrol.

13. Once the problems above have been fixed, turn power back **ON** to the welder and measure again at test points TP2 and TP3 with the meter set to **AC**.
14. With the electrodes open you should be reading a minimum of 50mv.
15. Turn **ON** the TIP DRESS switch and this reading should go to almost 0V and the system should be ready for operation.
16. Contact Unitrol if you cannot get the minimum voltages shown in the steps of these directions.

UNITROL ELECTRONICS, INC.
702 LANDWEHR ROAD
NORTHBROOK, IL 60062
847-480-0115
support@unitrol-electronics.com

SPECIAL OPTIONS

SOLUTION #9180
#9181-21A COMMUNICATION PORT OPTION
PAGE ONE

This option can be connected directly to an Epson compatible printer or to a PC or PLC. The system is normally supplied to use an RS-232 serial format, but can be ordered for an RS-485 format.

PRINTER MODE: When the control is set in the PRINTER mode, welding data from the SOLUTION will be sent to the printer for each weld or for only fault welds (program selection).

DOWNLOAD MODE: When the control is set in the UP\DOWN LOAD or UP\DN LOAD&PRN modes, a PC or PLC can send a serial string to load any of 73 programs into the SOLUTION control. The SOLUTION will send results of all welds or only fault welds (program selected) when operating in the UP\DN LOAD&PRN mode.

INSTALLATION:
The communication port option must be factory installed. Field installation requires return of the console to factory for installation of the PC and software.

The SOLUTION can be ordered for either RS-232 or RS-485 transmission formats.

****

RS-232 FORMAT SPECIFICATIONS

TRANSMISSION REQUIREMENTS SPECIFICATION:

System includes an RS-232C asynchronous protocol terminated at a 9 pin subminiature D socket mounted on the back of the remote console or front of the series M, D, R, or L SOLUTIONS. Customer must supply a 3 wire shielded cable with plugs to match this socket and PC or printer. Wiring for this cable is shown on page three. **The shield should be connected to the #5 wire (system ground) on the SOLUTION side ONLY.**

Printer, PC, or PLC settings:

SERIAL communication
BAUD rate = 9600
NO parity check (PARITY OFF)
MARK (1) = -3V to -27V
SPACE (0) = +3V to +27 V
CTS (BUFFER CLEAR) = LOW

LOST PRINT DATA: Note that if the CTS line is not connected (input at plug terminal #1 is low), the SOLUTION will continue to send data out even if the printer's buffer is full. This will result in a loss of print lines. This is normally only a problem if you are trying to print all loaded programs using PROGRAM 97/ENTER/95.

This option supports IBM and Epson formats, but should work with most other printers. If there is a question on printer interface, contact the Unitrol Service Department at 847-480-0115.

CABLE CONNECTIONS: See attached hookup drawing for connection from the SOLUTION and a printer.

RD is only used for UP/DOWN LOAD functions and is not need for connection to a printer.

****

RS-485 FORMAT SPECIFICATIONS

SPECIFICATIONS:
System includes an RS-485 asynchronous protocol terminated at a 9 pin subminiature C socket mounted on the back of the console. Customer must supply cable and plugs to match this socket and printer.

Printer settings:

SERIAL communication
BAUD rate = 9600
NO parity check (PARITY OFF)
NRZ format
TRANSMISSION: 6.8V. differential

CABLE CONNECTIONS: See attached cable hookup diagram for connection to a PC or PLC.

A two wire **twisted pair** cable, minimum 24 AWG, maximum 3,900 feet, is wired to a 9 pin subminiature D male plug. If the cable has a shield, that shield should be connected at the printer or PC end **only**. Note that there is no "handshake" in an RS-485 format transmission. Data is sent as it occurs. The system does not know if the receiving end is ready or if data has been received successfully.

Note that RX-A and RX-B are only used when operating in the UPLOAD/DOWNLOAD mode.

****

If there is a question on either of the interface specifications, contact the Unitrol Service Department at 847-480-0115.

****

USING THE SOLUTION WITH A PRINTER

If you are using this option as an UPLOAD\DOWNLOAD system, skip to PAGE SEVEN.

SELECTING OPERATING MODE:

This SOLUTION control can be used in various ways. To select the desired mode,

press: **PROGRAM, 87, ENTER, 97**, and the display will show the communication mode:

COMMUNICATON SET

PRINTER SET-UP	or	RS232 MODE SETUP

CHANGE1=YES,0=NO

If the mode shown is PRINTER SET-UP, press **0** to **not** change.

If the mode shown is RS-232 UPLOAD/DOWN, press **1** to leave in this mode.

Press **ENTER**, and the display will show:

BUILT-IN PRINTER

CHANGE1=YES,0=NO

If you are using a Unitrol supplied built-in printer, press **0** to leave in this mode.

If you are using an external printer, press **1** to change.

The SOLUTION will now be set for the correct printer format.

PRINTER FUNCTIONS:

1. **PRINT SYSTEM SETUP:** If you press: **PROGRAM, 86, ENTER**, the printer should list all of the set-up parameters in the control.

2. **PRINT WELDING PROGRAMS:** If you press: **PROGRAM, 87, ENTER, 95**, the printer should list all welding programs that have data.

3. **PRINT WELD RESULTS:** The option will print the following at the end of each weld:

    1. Weld (or part) number
    2. Tip Force at the **end** of the weld sequence if option #9181-05C (DIFFERENTIAL PRESSURE TRANSDUCER) or #9181-05D (LOAD CELL) is installed
    3. RMS current averaged during the **WELD** portion only . In case of IMPULSATION welding, this will be the average of **all** impulses.

4. Indication of fault in weld. The SOLUTION will sound a short tone and send the following to the customer printer under the conditions listed.

   a. **CURRENT FAULT*** when average RMS WELD CURRENT falls out of the customer set window (set in amps)

   b. **PRESSURE FAULT*** when the TIP FORCE at the end of HOLD falls out of the customer set window (requires #9181-05 or #9181-05D options)

   c. **CURRENT & PRES. FAULT*** when both TIP FORCE and CURRENT falls out of selected windows.

TYPICAL PRINT-OUT:

```
 *** PROGRAM #04 ***
---
SQUEEZE TIME  09
WELD TIME     05
WELD HEAT    78%
HOLD TIME     05
TIP FORCE 660 LB
TRANSF. TAP # 03
HIGH I = 09500 A
LOW I  = 09100 A

***
   AVC IS ON
PRESS. TRANSD.ON
I-READ & REACT

***
 WELD #: 00034  TIP FORCE = 0670 LB  CURRENT = 09,450 A
 WELD #: 00035  TIP FORCE = 0668 LB  CURRENT = 09,480 A
 WELD #: 00036  TIP FORCE = 0672 LB  CURRENT = 09,370 A
 WELD #: 00037  TIP FORCE = 0665 LB  CURRENT = 09,580 A  CURRENT FAULT
 WELD #: 00038  TIP FORCE = 0668 LB  CURRENT = 08,960 A  CURRENT FAULT
 WELD #: 00039  TIP FORCE = 0652 LB  CURRENT = 09,440 A  PRESSURE FAULT
 WELD #: 00040  TIP FORCE = 0650 LB  CURRENT = 09,560 A  CURRENT & PRES FAULT

 *** PROGRAM #08 ***
---
SQUEEZE TIME  12
WELD TIME     07
WELD HEAT    83%
HOLD TIME     06
TIP FORCE 660 LB
TRANSF. TAP # 03
HIGH I = 10500 A
LOW I  = 09800 A
UPSLOPE INIT 55%
UPSLOPE TIME  03

***
   AVC IS ON
PRESS. TRANSD.ON
I-READ & REACT

***
 WELD #: 00041  TIP FORCE = 0670 LB  CURRENT = 10,300 A
 WELD #: 00042  TIP FORCE = 0668 LB  CURRENT = 10,150 A
 WELD #: 00043  TIP FORCE = 0672 LB  CURRENT = 09,870 A
 WELD #: 00044  TIP FORCE = 0665 LB  CURRENT = 09,470 A  * CURRENT FAULT
```

The print-out on page two shows that:

a. Before the first weld, the control was set to use PROGRAM #04 with the data as shown.

b. In weld #00037, the current was above the window.

c. In weld #00038, the current was below the window.

d. In weld #00039, the tip force at the end of HOLD was below the allowed variation (set in +/-psi. elsewhere in the program).

e. In weld #00040, both the tip force at end of HOLD was below the allowed variation, and weld current was below the window.

f. After weld 40 was completed, a new program #08 was selected for welding using the data as listed.

g. In weld #00044, the current was below the window.

If the CURRENT or TIP FORCE option is not turned on, the printer will show - - - - as a value for each line.

If the welder is operating faster than the printer, data will be sent continuously to the printer's buffer. If the printer is turned off, **no** storage of data will be maintained in the SOLUTION.

DUAL OR MULTI-SCHEDULE DATA: If two weld schedules (DUAL HEAT), or multi-channel welding is being done in the system, the print-out will identify which one is being used for each transmission.

CHANGE IN SCHEDULES: On local input systems, the RS-232 option will transmit any changes in weld schedules to allow full documentation of all welding parameters being used. This prevents local change in weld schedules to be made without a permanent record being made.

SELECTIVE PRINTING: Through keypad selection, the system can send data on ALL WELDS made, or only send data on FAULT WELDS. By using the ALL WELDS feature during early set-up of the system, data can be collected for later comparison of "good" welds. Then during production, the FAULT WELDS option can be selected to eliminate excessive paper use.

USING THE SOLUTION IN UPLOAD/DOWNLOAD MODE

PURPOSE:

To allow serial communication loading of weld programs and have an echo back for comparison. See page 10 for keystrokes to select this mode.

OPERATION:

1. **FIXED FIELD SERIAL STRINGS:** A serial string, as shown on the two following pages, is sent to the SOLUTION control in the order shown. Each string must start with the two control characters as shown, followed by exactly 70 numerals for CONSTANT VOLTAGE programs, and 82 numerals for CONSTANT CURRENT programs. All strings must then end with the three control characters at the end. If a function is not being used, 0's must be sent in the function's field.

2. **ECHO BACK:** The SOLUTION now will echo back the string **but with a slight order change**. The first two characters of the echo will be the CONTROL ID NUMBER. This will be followed by the string (missing the CONTROL ID NUMBER). At the end of the echo string, and ending at the ^P symbol. The ^C and ^M symbols will **not** be sent back. The sending PLC or PC should now compare the strings. If all is OK, then welding can begin. If not, the string should be sent back.

   a. Note that if the proper starting DLE, STX, and the ending DLE, ETX, and CR are not sent in the correct order, the SOLUTION will display COMMUNICATION ER AND **no** echo will be sent back. This display will remain on the display until a legal transmission has been received.

   b. If the SOLUTION is welding when a string is being sent, or if the SOLUTION is not in the SINGLE, NO WELD, or REPEAT mode (see lights on control face), no communication will be accepted and no echo will be returned.

3. **ERROR CODES:** See page 5 for explanation of ERROR CODES that will be sent with this ECHO string.

FOOTNOTES FOR STRINGS ON PAGE 8 AND 9

1. Control ID number is assigned in PROGRAM 79. This will become part of the permanent record and can be used for sorting purposes in network systems. Note that if this Control ID number is set at 00, transmissions will be accepted even if the Control no matter what the ID number is in the string.

2. Program number will direct the SOLUTION to store this program in one of 73 locations. This is only useful if storage is desired. If not, use 01 or any number between 1 and 73 as desired. This will not effect the operation, but the chosen PROGRAM number will be on the display when the system is reset.

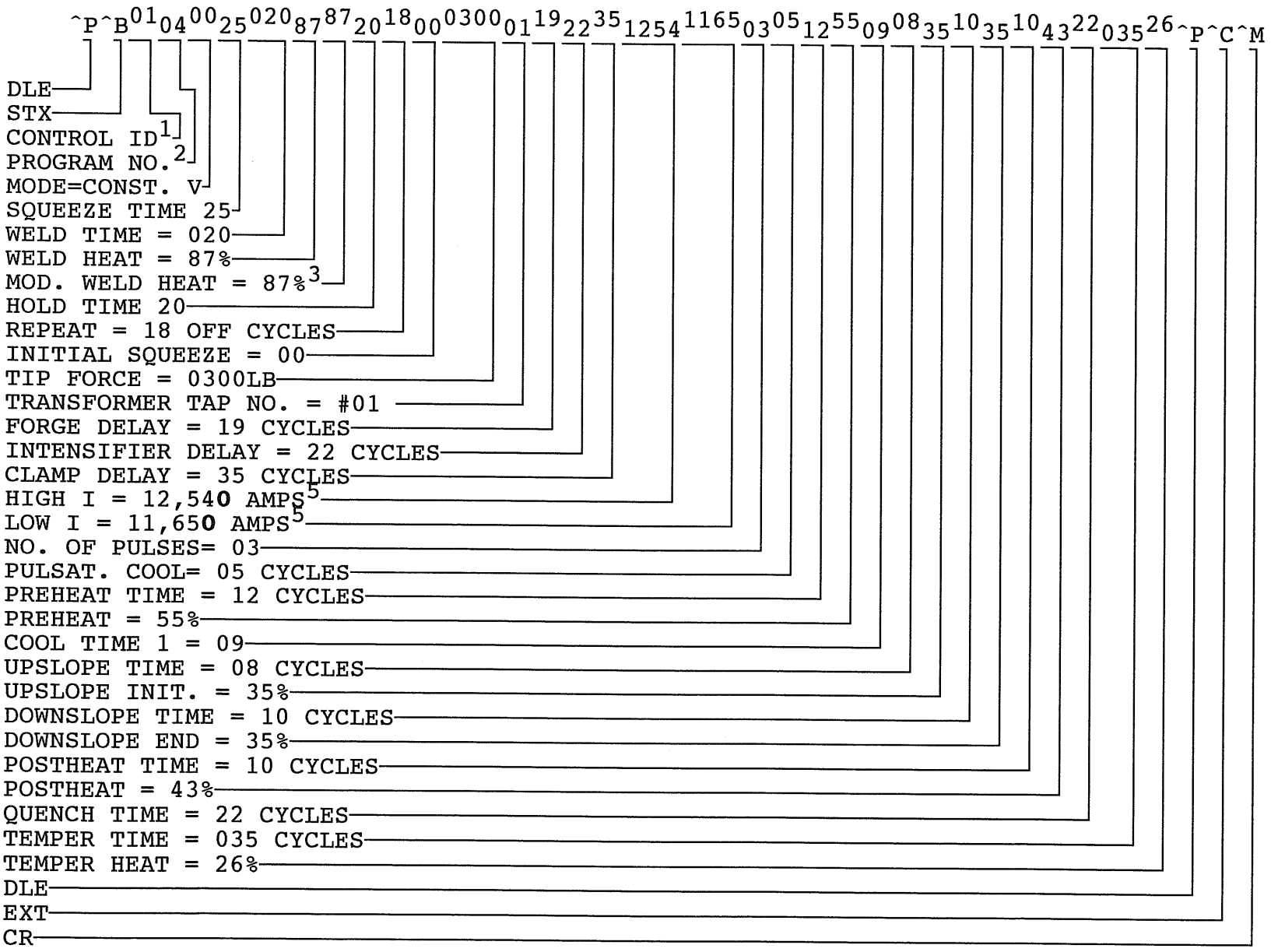
3. Enter the same value of HEAT as in the WELD HEAT line above.

4. The right hand zero (0) is permanent in the display and should **not** be entered in the string. Therefore to enter 11,600 amps in a line, enter: 1160 **only**.

5. If primary or secondary current options #9181-22A or #9181-22B are **not** included with this control, these fields will have no meaning but must still be entered as **0000**.

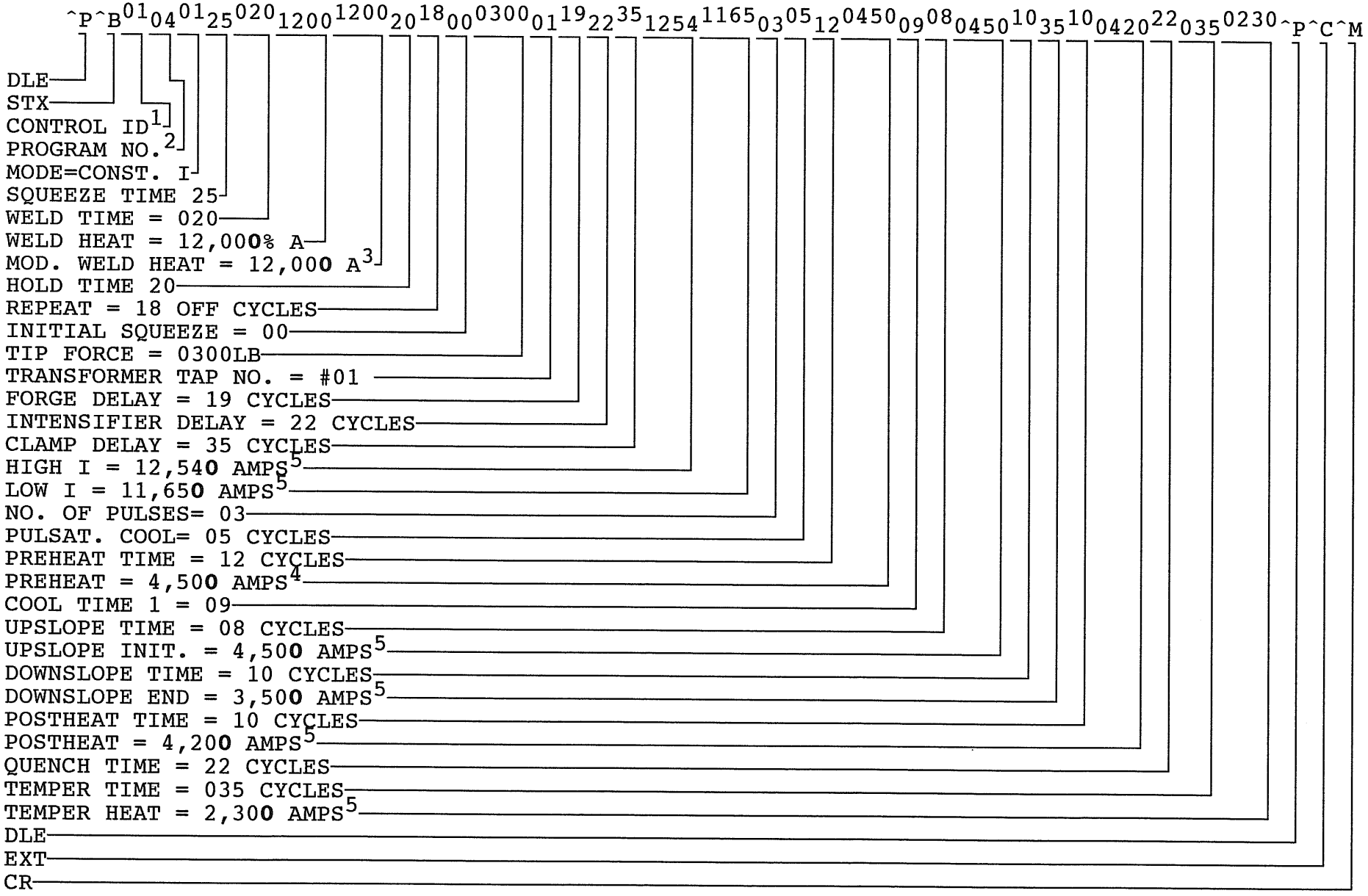
SOLUTION #9180
#9181-21A COMMUNICATION PORT OPTION
PAGE EIGHT

CONSTANT VOLTAGE MODE (MODE 00)



SOLUTION #9180
#9181-21A COMMUNICATION PORT OPTION
PAGE NINE

CONSTANT CURRENT MODE (MODE 01)



SELECTING OPERATING MODE:

This SOLUTION control can be used in various ways. To select the desired mode, press **PROGRAM, 87, ENTER, 97**, and the display will show the communication mode:

COMMUNICATON SET

PRINTER SET-UP	or	RS232 MODE SETUP

CHANGE1=YES,0=NO

If the mode shown is PRINTER SET-UP, press **1** to change.

If the mode shown is RS-232 UPLOAD/DOWN, press **0** to leave in this mode.

The display will now show:

UP\DOWN LOAD&PRN

CHANGE1=YES,0=NO

This mode allows download with echo as described earlier, but will also send back weld results at the end of every weld in a numerical format of as shown in the following example:

```
                    01 00345 1350 12540 463 0
                    |  |     |    |     |   |
CONTROL ID number---+  |     |    |     |   |
WELD or PART count-----+     |    |     |   |
TIP FORCE at end of HOLD time+    |     |   |
RMS WELD CURRENT in WELD portion--+     |   |
LINE VOLTAGE (requires #9181-06A option)+   |
WELD FAULT CODE-----------------------------+
   0 = NO FAULT
   1 = CURRENT FAULT
   2 = FORCE FAULT
   3 = VOLTAGE FAULT
   4 = FORCE & CURRENT FAULT
   5 = FORCE AND VOLTAGE FAULT
   6 = VOLTAGE AND CURRENT FAULT
   7 = FORCE, CURRENT, AND VOLTAGE FAULT
```

If it is desired to only have the ability to download program information without having any feedback during the weld, and the display shows:

```
UP\DOWN LOAD&PRN
```

```
CHANGE1=YES,0=NO
```

press **1** to change.

If you want to use the UP\DOWN LOAD&PRN mode that feeds back weld results, press **0** to **not** change.

After entering either of the above numbers, the display will show:

```
RECEIVE DEL. MIN
```

```
CHANGE1=YES,0=NO
```

If you are sending a PRESET string from a PC or PLC, press **0** to leave it in the default speed. This will allow a short amount of time from the start of the string to the end before the control aborts. This protects the system from being hung waiting for the balance of a string. In case of a string that is not received within the allowed time, the string being sent will not be sent back in echo (see below).

If you are sending a string "LIVE" while entering data into a keyboard (usually done for testing purposes), press **1** to allow the maximum time for test purposes. The display will now show:

```
RECEIVE DEL. MAX
```

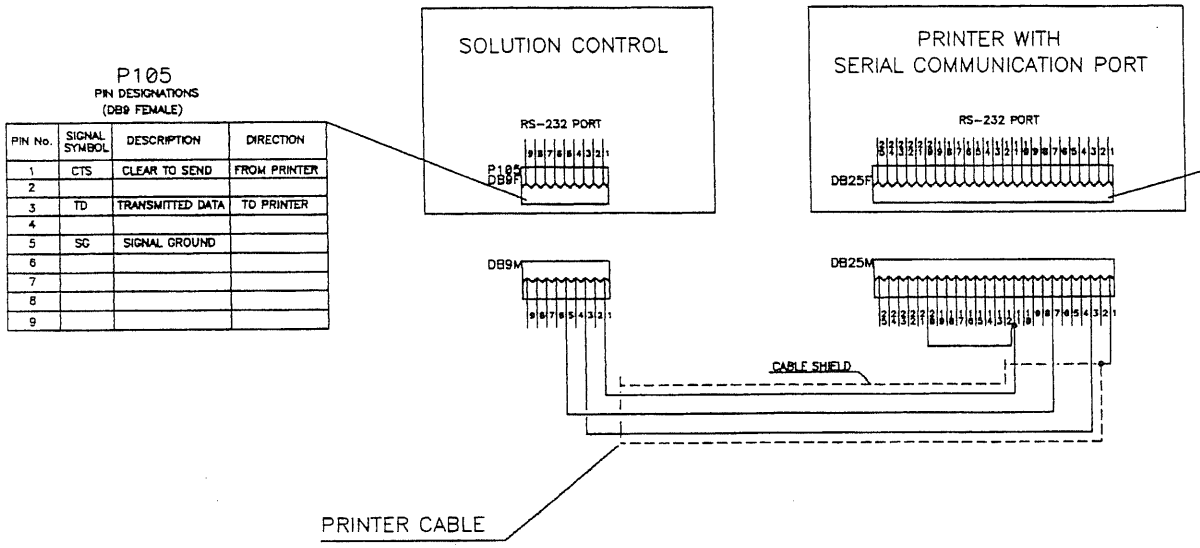
ERROR CODES:

When a string has been sent, and a format error is detected by the SOLUTION control, the program in the SOLUTION control will **not** be changed, and the string will be sent back followed on the next line by one of the following "E" codes:

E1 = The string does not contain the correct number of numbers. For a CONSTANT VOLTAGE string, this number is 71. For a CONSTANT CURRENT string, this number is 84.

E2 = The string attempted to load into a PROGRAM that was either = 00, or greater than 73.

E3 = When sending a string for CONSTANT CURRENT, the SOLUTION CONTROL has not been run through the LEARN PROGRAM (97/21). This means that the SOLUTION cannot use the data sent.



P105
PIN DESIGNATIONS
(DB9 FEMALE)

PIN No.	SIGNAL SYMBOL	DESCRIPTION	DIRECTION
1	CTS	CLEAR TO SEND	FROM PRINTER
2			
3	TD	TRANSMITTED DATA	TO PRINTER
4			
5	SG	SIGNAL GROUND	
6			
7			
8			
9			

PRINTER SERIAL PORT
PIN DESIGNATIONS
(DB25 FEMALE)

PIN No.	SIGNAL SYMBOL	DESCRIPTION	DIRECTION
1	PG	CHASSIS GROUND	
2			
3	RD	RECEIVED DATA	TO PRINTER
4			
5			
6			
7	SG	SIGNAL GROUND	
8			
9			
10			
11	CTS	CLEAR TO SEND	FROM PRINTER
12			
13			
14			
15			
16			
17			
18			
19			
20	CTS	CLEAR TO SEND	FROM PRINTER
21			
22			
23			
24			
25			

APPROVED:

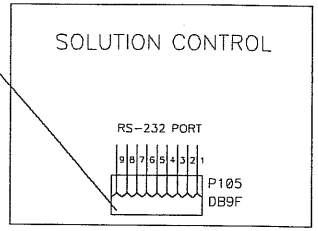
UNITROL ELECTRONICS, INC.
702 LANDWEHR RD.
NORTHBROOK, IL 60062

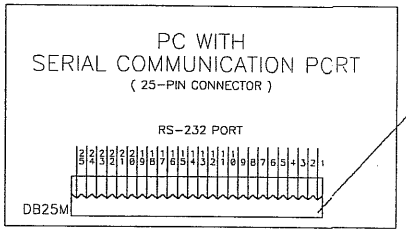
Title	CABLE FOR "SOLUTION" & "SOLUTION-2" RS-232 SERIAL INTERFACE WITH PRINTERS	
Size C	Number #1700-RS232 PRINTER	Rev 2
Date 05.30.01		Drawn by G.I.
Filename PRINTER5.S01		Sheet 1 of 1

P105

PIN DESIGNATIONS
(DB9 FEMALE)

PIN No.	SIGNAL SYMBOL	DESCRIPTION	DIRECTION
1			
2	RD	RECEIVED DATA	FROM PC
3	TD	TRANSMITTED DATA	TO PC
4			
5	SG	SIGNAL GROUND	
6			
7			
8	CTS	CLEAR TO SEND	FROM PC
9			

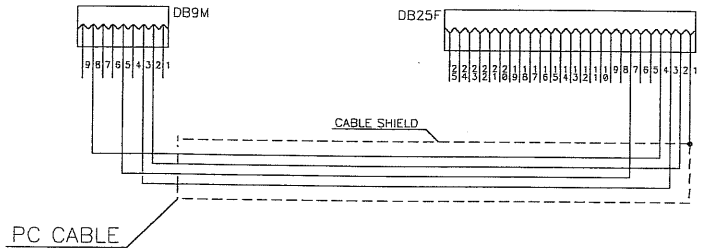




PC SERIAL PORT

PIN DESIGNATIONS
(DB25 MALE)

PIN No.	SIGNAL SYMBOL	DESCRIPTION	DIRECTION
1	PG	CHASSIS GROUND	
2	TD	TRANSMITTED DATA	TO SOLUTION
3	RD	RECEIVED DATA	FROM SOLUTION
4	RTS	REQUEST TO SEND	TO SOLUTION
5			
6			
7	SG	SIGNAL GROUND	
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			

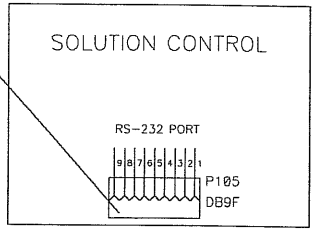


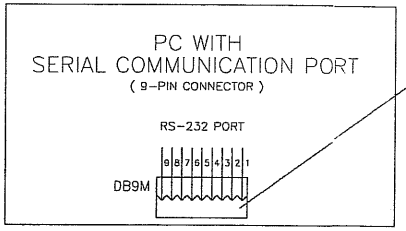
OR

P105

PIN DESIGNATIONS
(DB9 FEMALE)

PIN No.	SIGNAL SYMBOL	DESCRIPTION	DIRECTION
1			
2	RD	RECEIVED DATA	FROM PC
3	TD	TRANSMITTED DATA	TO PC
4			
5	SG	SIGNAL GROUND	
6			
7			
8	CTS	CLEAR TO SEND	FROM PC
9			

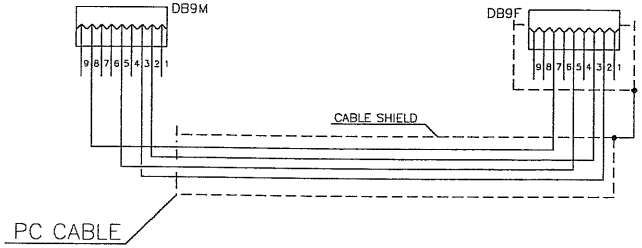




PC SERIAL PORT

PIN DESIGNATIONS
(DB9 MALE)

PIN No.	SIGNAL SYMBOL	DESCRIPTION	DIRECTION
1			
2	RD	RECEIVED DATA	FROM SOLUTION
3	TD	TRANSMITTED DATA	TO SOLUTION
4			
5	SG	SIGNAL GROUND	
6			
7	RTS	REQUEST TO SEND	TO SOLUTION
8			
9			



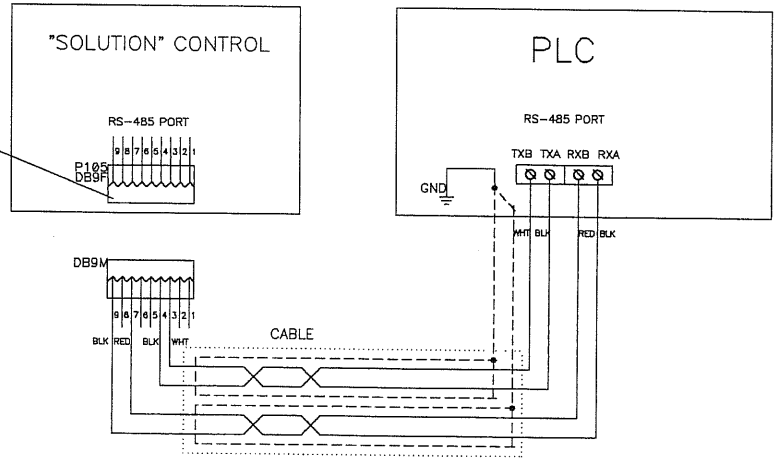
APPROVED:

UNITROL ELECTRONICS, INC.
702 LANDWEHR RD.
NORTHBROOK, IL 60062

Title	CABLE FOR "SOLUTION" & "SOLUTION-2" RS-232 SERIAL INTERFACE WITH PC	
Size C	Number #1700-RS232 PC	Rev 1
Date 09.11.2013		Drawn by G.I.
Filename PCCABLE1.S01		Sheet 1 of 1

P105
PIN DESIGNATIONS
(DB9 FEMALE)

PIN No.	SIGNAL SYMBOL	DESCRIPTION	DIRECTION
1			
2			
3	RXB	RECEIVED DATA	TO "SOLUTION"
4	RXA	RECEIVED DATA	TO "SOLUTION"
5			
6			
7	TXB	TRANSMITTED DATA	FROM "SOLUTION"
8			
9	TXA	TRANSMITTED DATA	FROM "SOLUTION"



NOTES:

1. RECOMMENDED TYPE OF CABLE FOR RS-422/485 APPLICATIONS
   "BELDEN" NO.9729
   (24 AWG, TWO TWISTED PAIRS, INDIVIDUALLY SHIELDED)

APPROVED:

UNITROL ELECTRONICS, INC.
702 LANDWEHR RD.
NORTHBROOK, IL 60062

Title	CABLE FOR "SOLUTION" WELDING CONTROL RS-485 SERIAL INTERFACE WITH PLC	
Size C	Number #1700-RS485 PLC	Rev 0
Date 08.31.01		Drawn by G.I.
Filename PLCCABL1.S01		Sheet 1 of 1

DIRECTIONS FOR USE

Your Unitrol **SOLUTION** microcomputer control has been designed to allow use without the use of special codes. All functions can be entered and checked by answering the questions on the control's readout.

It is recommended that the you first identify the options installed on this control by checking the first page in this booklet. Each option can be found in the TABLE OF CONTENTS, and should be checked **after** the basic instructions have been read.

If at any time during your use of this SOLUTION control a question occurs, please do not hesitate to call the Unitrol Technical Assistance Department. We at Unitrol want to be sure that all of the unique features in the system are being used to improve your company's product. Our toll free number is 1-800-621-4244. We appreciate your purchase of this system.

1. Turn power on. The control will go through the following readout sequence:

   DIAGNOSTIC TEST
   UNITROL SOLUTION
   TEST COMPLETED
   60 HZ (OR 50HZ) SYSTEM
   (other condition lines)
   PROGRAM __ READY

   This indicates that the system has loaded the entire program correctly and is ready to run.

   IMPORTANT NOTE #1: If frequency shown on this line (60HZ or 50HZ) does not match your electric service, press **PROGRAM 87, ENTER, 71** and enter a **1** to change. **DO NOT OPERATE THE CONTROL IN THE WRONG FREQUENCY.**

   IMPORTANT NOTE #2: If one of the lines shows: **AVC SYSTEM FAULT**, this indicates that the input voltage signal for the AVC (Automatic Voltage Compensation system) is not being received by the computer. While the control will still operate, this function will be lost. Contact the Unitrol service department for assistance.

2. If the program shown from the above step is the program to be used, choose the desired mode by pressing the SINGLE, NO WELD or REPEAT buttons. A colored LED will light above the chosen mode.

   SINGLE will complete the weld only one time.

   NO-WELD/SINGLE (push NO WELD button **once**) will go through the sequence without welding.

   NO-WELD/REPEAT (push NO WELD button **twice**) will go through the sequence **without** weld heat, open the points for a selected REPEAT OFF TIME and if initiation is **still** closed, repeat the sequence.

   REPEAT will go through the sequence **with** weld heat, open the points for a selected time, and if initiation is **still** closed, repeat the sequence.

3. If a mode is not chosen, and the initiation is made (foot pedal or palm buttons), the screen will display, "CHOOSE MODE". and the three LED's will flash. If this happens, select a desired mode.

4. If another program from the memory is desired, press:

   PROGRAM ## (## = program number previously programmed)
   ENTER
   desired mode (SINGLE, NO WELD/SINGLE, NO WELD REPEAT, REPEAT)

5. The system will now be ready to run. If a program that has no data is selected, the control will display:

   PROGRAM ## EMPTY

   Note that an incorrect operation cannot be done with this control. This means that the UNITROL SOLUTION will not operate until all correct information has been entered.

6. To enter a new program, press the following sequence:

   PROGRAM
   1 to 75

   Where the number is either chosen to match the metal thickness (ie. program 18 for 18 gage, etc.), or random. If data is already in that program's memory, the control will display:

   PROGRAM ## READY

   If you do not want to change an old program, press **PROGRAM** again and choose another number.

   If you desire to check this existing program, press STEP, and the control will display:

   SQUEEZE TIME ##

   Then press STEP again, and each function will be displayed with either 00 if not used, or some number after each function.

   If it is desired to check the entire program rapidly, press and hold the **STEP** button to only display the functions used in that program. At the completion of this reading, the display will show:

   DATA TABLE END.

7. To use this program, push the desired mode (single, no-weld, repeat) at any time while viewing the schedule. The welder should now be ready for use.

8. **BACK STEP:** If you are stepping through a PROGRAM and you go past the desired line, press the triangular **BACK** button on the lower right corner of the keypad. This will bring you back one line for each push.

9. **BLOCK STEP:** If you want to skip over blocks of input for faster access to lines lower down in the PROGRAM, press the triangular **BLOCK** button on the lower right corner of the keypad for each block. Blocks are shown on pages U-3 and U-3A as the symbol: **-B-**.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-3

SAMPLE PROGRAM

To fully understand how simple the **UNITROL SOLUTION** is to operate, try the following program on your control.

SQUEEZE TIME=18 CYCLES
WELD TIME=21 CYCLES
WELD PERCENT(HEAT)=85%
HOLD TIME=10 CYCLES

STEP	PRESS	CONTROL WILL DISPLAY
1.	PROGRAM 20	PROGRAM 20
2.	ENTER	PROGRAM 20 EMPTY
3.	ENTER	SQUEEZE TIME 00
4.	18	SQUEEZE TIME 18
5.	ENTER	WELD TIME 00
6.	21	WELD TIME 21
7.	ENTER	WELD HEAT 00%
8.	ENTER	WELD HEAT 85%
9.	ENTER	MOD. WELD HEAT = 85%
10.	ENTER	HOLD TIME 00
11.	10	HOLD TIME 10
12.	SINGLE	PROGRAM 20 READY

1. To check the program, press the **ENTER** button and hold to view only the selected functions above. Release the ENTER button at any desired point to view or change the data. At the end of all chosen functions, the display will show **DATA TABLE END.**

2. Now enter your actual weld schedule into any of the 75 memory areas as illustrated in the example above. The choice of SCHEDULE number can reflect metal thickness (ie. SCHEDULE 20 for welding 20 gage, etc.) or can be random. In either case , the chosen number will retain this data until changed (solid state non-battery memory).

3. Try a weld by pressing the foot (or hand) buttons. Note that, during the weld, a series of letters will appear on the readout. These represent the first letter of each function (ie. S-squeeze, W=weld, H=hold, etc.). These will disappear at the end of HOLD time. If it is desired to check these functions, press PROGRAM 0, ENTER, ENTER, #1. This will turn the counter function and display off.

4. **TO ADD OTHER WELDING FUNCTIONS:**

Continue after step 10 in the above example to push and release the **ENTER** button. Each RWMA welding function will be displayed as follows:

REPEAT=## CY OFF — Time between opening and closing of weld solenoid valve when in REPEAT mode.

-B-

INIT. SQUEEZE=## — Time delay between first closing of initiation switch and start of weld current when in REPEAT mode. If initiation switch is held closed, SQUEEZE TIME will be used for successive welds.

-B-

TIP FORCE=####LB — TIP (electrode) FORCE used for calculation of required air psi. If #9181-05 option is in system, this value must be reached before the start of SQUEEZE TIME.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-3A

-B-

TRASF. TAP #--	Position of the welding transformer's tap switch. This is used for reference only and does not effect control function.

-B-

HIGH I =##,### A	High current limit used with #9181-22A or #9181-22B options to decide when weld has exceeded maximum desired welding current. Does not effect operation without this option
LOW I =##,### A	Low current limit used with #9181-22A or #9181-22B options to decide when weld has fallen under minimum desired welding current. Does not effect operation without this option

-B-

NO.OF PULSES =##	Number of times WELD TIME is repeated before balance of weld sequence is completed. PULSAT COOL 2 time will occur between each pulse of WELD. Does not repeat other functions.
PULSAT COOL 2=##	Time between weld PULSES. See NO. OF PULSES above
PREHEAT TIME =##	Time of current conduction prior to UPSLOPE. Typically used when welding GALVANIZED metals (see COOL TIME 1 below) Also used when welding very thick metals for preheating.
PREHEAT =##%	Level of current used for PREHEAT cycles
COOL TIME 1=##CY	Non welding time between end of PREHEAT and start of WELD. When used to weld GALVANIZED steel,allows galvanized coating to move from under the electrode prior to WELD current.

-B-

UPSLOPE INIT=##%	Level of current used for the first half cycle of UPSLOPE. Control then increases from this percent heat to the WELD % in linear steps.
UPSLOPE TIME =##	Number of cycles of UPSLOPE.
DNSLOPE TIME =##	Number of cycles of DOWNSLOPE.
DNSLOPE END =##%	Level of current used for the last half cycle of DOWNSLOPE. Control decreases from WELD % in linear steps to this level in the last half cycle of DOWNSLOPE.
POSTHEAT TIME=##	Heat cycles after DOWNSLOPE.
POSTHEAT =##%B	Level of current during POSTHEAT.

QUENCH TIME =##	Non heating time after POSTHEAT typically used when welding spring or high carbon steel. Lets nugget cool prior to ANNEAL
TEMPER TIME =###	Number of cycles that a normally low current level will flow after QUENCH TIME. Anneals weld nugget area.
TEMPER HEAT =##%	Level of current during TEMPER (see TEMPER TIME)

As each function is displayed, select the desired number of cycles or percent heat per job requirements. You can, at any time, start to weld or go back to the start of the program by pressing the **SINGLE**, **NO WELD**, or **REPEAT** button.

5. **REPEAT MODE:**
By pressing the **SINGLE** button in the above example, the welder will cycle one time **only** and then wait for the initiation switch to be opened and closed for the next weld. However, if the **REPEAT** button is pushed in step 11 above, the welder will automatically cycle as long as the initiation is kept closed. To select the desired time **between** welds, enter the time in cycles (1 cycle = 1/60 second) after step 10 in the above example (REPEAT 00 CY.).

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-4
AVAILABLE FUNCTIONS

Your UNITROL SOLUTION can be used in many ways. The following choices can be made to have your welder operate as required by your equipment and production needs.

Note that all of these AVAILABLE FUNCTIONS can be selected and changed by use of the DIRECT PROGRAM numbers shown in each section below, or can be reached in the SET-UP program on page U7. The list of these DIRECT ACCESS PROGRAM numbers can be found on page U15. To use, just push : PROGRAM ##, ENTER.

COUNTER SYSTEM

The electronic counter system can be used three ways:

1. To count **individual welds** made
2. To count complete parts by changing one number every time a **specified number of welds** has been made.
3. To **not count** when either the **NO-WELD** mode is in use, or when you have turned off the counter function.

Note: When the counter is OFF, the readout will display letters representing the first letter of each function (ie. S=squeeze, W=weld, H=hold, etc.).

To operate the counter, press: **PROGRAM, 91, ENTER**, and answer questions on the readout.

FOREIGN LANGUAGE PROMPTS

This feature allows all words shown on the SOLUTION console to be in your choice of foreign languages for easy use by non-English speaking operators, or operators who are more comfortable in their native tongue. Note that all set-up instructions will remain in English. Press **PROGRAM 92, ENTER** and answer questions.

INITIATION MODES

The SOLUTION can be operated using one of these switches:

SINGLE STAGE FOOT SWITCH which closes weld tips and goes through the welding cycle on closing of a single switch contact.

DOUBLE STAGE FOOT SWITCH where the tips are closed on closing of the first switch, and the weld sequence started on closing of the second.

SINGLE CONTACT CLOSURE typically used in automatic machine operations using a PLC or cam switch closure. Welding tips are closed and the weld cycle is started on a single signal.

DOUBLE HAND SWITCHES WITH ANTI-TIEDOWN that requires the closing of two double pole switches within one second of time to close the welding tips and start the weld cycle. If one of the switches has been permanently closed ("tied down"), no welding will occur, and this switch must be opened before another weld sequence can be started.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-5
AVAILABLE FUNCTIONS (CONTINUED)

DOUBLE HAND SWITCHES WITH ANTI-TIEDOWN (continued)

The **SOLUTION** control automatically knows what type of switch is being used by the sequence in which the first and second level initiation inputs are closed:

If **LEVEL I** input is closed first, then **LEVEL II**, the SOLUTION control will operate in the **DOUBLE LEVEL FOOT SWITCH** mode.

If **LEVEL II** input is closed first, then **LEVEL I**, the SOLUTION control will operate in the **DOUBLE HAND SWITCH ANTI-TIEDOWN** mode.

If **BOTH LEVEL I and LEVEL II** are closed at the same time, the SOLUTION control will operate in the **SINGLE SWITCH/SINGLE FOOT SWITCH** mode.

IMPORTANT: To achieve this these modes, the welder must be wired per the hook-up diagram for the selected type of switches. If more than one initiation is desired, ie. foot switch and double hand switches, a customer installed switch can be added per diagrams available from Unitrol. In any case, selection of initiation can be made externally without the need to operate the SOLUTION keypad.

INITIATION STARTING MODES: With any of the **INITIATION MODES** shown above, two **INITIATION STARTING MODES** are possible with the SOLUTION:

1. **HOLDING MODE** which requires the initiation switch to be held closed **until the start of the first heat cycle.** If released during or before the end of **SQUEEZE**, the control will release the solenoid and stop the cycle. **This HOLDING MODE is the normal mode used for FOOT and DOUBLE HAND SWITCH operation where space between the electrodes is greater than 3/8" and/or the electrode area is not guarded against insertion of the operator's hand.**

2. **MOMENTARY MODE** which locks the control into the electrode closing and weld cycle **even if the initiation switches are released before the end of SQUEEZE.** This is the normal position used with single level switch closure from an automatic control (PLC) system on properly guarded welders. **This MOMENTARY MODE should NEVER be used on welders where the tips are open more than 3/8" and/or the weld area is unguarded!**

To select the desired **INITIATION STARTING MODE,** enter the following on the keypad: **PROGRAM, 90, ENTER**

and answer questions on the readout.

POSITIVE OR NEGATIVE START
This function allows selection of the first half cycle polarity. It has been found in welding with a small number of cycles, that proper choice of this direction will increase the weld's strength. In welds of 3 or more cycles, this direction should make no difference in weld strength. Try both directions as selected below to find the one that creates the maximum strength weld.

To select between **POSITIVE** or **NEGATIVE** direction, press:
PROGRAM, 94, ENTER
and answer questions on the display.

AVAILABLE FUNCTIONS CONTINUED

OPERATING MODE

This function offers the user the following choices:

1. **0-99 CYCLES** using a single welding program with 0-99 cycle count heat times. This is the typical mode for spot welding.

2. **0-999 CYCLES** using a single welding program with 0-999 cycle count heat times. This is the typical mode for resistance brazing. If it is desired to do serious resistance brazing on this control, we recommend that one of the INSTA-BRAZE process options be added. Consult your Unitrol distributor for data.

3. **DUAL PROGRAM** allows selection of two programs by the closing of two initiation circuits. See page U-8 for **DUAL PROGRAM** use instructions

To choose the desired **OPERATING MODE,** press: **PROGRAM, 95, ENTER** and answer questions on the display.

KEYBOARD SECURITY LOCK SYSTEM

The SOLUTION control has a three level security lock system that allows the user to restrict access and change to various functions in the system. The three levels are:

1. **SEMI KEYBOARD LOCK:** This mode is a typical security level used for most **manually operated welders.** It allows restricted modification of welding heat %, and selection of SINGLE, NO WELD, and REPEAT modes.

2. **FULL MANUAL KEYBOARD LOCK:** This mode is typically used for **manually operated welders where absolutely no change is allowed** to any program, but operator can select SINGLE, NO WELD, and REPEAT modes.

3. **FULL AUTO KEYBOARD LOCK:** This mode is typically used on **automatic welding systems where absolutely no change is allowed, and no change to weld heat% can be made.**

FUNCTION	WITH KEY IN "LOCK" POSITION SEMI	FULL MAN	FULL AUTO
REVIEW PROGRAM DATA.....	YES	NO	NO
CHANGE PROGRAM DATA.....	NO	NO	NO
SELECT NEW PROGRAM.....	YES	NO	NO
LINK PROGRAMS TO INIT A&B,PROG. 95	YES	NO	NO
CHANGE REPEAT OFF TIME IN PROGRAMS	YES	NO	NO
RESET COUNTER, PROG 91.....	YES	NO	NO
MEASURE TIP FORCE, PROG. 96.....	YES	NO	NO
TURN TRANSDUCER ON/OFF, PROG. 96..	NO	NO	NO
SET LB/PSI AND HEAD WEIGHT,PROG 97	NO	NO	NO
ACCESS SERVICE PROGRAMS	NO	NO	NO
MODIFY WELD HEAT% (SEE PAGE U-6A).	YES	NO	NO
SELECT SINGLE/NO WELD/REPEAT.....	YES	YES	NO

If the key switch is in the **locked** position, and a change to any locked function is attempted, the control will refuse to make such a change, and the display will show **"KEYBOARD LOCKED".**

AVAILABLE FUNCTIONS CONTINUED

SECURITY KEYBOARD LOCK SYSTEM continued
To select the desired **KEYBOARD LOCK** mode, with the lock in the OPEN position press: **PROGRAM, 87, ENTER, 96.** The display will show:

KEYBOARD LOCK SEMI =1	OR	KEYBOARD LOCK FULL MANUAL =2	OR	KEYBOARD LOCK FULL AUTO =3

If the desired KEYBOARD LOCK mode is **not** displayed, push **1** to change, and then select the number of the desired mode.

If the desired KEYBOARD LOCK mode **is** shown on the display, press **0** to leave in this mode.

NOTE: Every time the SOLUTION control is turned on, this KEYBOARD LOCK mode will be shown along with the other mode displays. If a printer option is in this control, this KEYBOARD LOCK mode will be printed after turn-on.

WATER SAVER CIRCUIT
Your UNITROL SOLUTION comes standard with electrics to operate a 115 volt solenoid to control cooling water. A solenoid valve connected to points 39 and 40 of the power supply board it will turn ON at the start of initiation and remain ON for one minute after the last weld has been made. **NOTE:** If RETRACT is used (see below), the WATER SAVER function cannot be used.

For WATER SAVER function, set power supply jumper 1J1 to **WATER SAVER** position.

RETRACT SYSTEM
The SOLUTION can control a RETRACT solenoid valve connected to terminals 50 and 51 (SVWS/SVC) on the power supply. The Normally Closed 3 way valve should be installed so that it will **fully open** the electrodes when **not** energized, and bring the electrodes to the **work** position (small opening) when the valve **is** energized. Note that when using the RETRACT function, the WATER SAVER function above is **eliminated.**

This **RETRACT** function can be used in two ways:

1. **MOMENTARY ACTION RETRACT SWITCH with HEAD DOWN LIMIT SWITCH:**

   Momentary closing of a spring return (non-latching) switch connected to terminals 13 and 14 (RT1/RTC) will cause 115VAC at terminals 39/40 (SVWS/SVC) to turn on the RETRACT valve.

   If a HEAD DOWN LIMIT SWITCH connected to terminals 15 and 16 (PSI/PS2) closes **before** the momentary retract switch has been released, the head will **stay** in the DOWN position (small clearance between electrodes).

   If a HEAD DOWN LIMIT SWITCH connected to terminals 15 and 16 (PSI/PS2) does **not** close **before** the momentary retract switch has been released, the head will stay in the DOWN position (small clearance between electrodes).

AVAILABLE FUNCTIONS CONTINUED

TO RELEASE the head back to the full open position, press close the switch one more time.

POWER OFF SAFETY: If the head is **down** when power is turned OFF to the control, and power is then restored, the retract switch must be pushed once to bring the electrodes to the work position. This is a safety procedure to prevent electrodes closing during power up.

SELECTING MOMENTARY ACTION RETRACT SWITCH MODE: PROGRAM, 87, ENTER, 93. The display will show:

RT1 NOT USED =1

CHANGE1=YES,0=NO

Press **1**, and the display will show:

RT1 NOT USED =1

RT1 LIGHTCURTN=2

RT1 RETRACTMOM=3

RT1 RETRACTLAT=4

To select **MOMENTARY** switch action retract mode, press **3**.

Set power supply jumper 1J1 to **RETR. VALVE** position.

2. **LATCHING ACTION RETRACT SWITCH without HEAD DOWN LIMIT SWITCH:**

Pushing a LATCHING ACTION switch will keep **closed** the contact connected to terminals 13 and 14 (RT1/RTC) will cause 115VAC at terminals 39/40 (SVWS/SVC) to turn on the RETRACT valve. In this type of switch, the contact will remain closed until the switch is pushed again (alternate action) or when a mechanical locking mechanism is released (toe switch).

Pushing of the switch a second time (or pushing the release) will **open** the conta and **deenergize** the solenoid valve to bring the head to the fully open position.

TO RELEASE the head back to the **full open** position, press the switch one more time (opens switch contacts).

POWER OFF SAFETY: If the head is **down** when power is turned OFF to the control, and power is then restored, the retract switch must be pushed **twice** to bring the electrodes to the work position. This is a safety procedure to prevent electrodes closing during power up.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-6C

AVAILABLE FUNCTIONS CONTINUED

SELECTING LATCHING ACTION RETRACT SWITCH MODE: PROGRAM, 87, ENTER, 93. The display will show:

RT1 NOT USED =1

CHANGE1=YES,0=NO

Press **1**, and the display will show:

RT1 NOT USED =1

RT1 LIGHTCURTN=2

RT1 RETRACTMOM=3

RT1 RETRACTLAT=4

To select **LATCHING** switch action mode, press **4**.

HALF CYCLE COUNT/POLAR OR UNIPOLAR OPERATION
Allows use of your welder with half cycle timing. Thus, if welding very small parts you desire to use 1-1/2 cycles of time (1 cycle is too short, 2 cycles is too long), enter: **PROGRAM 93, ENTER** and answer question on the display. Note that **SQUEEZE, HOLD, OFF, and REPEAT** timing will still be in full line cycle timing.

If after putting the control into HALF CYCLE COUNT mode you press the STEP button, you can choose between ALTERNATE POLARITY or UNIPOLAR. In ALTERNATE POLARITY, the first cycle of any weld will be opposite polarity of the last cycle of the previous weld. This is the **normal** mode for FULL CYCLE COUNT and HALF CYCLE COUNT welding.

However there are some 1/2 cycle welding processes that will show a different weld reaction when current is the positive half cycle and the negative half cycle. In this case there are two choices.

The best choice would be to keep the control in ALTERNATE POLARITY mode, have 1/2 cycle of WELD (system in HALF CYCLE COUNT) of the desired HEAT %, and then add one more 1/2 cycle of WELD at 20% HEAT. This extra 1/2 cycle of heat will be low enough to not effect the weld quality, but will act as a way of reversing the weld transformer flux to "reset" the transformer. If this is not done, residual flux in the weld transformer core can "saturate" the transformer core to both do damage to the transformer as well as lowering the welding current (eventually at the extreme to zero).

AVAILABLE FUNCTIONS CONTINUED

HALF CYCLE COUNT/POLAR OR UNIPOLAR OPERATION (continued)

The second choice is to set the control into UNIPOLAR mode. If you are using only 1/2 cycle of weld, it will always fire in the same direction. This can saturate the weld transformer core as noted above and is not normally a good practice.

MODIFY WELD HEAT % "ON THE FLY":
This feature allows the operator to **increase or decrease WELD HEAT without going into the weld program.** This is useful to compensate for material variations without changing the company set program. It only functions in the SEMI and FULL MANUAL modes with the keylock in either position. The increase or decrease will effect only the WELD HEAT and leave all others (PREHEAT, POSTHEAT, TEMPER) unchanged. UPSLOPE and DOWNSLOPE will follow this new percent.

If is first necessary to set a maximum heat adjustment range. This is done by pressing: **PROGRAM, 78, ENTER** when the keylock is in the OPEN position. The display will show:

MAX. + #% CHANGE

CHANGE1=YES,0=NO

This is maximum **increase** allowed over the WELD HEAT % entered in the program being used. If the control is in DUAL PROGRAM mode, this change will be made to the **last WELD PROGRAM** used **prior** to change. This allows an increase of up to 9% to be made. If zero (0) is used, no increase in heat will be allowed without going into the program with the keyboard unlocked.

A percent value should now be entered that will prevent expulsion (spitting) in the weld and still allow a little "headroom" for the operator. Press **1** to change, and then enter 0-9 as desired. When finished, press: STEP.

The display will now show:

MAX. - #% CHANGE

CHANGE1=YES,0=NO

This is maximum **decrease** allowed over the WELD HEAT % entered in the program be used. If the control is in DUAL PROGRAM mode, this change will be made to the last WELD PROGRAM used **prior to change.** This allows an decrease of up to 9% to be made. If zero (0) is used, no decrease in heat will be allowed without going into the program with the keyboard unlocked.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-6E

AVAILABLE FUNCTIONS CONTINUED

CHANGING WELD HEAT% IN PRODUCTION:
After a weld has been made, pushing of the number 3(I+) button on the keypad will **increase** the WELD HEAT by 1%. If the control is in **CONSTANT CURRENT** mode, this will be an **increase** of 1% of the displayed current value.

Pushing of the number 1(I-) button on the keypad will **decrease** the WELD HEAT by 1%. If the control is in **CONSTANT CURRENT** mode, this will be an **decrease** of 1% of the displayed current value. Each change will be confirmed on the upper row of the display as:

MOD.WELDHEAT=##%	OR	MOD.I = ##### A

This line will also be shown in the welding program being used following the original unchanged WELD HEAT % as: **MOD.WELDHEAT=##%** or **MOD. I=#####A.**

The new heat level will continue to be used until either a change is made on the number 1 or 3 button, or if a new WELD HEAT has been installed in the program. The modified heat will be remain even if the control is turned off and on.

If an increase or decrease is attempted that exceeds the MAX. +/- % CHANGE set above, the WELD HEAT % will stay at the maximum value, and the display will show:

MAX. + #% CHANGE	or	MAX. - #% CHANGE

If a **printer option** is installed in this control, all of these changes will be documented.

LIGHT CURTAIN DETECTION SYSTEM:

The **RT1/RTC** input port can be connected to contacts on a LIGHT CURTAIN if this mode has been selected. Note that if one of the RETRACT functions is being used, you cannot use a LIGHT CURTAIN on this control.

With the control set in the **LIGHT CURTAIN** monitor mode (see steps below), the sequence operates as follows:

1. When the control is initiated, the **RT1/RTC** input port is monitored. If the **LIGHT CURTAIN** has been penetrated (**RT1** input port is **OPEN**), the solenoid valve will **not** be activated and the welding sequence will **not** start.

2. If the **LIGHT CURTAIN** is cleared (**RT1** input port is **CLOSED**) when the control is initiated, the solenoid valve will come forward and the welding sequence will start.

3. If before the **start** of any **weld heat** the **LIGHT CURTAIN** is penetrated (**RT1** is opened), the solenoid valve will be turned off and the sequence will be aborted. At this time, clearing of the **LIGHT CURTAIN** will **not** start the weld sequence. Initiation must be released and then closed again for the sequence to start again.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-6F

AVAILABLE FUNCTIONS CONTINUED

SETTING CONTROL IN **LIGHT CURTAIN** MODE:

1. Press: **PROGRAM, 87, ENTER, 93.** The display will show:

RT1 NOT USED =1
CHANGE1=YES,0=NO

Press **1**, and the display will show:

RT1 NOT USED =1
RT1 LIGHTCURTN=2
RT1 RETRACTMOM=3
RT1 RETRACTLAT=4

To select **LIGHT CURTAIN** mode, press **2.**

2. The control is now set for the LIGHT CURTAIN monitor mode.

IMPORTANT NOTE: When the system is in the **LIGHT CURTAIN** mode, the control **cannot** be used with the **RETRACT** function.

SELECTING LOW FORCE START, FORGE DELAY, INTENSIFIER DELAY, CLAMP DELAY, or LEVEL 2 modes:

A 115V. valve driver output marked **SVO** (terminals 41 & 42) can be configured to handle the above functions. If one of the functions (except LOW FORCE START) has been selected as shown below, a line will appear **in each program** (after TRANSF. TAP NO.) to allow entry of desired value.

To select function, press: **PROGRAM, 87, ENTER, 80.** The display will show:

VALVE FUNCTION: NOT ASSIGNED =1
CHANGE1=YES,0=NO

This says that the **SVO** output will not have any voltage output during the welding sequence. Now press **1** and the following screens will be shown:

VALVE FUNCTION: NOT ASSIGNED =1	No valve output.
VALVE FUNCTION: FORGE DELAY =2	The output will be turned **on** <u>after</u> the **FORGE DELAY ##CY** selected in the program being used has been completed. Timing starts from the **first** WELD cycle. If using IMPULSATION, timing will start from the **first** WELD cycle of the **last** IMPULSE. **FORGE** will appear on the upper display when this output is energized.

SELECTING LOW FORCE START, FORGE DELAY, INTENSIFIER DELAY, or CLAMP DELAY (continued):

VALVE FUNCTION: INTENSIFIER =3

This function is used to operate an INTENSIFIER type cylinder. Output will turn **on** <u>after</u> **INTENSIFIER ##CY** selected in the program being used has been completed. Timing begins from <u>start</u> of **initiation. INTENSIFY DELAY** appears on the lower row before output is turned on.

VALVE FUNCTION: CLAMP =4

This function is used to operate CLAMPS or SHUTTLES during a welding sequence.

There are two modes from which to choose:

ON DELAY: When you push the #4 to select a CLAMP function, the next line will show:

DELAYED CLAMP ON	-	CHANGE1=YES,0=NO

If you push **0** (to keep this mode), the control will now turn the SV0 output ON when the control has been initiated and have the main SV1 output (operates the weld solenoid) turn ON after the your selected CLAMP DELAY time of each of the 75 welding programs. This line is timed in cycles (1/60th. second).

OFF DELAY: If you push **1** (to change the mode), the display will change to:

DELAYED CLMP OFF

In this mode, the control will turn both the SV1 and SV0 outputs ON when the control has been initiated. They will both remain ON until the end of HOLD TIME. At this time, the weld solenoid output SV1 will release, and the SV0 output will remain ON for the CLAMP DELAY time you have selected in each of the 75 welding programs. This line is timed in cycles (1/60th. second)

VALVE FUNCTION: ON W\LEVEL 2 =5

The output will be turned as soon as the **second level** of the initiation switch has been closed. This can be useful for operations such as SOFT TOUCH DOWN where a dual pressure valve is used to select one pressure for initial closing, and a second one during welding.

VALVE FUNCTION: DEPTH DETECT =6

Operates a second solenoid valve to close welder electrodes under low force and only applies full welding force if electrodes close on the metal work piece. This function is used where the operator's fingers are close to the electrode area.

To use this function, your welder will require additional pneumatic components (valves, etc.) to close the electrodes under low force and then apply full welding force if the welding area is clear.

The system can operate using either an external limit switch set to CLOSE when the electrodes are less than 1/4" apart, or can use an optional SOFT TOUCH input board to detect when the electrodes have contacted a conductive surface. In either case, the PRESSURE SWITCH input PS1 will be closed when the it is safe to apply full welding force.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-6H

DEPTH DETECT SYSTEM (continued):

DEPTH DETECT PNEUMATIC SYSTEMS:

For PRESS WELDERS with low weight rams, or for ROCKER ARM welders:

The pneumatic system on the welder will be installed to match Unitrol drawing #1920. This setup is used on welders where air pressure is needed to close the electrodes (will not close by head weight only).

When the 4-way solenoid valve SV1 is energized, air is exhausted from the back side of the cylinder, and low pressure air (PRC) will be sent to the top of the cylinder to close the electrodes under low force. If the work area is clear (PS1 input is closed) within the maximum time limit (see below), the main 3-way solenoid (SV0) will be energized to shift the shuttle valve and put high pressure (PRW) to the cylinder.

For PRESS WELDERS with HIGH weight rams:

The pneumatic system on the welder will be installed to match Unitrol drawing #1915. This system recognizes the fact that just the ram weight is enough to cause damage to an operator's finger.

After initiation, a 3-way solenoid valve SV1 is energized to exhaust air from the underside of the piston to let the ram fall by gravity. When the air pressure falls below that of the setting on regulator PRC, the shuttle valve will shift and keep this low pressure on the piston's back side to partially balance the ram weight.

If PS1 input closes before the maximum time selected (see below), the four-way solenoid valve SV0 will be energized to put full air pressure on the top of the cylinder and exhaust the pressure on the back side.

SETTING PRU PRESSURE REGULATOR

It is important that the pressure setting on this regulator be just high enough to open the electrodes with reasonable speed. Setting this regulator too high will greatly slow down the closing speed of the electrodes.

SETTING MAXIMUM TIME DELAY:

If the PS1 input does not close fast enough the control will turn SV1 OF to open the electrodes. At this time, the display will show:

DETECT TIME OUT

and will require release of the initiation switch and closure again to start the next sequence. After you have pushed the #6 button to select this mode, the display will show:

DETECT TIME = 00

This is a default time of 30 cycles (1/2 second). You can select another delay time to represent a time slightly longer than needed to close the electrodes or just leave the default.

To change this time after testing the system, press: **PROGRAM, 87, ENTER, 80**. The display will show:

DEPTH DETECT = 6	-	CHANGE1=YES,0=NO

Push **STEP** and you will be able to select a new maximum detect time.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-7

MACHINE SET-UP PROCEDURE TO USE AVAILABLE FUNCTIONS

Use the following to customize your welder's operation. Don't forget that each of the functions shown below can also be changed by using the **DIRECT ACCESS** code numbers found on page U15.

STEP	PRESS	CONTROL WILL DISPLAY
1.	PROGRAM 0	PROGRAM 0
2.	ENTER - - -	SET UP PROGRAM WELDS (OR PARTS) MADE #### RESET COUNTER? PRESS: 1=YES, 0=NO
3.	1 or 0 - -	IF 1, 0000 WELDS MADE COUNTER IS ON (or OFF) CHANGE 1=YES, 0=NO
4.	1 or 0 -	if 1, COUNTER IS OFF (or OFF) WELDS\PART ####
5.	1 to 999 - -	WELDS\PART 001 to 999 * PRESSURE TRANSDUCER ON (or OFF) * CHANGE 1=YES, 0=NO
6.	1 or 0 - -	* if 1: TRANSDUCER OFF * CHECK TIP FORCE? * PRESS 1=YES, 0=NO
7.	1 or 0	* if 1: PLEASE INITIATE
8.	INITIATE	* TIP FORCE = ### LBS
9.	STEP -	* CHECK INPUT? * PRESS 1=YES, 0=NO

STEP	PRESS	CONTROL WILL DISPLAY
10.	1 or 0	* if 1: PLEASE INITIATE
11.	1 or 0	* AIR PRESS. = ## PSI
12.	STEP -	LANGUAGE IN USE ENGLISH (or other language)
13.	1 or 0 - - - - -	if 1, ENGLISH = 1 CHANGE 1=YES, 0=NO SPANISH =2 POLISH = 3 GERMAN = 4 FRENCH = 5
14.	1 to 5	language selected
15.	ENTER -	** AVC IS ON (or OFF) ** CHANGE 1=YES, 0=NO
16.	1 or 0 - - -	** AVC IS OFF (or ON) INITIATION MODE MOMENTARY = 1 (or other MODE) CHANGE 1=YES, 0=NO
17.	1 or 0	if 1, HOLDING = 1 MOMENTARY = 2
18.	1 or 0	mode chosen

MACHINE SET-UP PROCEDURE TO USE AVAILABLE FUNCTIONS (continued)

	-	FULL CYCLE COUNT
	-	CHANGE 1=YES, 0=NO
19.	1 or 0	if 1, HALF CYCLE COUNT
	-	POSITIVE START
	-	CHANGE 1=YES, 0=NO
20.	1 or 0	if 1, NEGATIVE START
	-	OPERATING MODE
	-	SINGLE PROGRAM
	-	CHANGE 1=YES, 0=NO
21.	1 or 0	if 1, DUAL PROGRAM
	-	PROGRAM A = - -
22.	1 to 75	PROGRAM A = ## (or PROGRAM ## EMPTY)***
	-	PROGRAM B = - -
23.	1 to 75	PROGRAM B = ## (or PROGRAM ## EMPTY)***
	ENTER	PROGRAM ## READY / PROGRAM A=## & B=##

NOTES:

* These steps will only be operational on systems having the #9181-05 pressure transducer option installed.

**If the AVC base voltage procedure was not done in PROGRAM 89, the control will tell you to GO TO PROG. 89 before AVC can be turned ON.

***If PROGRAM ## EMPTY is displayed, use another number or press the PROGRAM button to exit and set data into a weld schedule number.

DUAL PROGRAM OPERATION

Your UNITROL SOLUTION can be used with two different programs (weld schedules). This operation requires the installation of a second foot pedal or set of palm buttons. These would be wired to terminals #19, #20, and #21 on the power supply as shown on the hook-up wiring diagrams in this book. Note that in all cases, each set of initiation (foot switch or palm buttons) will act independently.

To use **DUAL PROGRAM:**

A. Follow the example below after step 20 on page U-7A

OR

B. Call **PROGRAM 95** and proceed as follows

STEP	PRESS	CONTROL WILL DISPLAY
1.	PROGRAM	PROGRAM NO.
2.	95	PROGRAM NO. 95
3.	ENTER -	SINGLE PROGRAM CHANGE 1=YES, 0=NO
4	1 -	DUAL PROGRAM PROGRAM A =
5.	1 to 75	PROGRAM A = ## (or PROGRAM ## EMPTY)*
6	ENTER	PROGRAM B =
7.	1 to 75	PROGRAM B = ## (or PROGRAM ## EMPTY)*
8	ENTER	PROG. A=##, B=## (selected programs)

NOTES:

* If **PROGRAM EMPTY** is displayed, press the **PROGRAM** button twice, and then the desired program number to be used. Now follow the normal routine as in the SAMPLE PROGRAM (page U-3) to program this number. **You cannot use the dual program system with an "empty" program.** Once you have finished, return to the DUAL PROGRAM set-up procedure by following the above steps once more.

TO CHECK THE ABOVE PROGRAM, close either initiation (first level of foot switch, or a single palm button). The display will indicate which switch has been pushed, and what program is being used. To verify the other program, push the second initiation (first level of foot switch, or a single palm button) for the same display information.

UNITROL SOLUTION
DIRECTIONS FOR USE PAGE U-9
TIP FORCE CALCULATION SYSTEM

The Unitrol SOLUTION will let you set air pressure accurately for a desired TIP FORCE (force between welding tips). To use this function, follow the step below that fits your welder.

A. Some welders list the **WELD FORCE RATIO** on the name plate. This number, when multiplied by air pressure, will yield the actual force between the welding electrodes (tips).

If this ratio is not shown, but a chart showing tip force for air pressure settings is on the welder, calculate the ratio as follows:

$$\text{WELD FORCE RATIO} = \frac{\text{TIP FORCE AT 50 PSI}}{50}$$

On both types of machines, press **PROGRAM 79**, press **ENTER** and the read-out should show:

PSI VARIATION=00

For the moment, leave this value at 00. Information on this number can be found on page U-14. Press **STEP** and the display will show:

XX LB. FORCE\PSI.

CHANGE 1=YES, 0=NO

Press #1 (YES). Now enter the **WELD FORCE RATIO** shown on the welder nameplate or calculated as shown above. The **SOLUTION** control will use this ratio for calculations. NOTE: If the value is **above** 99 LB. FORCE\PSI, go to PROGRAM 87, ENTER, 91 and change from XX.X to XXX range. Then come back to this program.

B. For use on welding units with multi section air cylinders ("gun" cylinders), check manufacturers data sheet for the correct effective total cylinder area and enter as in step A above.

C. On all other welders:

First calculate the cylinder area follows:

CYLINDER AREA = CYLINDER DIAMETER X CYLINDER DIAMETER X .785

where CYLINDER DIAMETER is the <u>inside</u> dimension across the cylinder. This is typically about 1/8" smaller than the outside cylinder diameter.

The following are areas of common cylinder sizes:

INSIDE CYLINDER DIAMETER	CYLINDER AREA
3in.	7.1 in^2
3-1/2in.	9.6 in^2
4in.	12.6 in^2
4.5in.	15.9 in^2
5in.	19.6 in^2
6in.	28.3 in^2
8in.	50.2 in^2
10in.	78.5 in^2

C. continued

Now press **PROGRAM 79, ENTER, ENTER.** The display will show:

00.0X LB FORCE/PSI

If you are operating a **PRESS WELDER** or **PROJECTION WELDER** (direct acting cylinder types), enter the number calculated above. If the number exceeds 99.9, go to **PROGRAM, 87, ENTER, 91** and follow instructions on the display to change the control to **XXX LB/PSI.**

If you are operating a **ROCKER ARM WELDER**, you must first calculate the machine **ARM LEVERAGE** as follows:

ARM LEVERAGE = (A ÷ B)

A=distance from the weld cylinder rod to the weld arm pivot
B=distance from the weld arm pivot to the weld tip

As an example, on a **ROCKER ARM WELDER** with a 5" diameter cylinder that measures 18" from the cylinder rod to the weld arm pivot ("A"),and 24" from the weld arm pivot to the welding tip ("B"):

ARM LEVERAGE = 18 ÷ 24
= .75

LB FORCE/PSI = ARM LEVERAGE X CYLINDER AREA
= .75 X 19.6
= 14.7

Enter this value as shown above. This ratio will now be maintained by the SOLUTION, and will only require changing if, on a **ROCKER ARM WELDER** the length of the welding arm is changed (moved inward or outward).

After the **LB/PSI** value has been entered, press **STEP** and the display will show: **HEADWEIGHT = ###LB.** Enter the dead weight of the welder head. This can be measured by placing a UPS type scale between the electrodes and turning power off the welder. The weld head should now drop by gravity. The weight shown on the scale should be entered on this line. On some rocker arm welders, the HEADWEIGHT is effectively 00. After the number has been entered, press **ENTER** and the system will now be set.

To determine the correct pressure gage setting needed for any particular metal combination, follow these steps:

1. Check your company "weld set-up sheet, or consult a welding chart for the correct **TIP FORCE** and enter it into any of the 75 welding programs, and then press **SINGLE, NO WELD,** or **REPEAT.**

2. The SOLUTION computer will subtract the HEAD WEIGHT from the chosen TIP FORCE and then divide it by the LB/PSI. and display this value as: **SET AIR AT ##PSI.** Set the welder air regulator to this value. If your control has the **PRESSURE TRANSDUCER OPTION** installed, this number will be used to set the point that the control will start the welding process (See page U-11).

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-11

SOLID STATE PRESSURE TRANSDUCER WITH HI/LOW FEATURE
OPTION #9181-05C

THEORY:
A major variable in the resistance welding process is tip force. Since the electrical resistance between parts being joined **decreases** as force between the welding electrodes **increases**, the heat generated during the weld changes accordingly.

Additionally, since the tip force also acts as a **forge** in the nugget development process, variations will greatly effect weld strength and ductility.

If current starts to flow before proper tip force has been reached, metal expulsion (flash) will occur causing part indentation, tip pick-up of metal (greatly shortened electrode life), and potential danger to the operator and others in the area of the welder.

Lastly, if during the weld the TIP FORCE **increases** above the required level, cold brittle welds will be produced.

> **Welding before proper tip force has been reached DRASTICALLY lowers the quantity of welds possible between tip dressing , and REDUCES overall weld strength, consistency, and appearance.**

APPLICATION:

This **SOLUTION** option is designed to start current flow in the welder at the **EXACT** TIP FORCE desired. At the end of the weld, it will check the TIP FORCE a second time to be sure that it has not gone **above** or **below** a customer's set VARIATION window.

As shown in the graph on the next page, air pressure in the welding cylinder, as measured by the **DOUBLE SIDED** (differential) **PRESSURE TRANSDUCER** supplied with this option changes in three steps:

1. As the welder head starts to move, and before the electrode touches the electrode, volume in the upper half of the cylinder starts to **INCREASE**. Therefore, during this same time, air pressure in the **VARIABLE** volume cylinder builds only slightly as required to overcome friction and inertia. This varies depending on air temperature, viscosity, oil content in air, temperature of welder bearings, etc. The SOLUTION read-out will show: **WAIT: TIP FORCE** during this time.

2. When the weld electrode touches the work piece, the cylinder stops moving, and the now **FIXED** volume of the cylinder causes each additional amount of air to increase pressure. This continues until the pressure inside the cylinder has reached that of the welder's pressure regulator. **THIS IS THE EXACT POINT THAT WELD CURRENT FLOW SHOULD BE STARTED,** and the **WAIT: TIP FORCE** readout will be turned off.

3. This level now remains as long as the welder's solenoid is on.

SOLID STATE PRESSURE TRANSDUCER WITH HI/LOW FEATURE (CONTINUED)
OPTION #9181-05C

TIP FORCE (in pounds) , as shown in the graph, remains at zero (0) until the electrode touches the work piece. Then the tip force increases in direct proportion to the change in air pressure.

The #9181-05C **DIFFERENTIAL PRESSURE TRANSDUCER** option connects to the weld cylinder as shown in the diagram below. Note that the hose connected to the UPPER (forward) port of the weld cylinder connects to the SOLUTION cabinet bulkhead fitting marked H (high), and that the hose connected to the LOWER (return) port of the weld cylinder connects to the fitting marked L (low). If these are reversed, the system will not work.

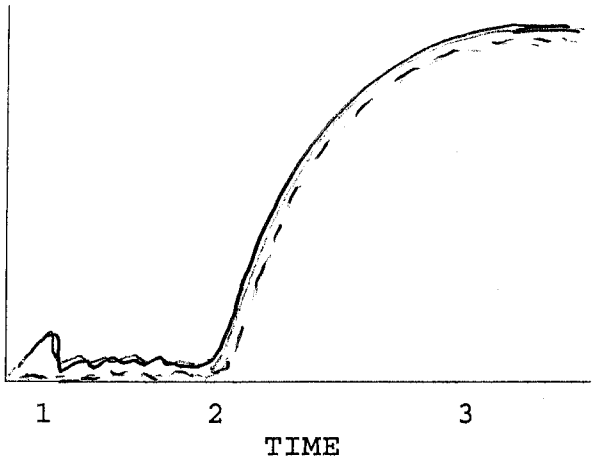
****

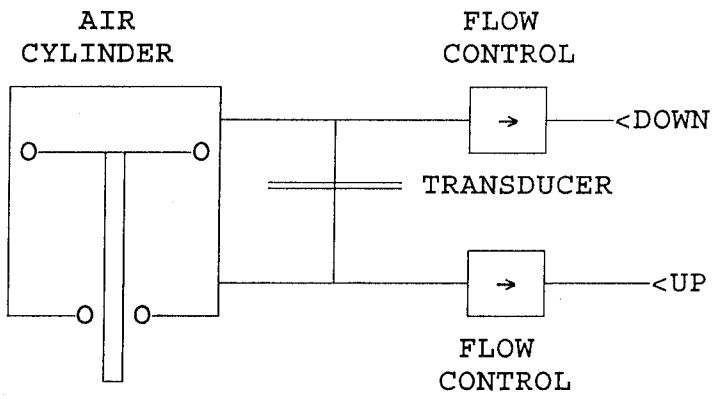
BE SURE THAT THE TRANSDUCER CONNECTIONS ARE INSTALLED BEFORE THE FLOW CONTROLS AS SHOWN. OTHERWISE, THE SYSTEM WILL BE RESPONDING TO THE SETTING OF THE FLOW CONTROLS RATHER THAN TO THE ACTUAL WELDING CYLINDER RESPONSE.

The transducer, provided in the option, subtracts the air pressure on the underside of the cylinder piston from that of the top. The resultant is the exact air pressure acting on the cylinder rod. Note that the pressure measurement is taken BEFORE any flow control devices.

Use of a **DIFFERENTIAL** type transducer eliminates error and false signals caused by changes in **welder head advance speed** as set by flow controls in the air system. Also, unlike mechanical pressure switches, this device is accurate to better than 1/2 psi. and will not change even under large temperature swings and changes in air density and composition.

Use of this option will present the **SAME EXACT FORCE CONDITIONS** every time that the weld has started. Because of this, the inter resistance of the parts being joined will be constant and, therefore, reproduce weld strength and ductility throughout the production run.





LEGEND

AIR CYLINDER PRESSURE ————————
TIP FORCE ----------

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-13

SOLID STATE PRESSURE TRANSDUCER WITH HI/LOW FEATURE(CONTINUED)
OPTION #9181-05C

TO SET AND CHECK TRANSDUCER OPTION:

1. Follow the directions on pages U-9 and U-10 to **calculate** and **enter** the **TIP FORCE RATIO.**

2. Press : **PROGRAM 96, ENTER**

   If the readout shows **PRESS. TRANSD. OFF**, turn on by pressing #1 to answer the question on the readout. The readout should now show:

   PRESS. TRANSD. ON

3. **TO CHECK TIP FORCE:**

   Press the **ENTER** button, and the readout will display:

   CHECK TIP FORCE?

   Respond to the message by pressing #1. The control will now display

   PLEASE INITIATE

   and wait for you to close the foot switch or hand buttons. Once you have this, the welding tips will stay closed automatically while you adjust the pressure gage to the desired **TIP FORCE.** No actual welding will occur. Note that, while the display shows readings every 1/2 second, the computer is updating continuously.

   The value shown will be calculated as:

   TIP FORCE = HEADWEIGHT [in program 79] + (AIR PSI) X (LBS/PSI)

   To release, press **STEP.**

5. **TO CHECK CALIBRATION ON YOUR PRESSURE GAGE:**

   After the above step, the readout will show:

   CHECK INPUT?

   Respond with by pressing #1, and the display will now show

   PLEASE INITIATE

   Initiate the welder (close foot or hand switch), and check the **SOLUTION** reading against your pressure gage. Again, keep in mind that the SOLUTION control updates slowly for purposes of the readout, but the system actually is monitoring the changes continuously. To release the welder, press **STEP.**

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-14

SOLID STATE PRESSURE TRANSDUCER WITH HI/LOW FEATURE(CONTINUED)
OPTION #9181-05C

USING TRANSDUCER OPTION IN PRODUCTION:

1. With the desired weld program entered, press **SINGLE, NO WELD, or REPEAT** as desired to set the control for welding.

2. When the foot pedal or hand switches are closed, and before the selected tip force has been reached, the readout will show:

   WAIT: TIP FORCE

   and welding will not start. Once the differential air pressure meets or exceeds the setting, welding will go through all sequences starting with **SQUEEZE**. Under normal circumstances, it is **not** necessary to have any **SQUEEZE TIME** in the program when using this transducer option.

Note that if you are in MOMENTARY initiation (program 90) and the air pressure is below the required setting, the system will not release when the foot or hand switch has been opened.

TO RELEASE at this point, either increase air pressure, press **EMERGENCY STOP**, or press any button on the keypad.

HI/LOW FEATURE

During HOLD TIME after the weld has been completed, the SOLUTION checks the TIP FORCE a **second** time. It compares the air psi reading to the value computed by the SOLUTION control for the TIP FORCE in the program. The control checks to see if this psi value is within the VARIATION window as customer set in PROGRAM 79 (PSI VARIATION).

The reason this is important is:

A. If the pressure is set too high, the SOLUTION will start welding as the selected TIP FORCE has been reached, but the parts will be under higher force during the weld. This will cause a lower electrical resistance between the parts and thus create less heat during the weld. This type of welds will typically have very shallow penetration and be brittle.

B. If the pressure drops during the weld because of a faulty regulator or leaks in the air cylinder, this will cause metal expulsion and possible cracks or holes in the weld nugget.

For example, if the SOLUTION displayed: **SET AIR AT 40 PSI** when the SINGLE button was pushed, and the **PSI VARIATION** in PROGRAM 79 was set at 4, the SOLUTION will find a fault if the air pressure during HOLD time is above 44 psi. (40 psi + 4 psi), or below 36 psi. (40 psi - 4 psi).

If an out of range psi is detected, the display at the end of the weld will show:
PRESS.HIGH=##PSI
RESET FAULT

FAULT RELAY: See PAGE U-39 for FAULT RESET MODES and FAULT/ACCEPT RELAY SYSTEM.

If you do **not** want to use this feature, set the **PSI VARIATION** in PROGRAM 79 TO **00**. Otherwise, a **PSI VARIATION** of 4 or 5 in PROGRAM 79 should protect the process and avoid random false faults

SOLUTION #9180

DIRECTIONS FOR USE PAGE U-15

DIRECT ACCESS CODES

The various options used in the **SET-UP** program #0 (page U7) can be accessed **directly** without the need to go through all other set-up steps. This is useful when a change, such as **MOMENTARY INITIATION,** is desired on a regular basis. To make such a direct selection, first push **PROGRAM**, then the desired function number listed below followed by the **ENTER** button.

PROG.	PAGE	FUNCTION
77	**U-6**	**WELD TIME RANGE,** 0-99CY OR 0-999 CY. Select **BEAT or NON-BEAT** operation
78	**U-6D**	Set + and - limits to **MODIFY WELD HEAT** from keypad buttons
79	**U-9**	**TIP FORCE CALCULATOR SET-UP–** set **LB/PSI**, **HEAD WEIGHT**, **VARIATION**
80	**-**	Select to **RESET** or **LEAVE MODIFY WELD HEAT%** when control is turned OFF.
81	**SPECIAL - 3**	**PRINTER MODE.** Select **PRINT ALL WELD RESULTS** or only **PRINT WELDS WITH FAULTS**
82	**U-39**	**FAULT RESET MODES**
83[1]	**U-24**	**CURRENT BLANKING.** For controls with current monitoring option
84[2]	**U-19**	**CURRENT MONITOR MODE** For controls with current monitoring option**.**
85[2]	**U-39**	**FAULT RELAY MODE.** Close on REJECT or ACCEPT
86	-	Read **SOFTWARE VERSION**
87/21	-	Sets **TIME** for closing **FAULT RELAY** and **EHR RELAY**
87/71	-	Set **60HZ or 50HZ** to match power line frequency
87/80	**SOFT TOUCH AND U-6F**	Select **SV0** valve driver output: **SOFT TOUCH, FORGE DELAY, INTENSIFIER DELAY, CLAMP**
87/81	-	Select transformer type: **WOUND CORE** or **STACKED CORE**
87/86	**SET MANUAL POWER FACTOR**	Sets **MANUAL POWER FACTOR** for special applications. Leave on **PF = 00** for normal automatic power factor. Consult factory before changing this setting. Manual PF. requires hardware changes.
87/91	**U-10**	Select **CYLINDER AREA** range. Up to 99.9 in^2 or $999in^2$
87/92[2]	**U-20**	Select **CURRENT RANGE** to match control. 10KA – 100KA or 7.5KA – 60KA (older)
87/93	**U6-E, U-6A**	Select LIGHT **CURTAIN** or **RETRACT** function.
87/95	**SPECIAL - 1**	**PRINT WELD SCHEDULES**
87/96	**U-6A**	**KEYBOARD SECURITY** level selection
87/97	**SPECIAL - 3**	**COMMUNICATION PORT SETUP.**
87/98[3]	**-**	**LOAD CELL** setup
87/99[2]	**U-20**	Set for control to read **PRIMARY or SECONDARY CURRENT** Set **CURRENT READING RANGE** if control uses a secondary current coil. Set **PRIMARY COIL RANGE** if control uses a primary current transformer
88	**U-41**	**HEAT STEPPER** setup
89	**U-17**	Set **AVC** (Automatic Voltage Compensation) first time welder is installed. Turn on in PROGRAM 98
90	**U-4**	**INITIATION MODES. HOLDING or MOMENTARY**
91	**U-4**	**COUNTER SETUP.**
92	**U-4**	**DISPLAY LANGUAGE SELECTION**
93	**U-6C**	**HALF CYCLE or FULL CYCLE** weld time selection.
94	**U-5**	**POSITIVE or NEGATIVE FIRST HALF CYCLE** polarity.
95	**U-6, U-8**	Select **SINGLE WELD PROGRAM or DUAL WELD PROGRAM** mode
96	**U-11**	**TIP FORCE** measurement setup. For controls with pressure transducer or load cell options
97/11[2]	**U-27**	Select **CONSTANT CURRENT or CONSTANT VOLTAGE** weld heat modes.
97/21[2]	**U-29**	**CONSTANT CURRENT** original setup procedure to set **LEARN TABLES** in control memory.
97/31[2]	**U-33**	View **LEARN TABLES** for constant current function.
97/41[2]	**-**	**PRINT LEARN TABLES** results for constant current function
97/51[2]	**factory set**	Set **MAX HEAT% CHANGE per CYCLE** before window is reached for constant current sequence.
97/6[2]	**-**	**PRINT WELD RESULTS** of just completed weld.
97/71[2]	**Factory set**	Set **HEAT TARGET WINDOW WIDTH** for constant current sequence
97/72[2]	**U-35**	Turn on or off **TRANSFORMER TAP SET RECOMMENDATION** function
97/81[2]	**Factory set**	Set **MAX, HEAT% CHANGE** during constant current.
97/91[2]	**U-20**	**CALIBRATE CURRENT MONITOR**
97/93	**U-28**	Set **LEARN TABLE SINGLE or GROUP**. Group is default for normal. Single is for very small thin mat'..
98	**U-18**	Turn **AVC** (Automatic Voltage Compensation) function ON or OFF.
99	**-**	**CLEAR MEMORY.** Requires factory security code number

Footnotes: 1. For controls with 9181-05C pressure transducer option or

2. Programs for "T" controls or controls with 9181-22A or 9181-22B options.

3. For controls with 9181-05E and 05F load cell options.

WARNING CODES

DISPLAY	MEANING	REQUIRED ACTION
TRANSFORMER OVERTEMP	THERMOSTAT ON WELDER TRANSFORMER TRIPPED	CHECK WATER FLOW IN TRANSFORMER
	POWER SUPPLY INPUT TERMINAL PLUG NOT FULLY IN	PUSH PLUG IN ON LEFT SIDE OF SUPPLY
SCR OVERTEMP	THERMOSTAT ON SCR	CHECK SCR SWITCH CHECK WATER FLOW
EMERGENCY STOP	EMERGENCY STOP PUSHED	RELEASE SWITCH
CHOOSE MODE	NO MODE HAS BEEN SELECTED	PUSH **SINGLE, NO-WELD OR REPEAT**
INIT. IS CLOSED	INITIATION CLOSED ON POWER UP	CHECK AND OPEN SWITCHES
EARLY RELEASE	INITIATION RELEASED BEFORE WELD SEQUENCE	HOLD BUTTONS TO END OF SQUEEZE
KEYBOARD LOCKED	KEY SWITCH IN **LOCKED** POSITION BEFORE WELD SEQUENCE	INSERT KEY AND ROTATE TO **OPEN** END OF SQUEEZE
INCORRECT ENTRY	INAPPROPRIATE ENTRY MADE	USE ONLY NUMBERS SHOWN IN QUESTION
PLEASE PROGRAM	TRYING TO WELD WITH AN EMPTY PROGRAM	USE A PROGRAM THAT HAS DATA INSTALLED
CHECK SCR!	SCR IS SHORTED	CHECK & REPLACE
	NO ZERO CROSS SIGNAL	CHECK U10 & U9
PRESSURE SW. OPEN	PRESSURE SWITCH OPEN	CHECK SWITCHE
PRESS. HIGH=##PSI PRESS. LOW =##PSI	PSI DURING HOLD TIME ↑ OR ↓ PSI VARIATION	MATCH REGULATOR TO PROGRAM REQUEST
PLEASE INITIATE	WAITING FOR INITIATION ON TIP FORCE OPTION	CLOSE FOOT SW. TO READ FORCE
INIT. IS CLOSED	INITIATION IS STILL CLOSED AFTER WELD	OPEN INITIATION SWITCH
WAIT: TIP FORCE	PRESSURE TRANSDUCER NOT SATISFIED (OPTION 9181-05)	INCREASE AIR SETTING ON AIR REGULATOR
RESET FAULT	SYSTEM HAS NOT BEEN RESET AFTER LAST FAULT	PRESS ANY NUMBER BUTTON ON KEYPAD
MAX. + % CHANGE MAX. - % CHANGE	TRYING TO INCREASE OR DECREASE A PERCENT GREATER THAN IN PRG 78	DON'T DO THAT! OR OPEN +/- MAX CHANGE IN PROG.78
PRES OVER 99 PSI	AIR PRESSURE CALCULATION IS OVER 99 PSI.	LOWER TIP FORCE OR CHECK LB/PSI.
HEADWEIGHT ERROR	VALUE OF HEADWEIGHT IN PROG. 79 TOO HIGH	INSTALL CORRECT HEAD WEIGHT

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-17
VOLTAGE COMPENSATION (AVC)

PURPOSE: To maintain constant welder secondary voltage under varying input voltage conditions.

FUNCTION: This function will read the incoming line voltage every weld, compare to the customer set reference voltage, and modify the phase angle (% heat) for that weld sequence. Since the change of phase angle is proportional to the variation of the line voltage, the output will adjust in a "closed loop" fashion in an attempt to hold the output to an exact level. This function operates during ALL weld sequences including slopes.

****

IMPORTANT NOTE: If this control **has** been supplied with one of the CURRENT MONITOR/CONSTANT CURRENT options (#9181-22A, #9181-22AH, #9181-22B, or #9181-22BH), the AVC startup will be done while setting the CONSTANT CURRENT system.

In this case, **skip the rest of this section** and go through the section starting on page U-19. The AVC setting procedure will be done starting on page U-29.

****

OPERATING DIRECTIONS:
The first time you operate a new control or after memory has been erased (by use of PROGRAM 99), the SOLUTION control must be run through the following to calibrate the electronics to you particular line voltage.

A. SETTING LINE VOLTAGE BASELINE:

1. Measure the line voltage going into the SOLUTION control using a meter. Note the value for use below. The measurement is not very critical and will be used in the future if diagnostics are required in servicing this control.

2. Turn the control on. After diagnostics have been completed, press: **PROGRAM, 89, ENTER**. The display will show:

VOLT CALIBRATION

SYSTEM VOLT.=###

CHANGE1=YES,0=NO

This is used to set a baseline for the Automatic Voltage Compensation system. Press **1** and the display will now show:

SYSTEM VOLT.=---

2. **Enter** the line voltage measured in step 1 above.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-18

VOLTAGE COMPENSATION (AVC)
(CONTINUED)

3. Press ENTER, and the display will show:

PLEASE WAIT READING VOLTAGE

4. The SOLUTION is now reading the line voltage over hundreds of line cycles, averaging the results, and storing this BASELINE value to represent the line voltage at this moment.

5. When the reading is completed, the display will clear and the AVC function will be turned on automatically.

TO TURN AVC FUNCTION OFF:

If it is desired to remove the AVC function for service or diagnostic purposes, do the following:

1. Press: **PROGRAM, 98, ENTER.** The display will show:

AVC IS ON

CHANGE1=YES,0=NO

NOTE: If display shows: **AVC SYSTEM FAULT**, contact the Unitrol service department for assistance.

2. Press **1** (to change). The display will show:

AVC IS OFF

3. If you want to turn this feature ON at any time,repeat the above steps.

MODIFICATION OF VOLTAGE REFERENCE:
If you move a welder to a new location, you will probably want to leave the voltage reference level, as set above, unchanged. Under this condition, all old programs should work even if the new location has a slightly different voltage.

However, if the new location has a voltage that is +/- 5% different than the original location, you may wish to go through PROGRAM 89 again as shown above. Note that, under this condition, all existing programs will probably have to be adjusted for % heat to compensate.

NOTES ON OPERATION:
Keep in mind that the control can only increase power to 99%. That means that if 95% is the heat used in a particular schedule, and the AVC is asked to increase power by 10%, the control will run out of "head room", and output will not be constant. **Therefore it is important to keep WELD HEAT% below 89% to use the full effect of this AVC function.**

9181-06A AVC HI/LOW OPTION: If this option is installed, a detection of line voltage out of the +/-10% range during a weld will create a fault. See page U-39 for FAULT RESET MODES and FAULT/ACCEPT RELAY SYSTEM data.

VOLTAGE COMPENSATION (AVC) (CONTINUED)

3. Press ENTER, and the display will show:

PLEASE WAIT READING VOLTAGE

4. The SOLUTION is now reading the line voltage over hundreds of line cycles, averaging the results, and storing this BASELINE value to represent the line voltage at this moment.

5. When the reading is completed, the display will clear and the AVC function will be turned on automatically.

TO TURN AVC FUNCTION OFF:

If it is desired to remove the AVC function for service or diagnostic purposes, do the following:

1. Press: **PROGRAM, 98, ENTER**. The display will show:

AVC IS ON

CHANGE1=YES,0=NO

NOTE: If display shows: **AVC SYSTEM FAULT**, contact the Unitrol service department for assistance.

2. Press **1** (to change). The display will show:

AVC IS OFF

3. If you want to turn this feature ON at any time, repeat the above steps.

MODIFICATION OF VOLTAGE REFERENCE:
If you move a welder to a new location, you will probably want to leave the voltage reference level, as set above, unchanged. Under this condition, all old programs should work even if the new location has a slightly different voltage.

However, if the new location has a voltage that is +/- 5% different than the original location, you may wish to go through PROGRAM 89 again as shown above. Note that, under this condition, all existing programs will probably have to be adjusted for % heat to compensate.

NOTES ON OPERATION:
Keep in mind that the control can only increase power to 99%. That means that if 95% is the heat used in a particular schedule, and the AVC is asked to increase power by 10%, the control will run out of "head room", and output will not be constant. **Therefore it is important to keep WELD HEAT% below 89% to use the full effect of this AVC function.**

9181-06A AVC HI/LOW OPTION: If this option is installed, a detection of line voltage out of the +/-10% range during a weld will create a fault. See page U-39 for FAULT RESET MODES and FAULT/ACCEPT RELAY SYSTEM data.

SOLUTION #9180
DIRECTIONS FOR USE
PAGE U-19

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

Before trying to measure weld current, it will be necessary to make some adjustment to the system. This is required to allow accurate measurement for a desired current range.

First determine the type of CURRENT measurement (primary or secondary) has been installed in this control. This is found on the first page of this direction book.

Then, follow the appropriate section below.

****

FOR CONTROLS WITH OPTION #9181-22B/22BH (SECONDARY CURRENT COIL)

NOTE: If your control uses a **PRIMARY** current coil (mounted inside the control cabinet), skip to the bottom of page U-21.

This option uses a current pickup coil on the **SECONDARY** (output side) of the welder. The coil should be clamped around a convenient point on the lower welding arm is possible. Route the coil cable to clear any parts that will be welded, and insert the plug on this cable into the mating socket extending from the SOLUTION remote console (#9180 series) or socket on the enclosure (#9180M, #9180-D, #9180-L, and #9180-R series).

Determine the maximum SECONDARY current range for your welder by checking the welder nameplate for MAXIMUM SECONDARY AMPERAGE. If it is not listed, check with the welder manufacturer or use the chart below.

While welder design and throat size can greatly vary welder maximum secondary current, a typical grouping will be:

1. Under 10 KVA = 10,000 A.
2. 10 KVA to 50 KVA = 25,000 A.
3. 50KVA to 150KVA = 50,000A
4. 150KVA TO 300KVA = 100,000A

Your control was factory set for one of the above ranges prior to shipment. This is marked on the first page of this direction book on the #9181-22B option line.

If this range is correct, no change should be necessary and you can skip to page U-24 to set **SETTING CYCLE BLANKING.**

If a range change **is** required:

1. On **9180 SOLUTIONS with remote data input console**, remove the blue console back plate and locate the four position DIP switch at the lower right corner of the circuit board.

   On **9180M, 9180L, and 9180D SOLUTIONS0(all components in one enclosure)**, remove four outer screws on front plate, carefully rotate the white keypad faceplate to the 90° position (bracket will hold it there), and locate the four position DIP switch near the bottom of the left side of the front printed circuit board (between board and white plate). Four tabs will be sticking out from the board.

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

Turn ON the switch that is in line with the MAXIMUM anticipated current.

On **9180 series SOLUTIONS** with **remote** input console, the switch is turned **ON** when pushed **DOWN** on the right hand side (to outside of board). one easy way to do this is to use an opened paper clip or ball point pen. The switches are (top to bottom) 100,000A, 50,000A, 25,000A, and 10,000A. All other switches **must** be turned OFF (down on left side) for the system to work properly.

On one piece **9180M, 9180D, and 9180L** series SOLUTION controls, the switch is turned **ON** when the switch is pushed towards the **FRONT** white metal plate. The switches, starting from the **bottom** of the board and going upward, 100,000A, 50,000A, 25,000A, and 10,000A. All other switches **must** be turned OFF (pulled away from the white plate) for the system to work properly.

****
SPECIAL NOTE: If updated software is being installed on a SOLUTION control manufactured prior to 1998, the ranges will be: 7 = 7,500 amps, 15 = 15,000 amps, 30 = 30,000 amps, and 60 = 60,000 amps.
****

2. Turn control ON, and after diagnostics have been completed press **PROGRAM 87, ENTER, 99.** The display should now show:

SECOND. I SYSTEM
CHANGE 1=YES, 0=NO.

If it shows **PRIMARY I SYSTEM**, press 1 to change.

Now press **ENTER** (**not** 1 or 0). The display will show: **I MAX 50 KA =2** (or other value). This indicates that the control presently is set for a maximum of 50,000 amps of secondary current.

The readout will now show: **CHANGE 1=YES, 0=NO.** Press 1, and select the range to match the switch setting of step #1 above. **THESE TWO SETTINGS MUST MATCH FOR THE CONTROL TO PROVIDE ACCURATE VALUES!.**

****
SPECIAL NOTE: **If** updated software is being installed in a SOLUTION control manufactured prior to 1989, the terminals will be marked 7, 15, 30, 60 (7,500A, 15,000A, 30,000A, 60,000A). **Only** in this case:

a. Press: **PROGRAM, 87, ENTER, 92**, and select the proper range.

b. Press: **PROGRAM, 97, ENTER, 91** and set ZERO=10, SPAN=59
****

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

****

NOTE ON CALIBRATION:

Your SOLUTION control has been factory calibrated to Unitrol standards. Unfortunately, there is no recognized U.S. standard for welding currents (non-sinusoidal current). Therefore it is probable that the Unitrol calibration will not exactly match readings from various brands of current monitors.

Unitrol does not encourage change of this calibration. However if it is desired to recalibrate the welding current measurement system to another standard, FAX a request to the factory at 847-480-0932.

IMPORTANT: You must include the control serial number in the FAX. We will send you these directions by return FAX.
****

You have now completed setup on SECONDARY CURRENT systems. **Skip to page U-24**, and go directly to **SETTING CYCLE BLANKING.**

****

FOR CONTROLS WITH OPTION #9181-22A/22AH (PRIMARY CURRENT COIL)

NOTE: If your control uses a **SECONDARY** side current pickup coil (mounted on the welder secondary), skip this section and go to page U-24, **SETTING CYCLE BLANKING.**

A. CHECKING PRIMARY CURRENT COIL SIZE:

Your control has been supplied with a current transformer mounted inside the white Unitrol SOLUTION control box. It measures current on the welding transformer **PRIMARY** (input) side. The SOLUTION control then uses this **PRIMARY CURRENT** multiplied by the transformer **TURNS RATIO** to calculate and display computed **SECONDARY CURRENT**

To use the option, first determine the maximum continuous **PRIMARY** current range for your welder by using the following formula:

$$\text{MAXIMUM CONTINUOUS PRIMARY CURRENT} = \frac{\text{WELDER KVA X 1000}}{\text{LINE VOLTAGE}} \text{ X } 3.5$$

This approximate value will vary with machine design. As an example, a 50 KVA welder operating on 230 volts would be calculated as follows:

$$\text{MAXIMUM PRIMARY CURRENT} = \frac{50 \text{ X } 1{,}000}{230} \text{ X } 3.5 = 760 \text{ amps.}$$

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

Your control was shipped with a primary current coil to match the KVA value of your welder as supplied with the original order. That current transformer range is listed (example: 800:5 will measure a maximum of 800 amps) on the first page of this direction book.

If the value you have calculated is **not** more than 10% higher than your calculation (using the above formula), the coil is correct.

If the calculated value is **more** than 10% higher than the value of the the coil rating, contact the Unitrol service department at 847-480-0115 to exchange this coil with the correct value.

Note that when a different current transformer is installed, this new value must be entered in PROGRAM 87/99 on the line:

I COIL CODE=###0

For example, a current transformer with a rating of 800:5 would be entered as 0800.

I COIL CODE=0800

B. TRANSFORMER TURNS RATIO

The SOLUTION calculates secondary welding current by multiplying the measured PRIMARY CURRENT (from the current transformer) by the welding transformer TURNS RATIO.

Therefore, to allow the SOLUTION to calculate **SECONDARY** current, the welding transformer TURNS RATIO must be entered. If the welding transformer has more than one transformer tap switch position, the TURNS RATIO for **each** position must be entered.

CALCULATING TRANSFORMER TURNS RATIO(S)

The TURNS RATIO can be calculated by dividing the transformer rated input LINE VOLTAGE by the SECONDARY VOLTAGE for each tap setting. This is done using the **nameplate** information on the welding transformer. Note that if your welder does not list these voltages on the nameplate, contact the welder manufacture for this data.

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

As an example, with transformer nameplate information of:

LINE VOLTAGE = 220

SECONDARY VOLTAGE = 3.2

$$\text{TURNS RATIO} = \frac{\text{LINE VOLTAGE}}{\text{SECONDARY VOLTAGE}} = \frac{220}{3.2} = 68.7$$

Rounded upward, **TURNS RATIO = 69.**

If your transformer does **not** have a tap switch, **calculate** the TURNS RATIO for your welding transformer. If it **does** have a tap switch, follow instructions below.

TRANSFORMERS <u>WITH</u> A TAP SWITCH:

If your transformer has **more than one** tap switch position, it will be necessary to calculate the TURNS RATIO for **each** position using transformer nameplate listing of minimum secondary voltage and maximum secondary voltage.

The TURNS RATIO for the #1 tap position will be:

$$\text{TURNS RATIO FOR TAP \#1} = \frac{\text{LINE VOLTAGE}}{\underline{\text{MIN.}}\ \text{SEC. VOLTAGE}}$$

The TURNS RATIO for the highest tap position will be:

$$\text{TURNS RATIO FOR HIGHEST TAP} = \frac{\text{LINE VOLTAGE}}{\underline{\text{MAX.}}\ \text{SEC. VOLTAGE}}$$

The tap switch positions between will be equally spaced. The value of TURNS RATIO for each step is calculated as:

$$\text{TURNS RATIO PER STEP} = \frac{(\text{TURNS RATIO \#1 TAP}) - (\text{TURNS RATIO TOP TAP})}{(\text{NUMBER OF TAPS} - 1)}$$

EXAMPLE:

Number of transformer taps = 4
CALCULATED TURNS RATIO of #1 tap position = 50
CALCULATED TURNS RATIO of #4 tap position = 35

$$\text{TURNS RATIO PER STEP} = \frac{50 - 35}{4 - 1} = \frac{15}{3} = 5$$

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

This would make the **TURNS RATIO** for each tap:

TAP #1= 50, TAP #2= 50 - 5 = 45, TAP #3= 45 - 5=40, TAP #4=45 - 5 = 35

Record these numbers for use later in the setup process.

****

IMPORTANT: If any TURNS RATIO is more than 99, do the following:

a. **DIVIDE** all calculated TURNS RATIOs by **2** for entry in steps below.

b. Press: **PROGRAM, 99, ENTER.** The display will show:

I COIL CODE=####

This is the number you entered earlier. **MULTIPLY** this number by **2** and enter it. For example if the COIL CODE was 400, enter **800.**

****

ONLY for controls with 9181-22**A** PRIMARY CURRENT, press: **PROGRAM, 97, 91, ENTER.** The display will show:

I ZERO = 500 A

Enter **000**, and the display will show:

I ZERO = 000 A

Press **ENTER** twice and exit this program.

****

SETTING CYCLE BLANKING (for PRIMARY & SECONDARY SYSTEMS):

Before measuring welding current, it is necessary to decide if any portion of the welding sequence is to be blanked. This procedure is usually necessary to produce more stable results since typically the first cycle of each weld involves INRUSH current, and stabilization of the electrode contact to the work piece. With **BLANKING** in the system, the SOLUTION will eliminate readings from the selected number of cycles when calculating welding current values.

To set BLANKING, press: **PROGRAM, 83, ENTER.** The display will show:

BLANK 00 CYCLES

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

Enter the desired number of WELD cycles. A typical number is 1 for a weld count of 1-4 cycles, and 2 for a weld count of over 4 cycles.

After the desired number has been entered, press ENTER, and this portion of the system will be ready.

The #9181-22A or #9181-22B options provide two modes of heat setting: CONSTANT VOLTAGE or CONSTANT CURRENT

****

CONSTANT VOLTAGE MODE

If the SOLUTION is set in **CONSTANT V** mode, all HEAT settings are in percent (ie. WELD HEAT = ##%). This utilizes the **digital** accuracy of the control to set the weld transformer output RMS voltage. In this mode, heat settings will be the same no matter what is happening in the welder secondary circuit. However secondary welding current will react to metal in the welder throat and metal thickness changes.

CONSTANT V mode works well with most welding sequences. It is normally **preferred** over CONSTANT CURRENT (see next section) for welding of projections or parts with very poor fit-up.

CONSTANT VOLTAGE mode **should** be used if your WELD TIME is **less** than 4 cycles. While it is possible to use the CONSTANT CURRENT mode with 3 cycles, the accuracy will be diminished.

If you use the control in CONSTANT CURRENT mode and have 1 or 2 cycles of WELD TIME, **no** compensation will occur.

One **advantage** of the CONSTANT VOLTAGE mode is that it does **not** depend on any analog feedback circuitry for setting heat levels.

Heat lines in each of the 75 PROGRAMS will be in percent:

PREHEAT ##%, UPSLOPE INIT=##%, WELD = ##%, DOWNSLOPE END=##%,
POSTHEAT = ##%, and TEMPER = ##%.

A setting of 99% will produce the maximum output of the welder at that transformer tap setting.

A setting of 50% will produce approximately 1/2 of the maximum output of the welder for that transformer tap setting.

****

CONSTANT CURRENT MODE

If the SOLUTION is set in **CONSTANT I** mode, all heat settings will be in amps. (ie. WELD I = 23000A). This means that a welding current value can be entered **directly** from a welding schedule chart. With

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

this mode of operation, the control utilizes either a primary current coil (option #9181-22A) or a secondary coil (option #9181-22B) to continuously measure current. Heat lines in each of the 75 PROGRAMS will be:

PREHEAT #####A, UPSLOPE INIT=######A, WELD = ######A, DOWNSLOPE END=#####A, POSTHEAT = #####A, and TEMPER = #####A.

CONSTANT CURRENT mode works well with most welding sequences. It is especially useful when welding steel in a **deep throat** welding machine. Since welding current is effected by the change in secondary impedance as metal moves in and out of the welder's throat (front to back), current in a CONSTANT VOLTAGE mode will vary, but CONSTANT CURRENT mode will produce **more uniform** results.

ACCURACY: Under normal circumstances, CONSTANT CURRENT mode produces secondary current RMS values that are within 1% of the range setting of the SOLUTION.

NOTE 1: CONSTANT **VOLTAGE** mode **should** be used if your WELD TIME is **less** than 4 cycles.

NOTE 2: Experience has shown that welding parts with **projections** produce **greater** weld strength **variations** using the CONSTANT CURRENT mode.

HOW CONSTANT CURRENT OPERATES

For PREHEAT, WELD, POSTHEAT, and TEMPER, the SOLUTION modifies the percent heat to match the selected AMP values in the PROGRAM being used. The system functions as follows:

1. At the start of each function (PREHEAT, WELD, etc.), the SOLUTION selects a percent heat value from a "learned" look-up table (to be explained later). This allows the electrodes to fully "seat" on the metal and produce a stabilized current reading without any "hunting".

2. At the end of 1-1/2 cycles, the current is read and compared to the program selected value. The percent heat for the next 1/2 cycle firing is then modified in proportion to the error. This is called CLOSED LOOP FEEDBACK.

3. This procedure is repeated at the start of every full cycle to be sure that your welding transformer will not go out of balance (saturation).

4. At the end of the weld, the display will show the average RMS current during the WELD TIME **only**. This is a check of the system and stability of the secondary welder circuit. If the SOLUTION cannot reach or hold the selected amperage, a diagnostic will be displayed to explain the problem.

****

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

SELECTING HEAT SETTING MODE

To select the desired mode, press: **PROGRAM, 97, ENTER, 11**. The display will show:

CONSTANT V MODE	or	CONSTANT I MODE

CHANGE1=YES,0=NO

If the desired mode **is** shown, press **0** to **not** change.
If the desired mode is **not** shown, press **1** to change.

This mode can be changed at **any time** desired.

If previous programs were set while the SOLUTION was in the CONSTANT V mode, each heat line will be shown as 00000A and require setting.

Both modes can use the UPPER CURRENT and LOWER CURRENT quality control feature as described at the end of this option section.
****

TEACHING YOUR SOLUTION ABOUT CURRENT

CARE IN DOING THIS INITIAL "LEARN" PROCEDURE WILL ENSURE THAT YOUR SOLUTION CONTROL WILL PERFORM ACCURATELY FOR YEARS TO COME! PLEASE TAKE YOUR TIME

IMPORTANT: Be sure your SOLUTION is in the CONSTANT I (constant current) mode before starting the "LEARN" procedure. To check, press: **PROGRAM, 97, ENTER, 11**. The display will show:

CONSTANT V MODE	or	CONSTANT I MODE

CHANGE1=YES,0=NO

If CONSTANT I **is** shown, press **0** to **not** change.
If CONSTANTV mode is **not** shown, press **1** to change.

Before you can start using CONSTANT CURRENT, your SOLUTION must "learn" how your particular welder responds to different heat percent settings. **BECAUSE THE SOLUTION LEARNS EACH OF THE WELDER'S TAP SWITCH POSITIONS, THIS PROCEDURE ONLY HAS TO BE DONE WHEN YOU FIRST INSTALL THIS CONTROL.**

WHAT ARE YOU WELDING?

Most applications involve welding of sheetmetal or cross wires. In this case, the "learn" process can be done with the factory default

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

method. However, if you are welding **very small** parts, **fusing** parts with tungsten or other heating electrodes, or **annealing long parts** (springs, etc.), you must switch the SOLUTION to a special "teach" mode.

This mode only passes a few cycles of current at each location on the part. On annealing of long springs, this allows the use of a cold part for each learn point. With the fusing process using heating electrodes, this allows the electrodes to cool down between "learn" samples.

If you are not using this process for one of the above types of parts, skip to step #1 below.

ONLY if you are using this process of one of the above types of part, change the "learn" mode by pressing: PROGRAM, 97, ENTER, 93. The display will show:

TEACH GROUP

CHANGE1=YES,0=NO

Press **1** to change, and the display will briefly show:

TEACH SINGLE

To start the "TEACH" process, do the following:

1. If you have the #9181-22A PRIMARY CURRENT option, be sure you have calculated all TURNS RATIO numbers as shown on page U-23.

2. Place the transformer tap switch (if it exists) on position #1.

3. Set the air pressure on your weld head regulator to about 75 psi. or to the highest pressure that your electrodes can support. Note that if your control has the #9181-16 Electronic Pressure Regulator option, this value will be set in step 9 below.

4. Install a clean set of electrodes in the welder and be sure they are properly aligned and dressed.

   IMPORTANT CAUTION: The SOLUTION will be operating as high as 80% heat for a short number of cycles. Be sure that the electrodes have a large enough contact area to support the maximum current possible on your welder! Using electrodes that are too small can cause major expulsion and possible welding together of the electrodes.

5. **Be sure that you are wearing an approved set of safety glasses.**

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

6. Select a part or metal sheet combination that represents a typical part that will be welded in this machine. If a large range of metal thickness combinations will be joined in this welder, select a combination that falls in the middle. This metal will be used later in step 12.

7. Measure the incoming line voltage to the welder with a meter. **This number will be used in step 9 below.** Note that absolute accuracy is not critical in this measurement. It is used for a base line only.

SETTING NUMBER OF TRANSFORMER TAP POSITIONS

8. Turn the control on. After diagnostics have been completed, press: **PROGRAM, 97, ENTER, 21.** The display will show:

TOTAL TAPS = 0

CHANGE1=YES,0=NO

Press **1** to change, and then enter the number of welder TAP SWITCH positions. If the transformer does **not** have a TAP SWITCH, enter 1. Then press **ENTER.**

****

FOR CONTROLS WITH PRIMARY CURRENT COIL, OPTION #9181-22A

If your control has been supplied with the #9181-22B **secondary current** option using an external current pickup coil, skip to step 9 on the next page.

If your control has been supplied with the #9181-22A **primary current** option with a single PRIMARY current pickup coil mounted inside the enclosure, the display will now show:

TURNS RATIO 50	if TOTAL TAPS =1

OR

TURNS R=50,TAP#1	if TOTAL TAPS = 2-9

CHANGE1=YES,0=NO

Press **1.** For a transformer **without** a tap switch, enter the TURNS RATIO as calculated on page U-23. For transformers **with** a tap switch, enter the TURNS RATIO for tap switch **position #1** as calculated on page

U-23. Press ENTER. If TOTAL TAPS is greater than one, the display will now show:

TURNS R=50,TAP#2

CHANGE1=YES,0=NO

Press **1** and enter the TURNS RATIO for **position #2** as calculated on page U-23, and press ENTER. Continue this procedure until the last TURNS RATIO has been entered. Then press ENTER.

****

9. If your SOLUTION control contains the #9181-16 Electronic Pressure Regulator option, the display will show the following. If this option is not installed, skip to step 10.

AIR PRES.=75 PSI

CHANGE1=YES,0=NO

If you do **not** change this line, the electronic pressure regulator will automatically be set to 75psi for this setup procedure. If this is too high for your electrodes, press **1** and enter the highest pressure your electrodes can support. Then press **STEP**.

SETTING Automatic Voltage Compensation BASELINE

10. The display will now show:

VOLT CALIBRATION

SYSTEM VOLT.=###

CHANGE1=YES,0=NO

This is used to set a baseline for the Automatic Voltage Compensation system. Press **1** and the display will now show:

SYSTEM VOLT.=---

Enter the line voltage measured in step 7 above.

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

11. Press ENTER, and the display will show:

SET TRANS.TAP #1
PLEASE INITIATE

12. Place the metal combination from #6 above between the electrodes. If this is a deep throat welder and you are working with a large sheet of metal, place the metal about half way back into the welder's throat.

13. Initiate the welder by pressing **AND HOLDING** the foot switch or hand buttons. The **electrodes will close** and the display will show:

KEEP INIT CLOSED
READING VOLTAGE

CONTINUE TO KEEP THE FOOT SWITCH OR HAND BUTTONS CLOSED. After about 2 seconds, the display will show:

REFER. VOLT.=###

indicating that the system has set the AVC baseline.

****

NOTE: If the foot switch or hand buttons have been opened at this time, the process will be stopped and the display will show:

SET-UP ABORTED

If this is the case, start again step #8 above.

****

14. **Continue to keep the foot switch or hand buttons closed.** The display will now show:

MEMORIZING DATA

TEACH GROUP MODE: If the SOLUTION is in the factory default "**TEACH GROUP**" mode (see page U-28), the SOLUTION will fire the welder for a few cycles at **different** heat levels with dwell time between levels. After it has "learned" the reaction of TAP SWITCH POSITION #1, the electrodes will open and the display will show:

RELEASE INITIAT.

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

Now release the foot switch or hand buttons. NOTE: It is **not** important if the parts between the electrodes actually are welded after this procedure.

****

SINGLE GROUP MODE: If you have selected the "**SINGLE GROUP**" mode in PROGRAM 87/93 (as set on page U-28), the SOLUTION will fire the welder for a few cycles at **only one** heat level of TAP SWITCH POSITION #1. After it has "learned" the reaction of this one heat level, the electrodes will open and the display will show:

RELEASE INITIAT.

now release the foot switch or hand buttons. NOTE: It is **not** important if the parts between the electrodes actually are welded after this procedure.

The display will now show:

SET NEW PART

Install a new part (or move part to a new weld or fusing location). For annealing of springs, you can plunge the spring into water and do all "learn" steps on the same part.

If a heating type electrode (molybdenum, etc.) is being used, allow the electrode to go back to room temperature.

Now repeat the "LEARN" sequence above four more times.

****

15. If the TOTAL TAPS number entered earlier is greater than 1, the display will now show:

SET TRANS.TAP #2 PLEASE INITIATE

a. Set the welder tap switch to position #2

b. Move the metal part to a new position

c. Close the foot switch or hand buttons

16. Repeat until the last TAP position has been "learned".

17. If you suspect that any of the above steps was not done correctly, press: **PROGRAM, 97, ENTER, 21** and start at TAP SWITCH #1 again.

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

AVC FUNCTION

The AVC (Automatic Voltage Compensation) system will now be automatically turned **ON**.

For the first 3-1/2 cycles of each weld, the SOLUTION will find the recommended %HEAT value from the electronic SET-UP chart generated above. It will then modify this value by the deviation from the baseline AVC setting.

READING THE "LEARN" PROGRAM RESULTS

At this time your SOLUTION has "learned" what each TAP SWITCH position can produce. To check these readings, press: **PROGRAM, 97, ENTER, 31.** The display will show:

TRANSF. TAP #1 HEAT 40%-##,###A

This says that when the welder was set with the tap switch in position #1, a 40% heat setting produced ##,### amps of secondary current.

By pressing the **STEP** button, you will be able to view how the SOLUTION responded to 40%, 50%, 60%, 70%, 80%, and 90% settings for each welder tap switch position. If you want to exit out before viewing the last tap switch readings, press SINGLE.

Record the values at 60% and 90% of each TAP SWITCH position for use later.

****

NOTE: If your SOLUTION contains the #9181-21A printer port or #9181-21B built-in printer, press **PROGRAM, 97, ENTER, 41** and the set of LEARN TABLES will be printed.
****

USING CONSTANT CURRENT IN PRODUCTION:

Before using this feature in production, be sure that you have the upper row of the display turned on so that current values can be read. This will not effect the operation of the welder, but will allow visual confirmation of the welding current being produced.

To do this, press: **PROGRAM, 84, ENTER.** The display will show:

I READ ONLY =1

or

I READ & REACT=2

or

I READ OFF = 3

CHANGE1=YES,0=NO

SOLUTION #9180
DIRECTIONS FOR USE
PAGE U-34

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

At this time, be sure that the SOLUTION is in the **I READ ONLY = 1** mode. If any other mode is shown, press **1** (to change), and then press **1** to select this mode.

1. Select a welding program (01-75) that will be loaded by pressing: **PROGRAM, ##, ENTER.** Enter desired values including WELD CYCLES and WELD CURRENT (in amps). If you are using PREHEAT, UPSLOPE, DOWNSLOPE, POSTHEAT, or TEMPER, also enter these values.

   NOTE: If you are using an RWMA or other welding chart, you can enter the numbers directly as shown for the material and thickness being welded. However remember that these values are starting points and also depend on the electrode shape. Some common welding charts are included in the back of this direction book.

2. Enter the desired TIP FORCE or SQUEEZE TIME as would be normally done in any welding program.

3. Check the welding current (WELD I) value against the "learn" chart in PROGRAM 97/31 as shown above. Set the WELDER'S TAP SWITCH to a position that puts this desired welding current between 60% and 90%. If you do **not** select a tap switch position that falls in this range, the SOLUTION will, as shown below, recommend that you go to another transformer tap switch position.

4. Step down the program to the line:

TRANSF. TAP # 0

   Enter the number that matches the WELDER'S TAP SWITCH position. If there is no TAP SWITCH on the welder, enter **1**.

   IF THESE NUMBERS DO NOT MATCH, THE CONTROL WILL LOOSE CONSTANT CURRENT ACCURACY.

5. After the desired program has been entered, press **SINGLE**. If the WELD I value selected does **not** require a heat setting of less than 60% or greater than 90%, it will be set for welding.

   However **if** the value of WELD I selected calls for a heat setting **less than 60%** or **greater than 90%**, the display will recommend that you change tap positions with one of the following displays:

ATTN: WELD I SET TOO LOW!	USE LOWER TAP

   or

ATTN: WELD I SET TOO HIGH	USE HIGHER TAP

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

****

WHY SHOULD YOU SET BETWEEN THESE RANGES?

A. **ABOVE 90%:** If the control is set **above** 90%, there not be enough "headroom" to compensate for a large drop in line voltage (AVC system) or extra metal in the welder's throat.

B. **BELOW 60%:** This is a little more complicated to understand.

A welding control adjusts heat using PHASE SHIFT technology. This means that as you lower the heat%, less time of each half cycle is used to heat the metal, and more is used as non-heating time. If the control is set **below** 60%, the lower ON time in each half cycle can have an effect on the weld quality and ductility. While it is possible to weld at very low percents, the results are not ideal and should be avoided if possible.

****

6. **FOR BEST RESULTS**, change the tap switch setting to match the display request.

AT THE SAME TIME, BE SURE TO CHANGE THE PROGRAM LINE: **TRANSF. TAP #** TO MATCH THE SWITCH SETTING.

While it is not suggested, **you can ignore** the recommendations and start welding without changing the tap switch setting. Obviously if you are on the last tap position and cannot follow the recommendation, just weld.

****

To turn OFF this warning system, press: **PROGRAM, 97, ENTER, 72**. The display will show: **TAP FAULT ON, CHANGE 1=YES, 0=NO**. To turn this function OFF, press **1**, and the display will show: **TAP FAULT OFF**.

****

DIAGNOSTICS DURING A WELD

When a weld is made, the SOLUTION will try to match your program values of current. If, because of the welder's response, the selected value of current **cannot** be reached, the display will show one of several diagnostics:

A. **VALUE OF CURRENT IN PROGRAM REQUIRES OVER 99% HEAT SETTING:**

This can happen when the welding current selected requires more than 99% (full output) of this transformer tap switch position. The SOLUTION will go to 99% for the balance of the weld, and then display:

CURRENT ##,### A TRY FOR OVER 99%

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

B. **VALUE OF CURRENT IN PROGRAM REQUIRES CONTROL TO GO PAST MAXIMUM SAFETY VALUE:**

The SOLUTION has a maximum heat increase level to prevent reaching for high heats when welder cables or shunts become loose or start to break. This also protects the system should a failure occur in the SOLUTION'S current measurement system. When this happens, the display will show:

CURRENT ##,### A
LIMIT-PRG. 97/81

This means that the MAXIMUM SAFETY value in program 97/81 has been exceeded. The factory default is 20%. While it is not recommended, this value can be changed by pressing: **PROGRAM, 97, ENTER, 81** and changing the value displayed.

C. **THE CURRENT COIL HAS BECOME DISCONNECTED, OR THE CURRENT MONITOR AMPLIFIER CIRCUITRY HAS MALFUNCTIONED:**

In this case, the SOLUTION, seeing no valid current input, will strictly use the "learn table" value for the WELD I value in the PROGRAM and use no feedback process. The control will now be in CONSTANT VOLTAGE mode. After each weld has been completed, the display will show:

CURRENT 00,000 A
NO CURRENT INPUT

CURRENT WINDOW QC SYSTEM

There is one more quality control feature in the SOLUTION. This will act as a check on the constant current system. There are two lines in each program to set HIGH and LOW current limits.

If the current being measured (during the WELD TIME portion only) falls out of this selected window, the control can be set to keep the electrodes closed and require closing of the foot or hand switch to release and reset the system.

NOTE: THE SOLUTION SOFTWARE EXCLUDES CURRENT MEASUREMENT DURING ALL OTHER RWMA FUNCTIONS (PREHEAT, UPSLOPE, DOWNSLOPE, POSTHEAT, AND TEMPER). THIS VALUE IS A MORE USABLE NUMBER THAN THAT MEASURED ON PORTABLE CURRENT MONITORS ("WELD CHECKERS") AND CAN BE COMPARED TO THE VALUES ON WELDING CHARTS DIRECTLY.

THE VALUES MEASURED BY THE SOLUTION WILL TYPICALLY BE HIGHER THAN THOSE ON PORTABLE CURRENT MONITORS IF ANY RWMA FUNCTION IS USED BECAUSE THESE OTHER CYCLES ARE NOT AVERAGED INTO THE SOLUTION'S CALCULATION BUT WILL BE AVERAGED IN A TYPICAL CURRENT MONITOR SYSTEM.

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

SETTING CURRENT WINDOW LIMITS

Each program has a setting for UPPER and LOWER current limits. Do the following for each welding schedule that is being used:

1. To set the control for reading current, press: **PROGRAM, 84, ENTER.** The display will show:

I READ ONLY =1	or	I READ & REACT=2	or	I READ OFF = 3

CHANGE1=YES,0=NO

If the control is **not** in **I-READ ONLY = 1** mode, Press **1** (to change), and then press **1** to select **I-READ ONLY** mode.

2. Set the desired starting welding schedule into any of the 75 programs. Make welds on coupons and adjust settings until an acceptable weld has been achieved. For the moment, ignore the lines in the program that show HIGH I and LOW I settings.

3. The average RMS current of the weld will be displayed on the upper readout after each sequence has been completed. Make several welds to be sure that this number is reasonably constant.

4. Decide on the allowable limits of current above and below that observed in step #3 above. To do this:

   a. Make welds as you continue to **LOWER** the WELD HEAT % or WELD-I (current) setting in 1% steps until the weld has **fallen below** minimum desired strength. **Increase** the displayed current value sightly and write down this number as the **LOW I** (low current) number in that program.

   b. Now go back to the original WELD HEAT% or WELD-I setting and start **RAISING** it in 1% steps until metal **expulsion** has started. **Lower** this value slightly and write down this number as **HIGH I** (high current) in the program.

Typically, when welding under 10,000 amps, a variation of +/- 400 amps is reasonable. On higher current welding, a range of +/- 700 amps is reasonable.

5. Now press the STEP button until the display shows:

HIGH I = 00000 A

Enter the HIGH I value from step 4 above. Note that the right hand **0** will not change. Be sure that the number displayed is as desired.

6. Now press the STEP button one more time and the display will show:

LOW I = 00000 A

Enter the LOW I value from step 4 above.

7. Now press SINGLE, and these values will be in the system.

USING CURRENT WINDOW QC SYSTEM IN PRODUCTION

The following procedure utilizes the current comparison QC system during production.

1. Press: **PROGRAM, 84, ENTER** and the display will now show:

I-READ ONLY

CHANGE1=YES,0=NO

Press **1**, and the display will show:

I-READ ONLY = 1

I-READ & REACT=2

I-READ OFF = 3

Press 2 and the control will be in the READ & REACT mode.

2. Now enter the weld schedule used earlier and start welding. As each weld is made, the system will show the current as averaged over the WELD portion of each sequence.

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

NOTE: When the READ & REACT function is active in the SOLUTION, an "*" (see arrow) will show on the upper right corner of the display as in the example:

```
CURRENT 07,500A* ←
00224 WELDS MADE
```

This confirms that the control is in the **READ & REACT** mode.

IF THIS "*" IS NOT SHOWN BUT CURRENT READINGS ARE SHOWN, THE SYSTEM IS IN **READ ONLY MODE** AND **NO FAULT INDICATION WILL BE MADE UNDER ANY CIRCUMSTANCES**.

FAULT RESET MODES

3. If the current, as shown on the upper display, is **ABOVE** or **BELOW** that in the weld schedule, one of three things will happen:

   a. If **PROGRAM 82** is set for **FAULT RESET MODE: KEYPAD & INIT.=1**, the electrodes will remain closed until **either** the initiation (foot switch, hand buttons) is released and closed again **or** any numbered button on the keypad has been pushed.

   b. If **PROGRAM 82** is set for **FAULT RESET MODE: KEYPAD & LOCK=2**, the electrodes will remain closed until the keylock is in the **OPEN** position, **and** any numbered button on the keypad has been pushed. This is the mode that can be used to require supervisor reset of a fault.

   c. If **PROGRAM 82** is set for **FAULT RESET MODE: AUTOMATIC = 3**, the electrodes will **not** remain closed and the system will beep momentarily and reset for the next weld.

FAULT OR ACCEPT RELAY SYSTEM:

Your SOLUTION has been supplied with an output relay that can be configured to close on either a FAULT or ACCEPT sequence. This relay can be changed to an **END OF HOLD** signal by moving a jumper plug on the power supply from **FAULT** to **EHR** (End Of hold Relay).

To configure the desired relay mode, press **PROGRAM, 85, ENTER**. The display will show:

```
FAULT RELAY
CLOSE ON REJECT
```

```
FAULT RELAY
CHANGE1=YES,0=NO
```

In this mode, the relay will close when a FAULT condition is detected. If you are in MAN. FAULT RESET mode, the relay will stay closed until the system has been reset. If you are in AUTO FAULT RESET mode, the relay will close for about 1/4 second and reset automatically. **To maintain this mode, press 0.**

#9181-22A AND #9181-22B
CONSTANT CURRENT / CONSTANT VOLTAGE / CURRENT COMPARE OPTION

ACCEPT MODE: If you would like this relay to close when **all** conditions <u>being sampled</u> are within the customer <u>selected</u> windows (CURRENT, FORCE, LINE VOLTAGE), press **1** to change this mode. The display will briefly show:

FAULT RELAY CHANGE1=YES,0=NO

In this mode, the relay will close for about 1/4 second when a **no FAULT conditions are detected.**

RELAY CONTACT CONNECTIONS:

If you are connected to terminals **C** and **NO**, a FAULT or ACCEPT (as configured) will momentarily act as a **closed** switch.

If connection is to terminals **C** and **NC**, a FAULT or ACCEPT (as configured) will momentarily act as an **open** switch.

4. **TURNING CURRENT READING OFF:** If it is desired to turn the current reading system **OFF**, press: **PROGRAM, 84, ENTER**

The display will now show:

I-READ ONLY

CHANGE1=YES,0=NO

Press **1**, and the display will show:

I-READ ONLY = 1

I-READ & REACT=2

I-READ OFF = 3

Press 3 (I READ OFF). In this mode, the welder will continue to operate, but no current values will be shown on the upper display. Comparison of welding current to the HIGH I and LOW I values will **not** be functional.

In this mode, **no QC function will be in operation.** However CONSTANT CURRENT mode will still be operational.

SOLUTION #9180
DIRECTIONS FOR USE PAGE U-41
WELDING STEPPER OPTION #9181-15

PURPOSE: To allow extended number of welds between tip dressing. It can also be used as a BATCH COUNTER without heat increase (counts to preset number of WELDS and stops).

INSTALLATION: Must be installed at factory at time of purchase, or can be added at any time by returning console to factory.

THEORY: As welding starts on a clean set of electrodes, the surface resistance is relatively low. As welding continues, the electrode surfaces become contaminated with material pick-up and surface resistance is increased. Since the welding transformer is supplying a fixed voltage output, the current between the electrodes (through the work pieces) decreases as this resistance increases. Thus, the weld becomes weaker as production continues.

When welding coated materials, such as galvanized steel, this problem increases. For example, in welding galvanized steel, the zinc in the coating alloys with the copper of the electrode to form a layer of brass on the electrodes. Brass has a poorer conductivity than copper and therefore causes lower current through the work piece resulting in weaker welds.

FUNCTION: The #9181-15 WELDING STEPPER option uses a computer generated chart to increase the welding heat % as welding continues to compensate for the conditions stated above.

OPERATING DIRECTIONS:

A. Press PROGRAM 88. If **ACCESS DENIED** is displayed, see INSTALLATION directions above.
B. The following steps should be used to set stepper:

STEP	PRESS	CONTROL WILL DISPLAY
1.	PROGRAM	PROGRAM --
2.	88	PROGRAM 88
3.	ENTER - -	WELDS LEFT #### RESET STEPPER? PRESS: 1=YES, 0=NO
4.	0 or 1 - -	if 1, WELDS LEFT = 0000 HEAT STEPPER ON (or OFF) CHANGE 1=YES, 0=NO
5.	0 or 1 - - -	if 1, HEAT STEPPER OFF (or ON) if 0, HEAT STEPPER ON (or OFF) TOTAL WELDS = #### CHANGE 1=YES, 0=NO
6.	1 or 0	if 1, TOTAL WELDS = ####
7.	1-9999	TOTAL WELDS = 0001 TO 9999
8.	ENTER - 0 or 1	MAX. INCREASE = ##% CHANGE 1=YES, 0=NO if 1, MAX. INCREASE = ##%
9.	01 TO 30	MAX. INCREASE = 01%-30%
10.	ENTER -	HEAT STEPPER ON PROGRAM ## READY

If system is working under **NO WELD** conditions, the heat stepper will not index.

If the system is working under **WELD** conditions, the stepper will increase the percent heat of all functions on a predetermined curve until the customer selected number of welds has been completed. At that time, the **SOLUTION** control will display **PLEASE DRESS TIPS**, sound a warning tone, and lock-out the system.

TO RESET SYSTEM, Push any button on the console ONCE. This will reset the stepper counter to zero, set the percent heat to the original setting, and allow welding.

CALCULATION OF SETTINGS:

1. To determine proper settings, make a full run of welds using production material with the heat stepper turned off.

2. During the run, increase the percent heat as necessary to maintain acceptable welds. Weld (without tip dressing) until a practical limit has been reached. On coated metals, this is typically between 1,000 and 3,000 welds.

3. After the last, weld note the **QUANTITY** of welds made and the last % heat **INCREASE** over the original setting. These two numbers are to be used in steps 7 and 9 above.

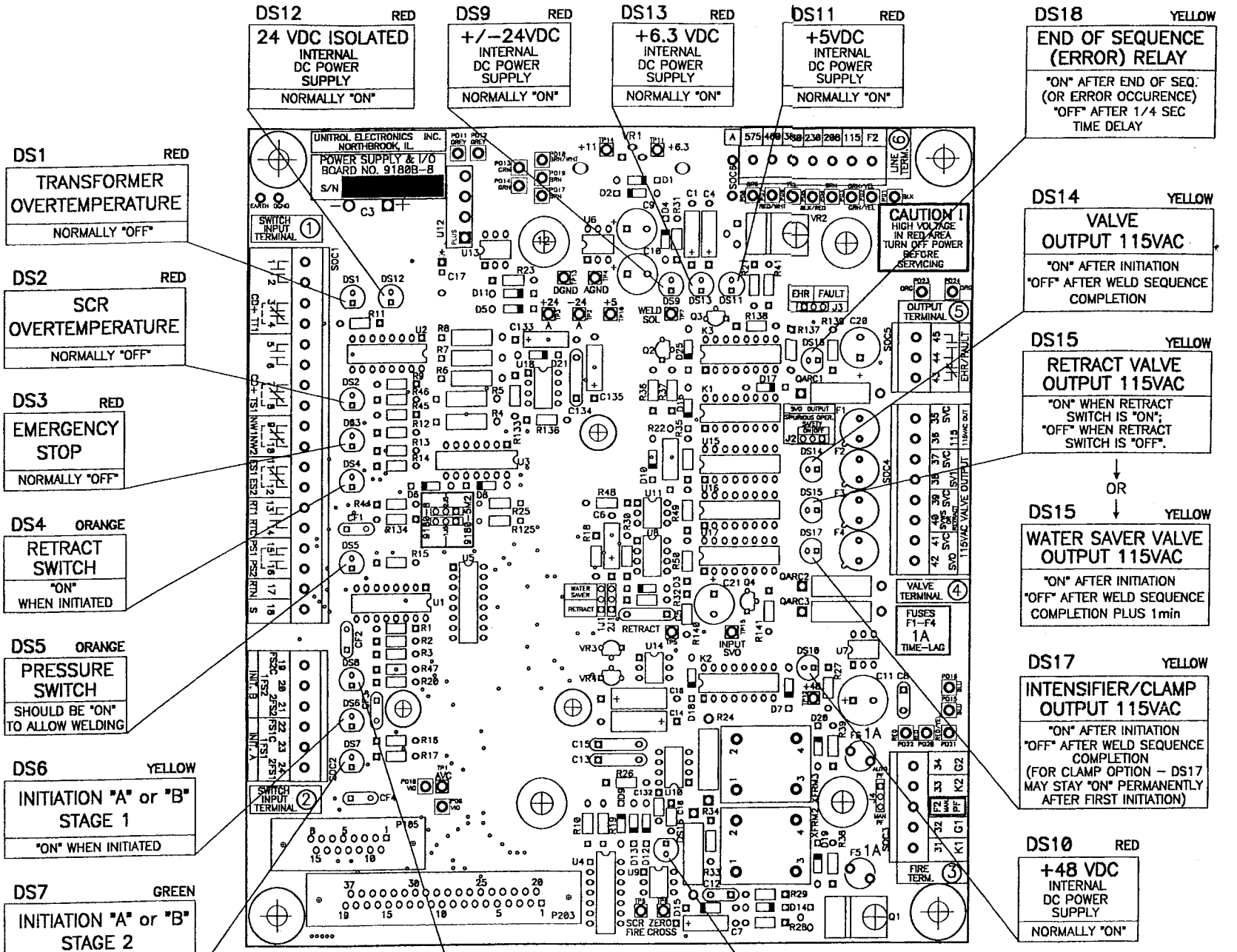
CHECK WELDS LEFT:

If at any time it is desired to find the number of welds left before completion of the selected quantity, press **PROGRAM, 88, ENTER**, and the control will display **WELDS LEFT ####**. To continue without changing, press **SINGLE** or **REPEAT**.

RESET STEPPER:

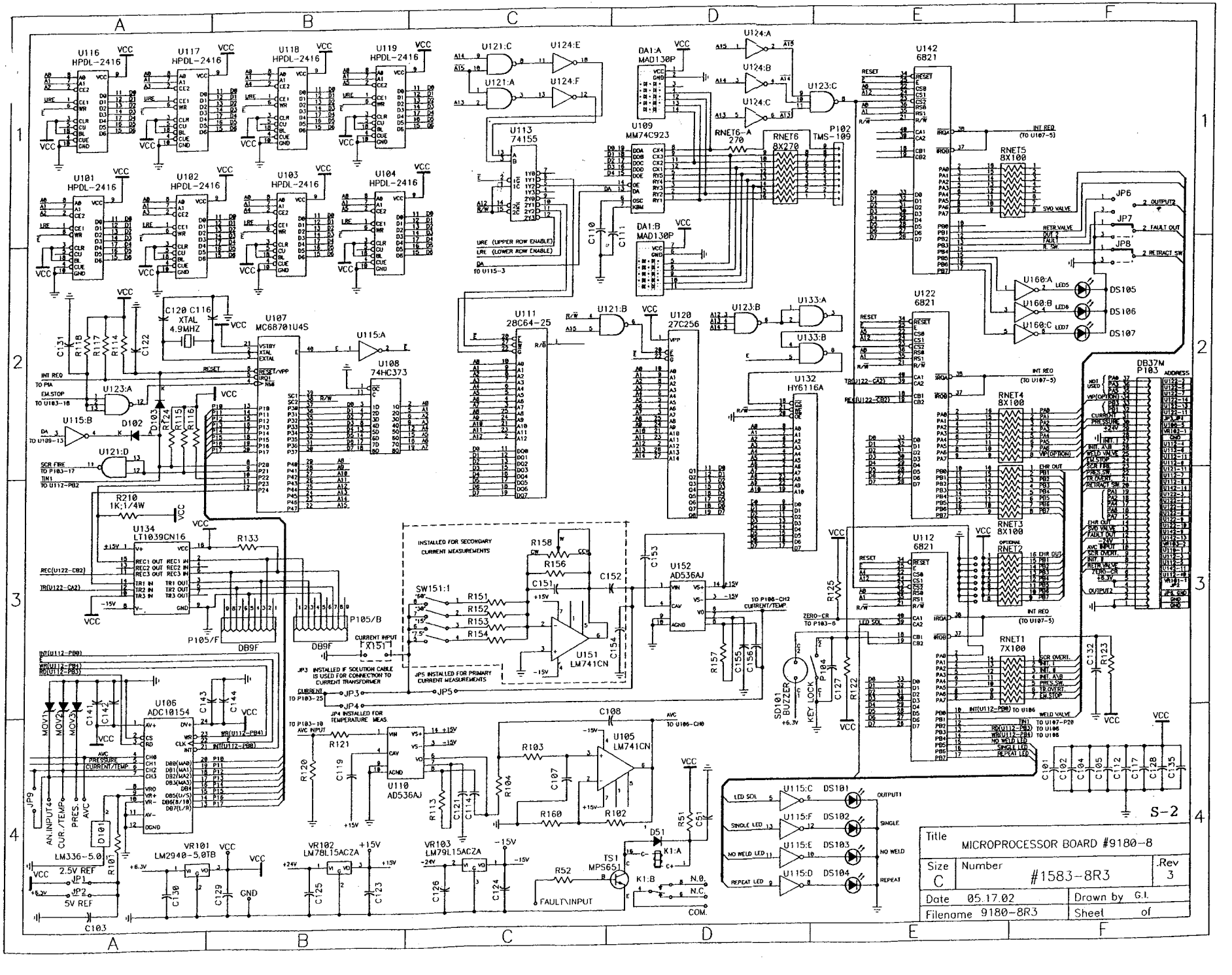
To reset at any time, press **PROGRAM, 88, ENTER**, and wait until the display shows **RESET STEPPER?**. Press #1. This reset may be used when a new electrode is installed before completion of the selected quantity of welds, or it is decided to dress the tips prior to completion of the selected quantity of welds.

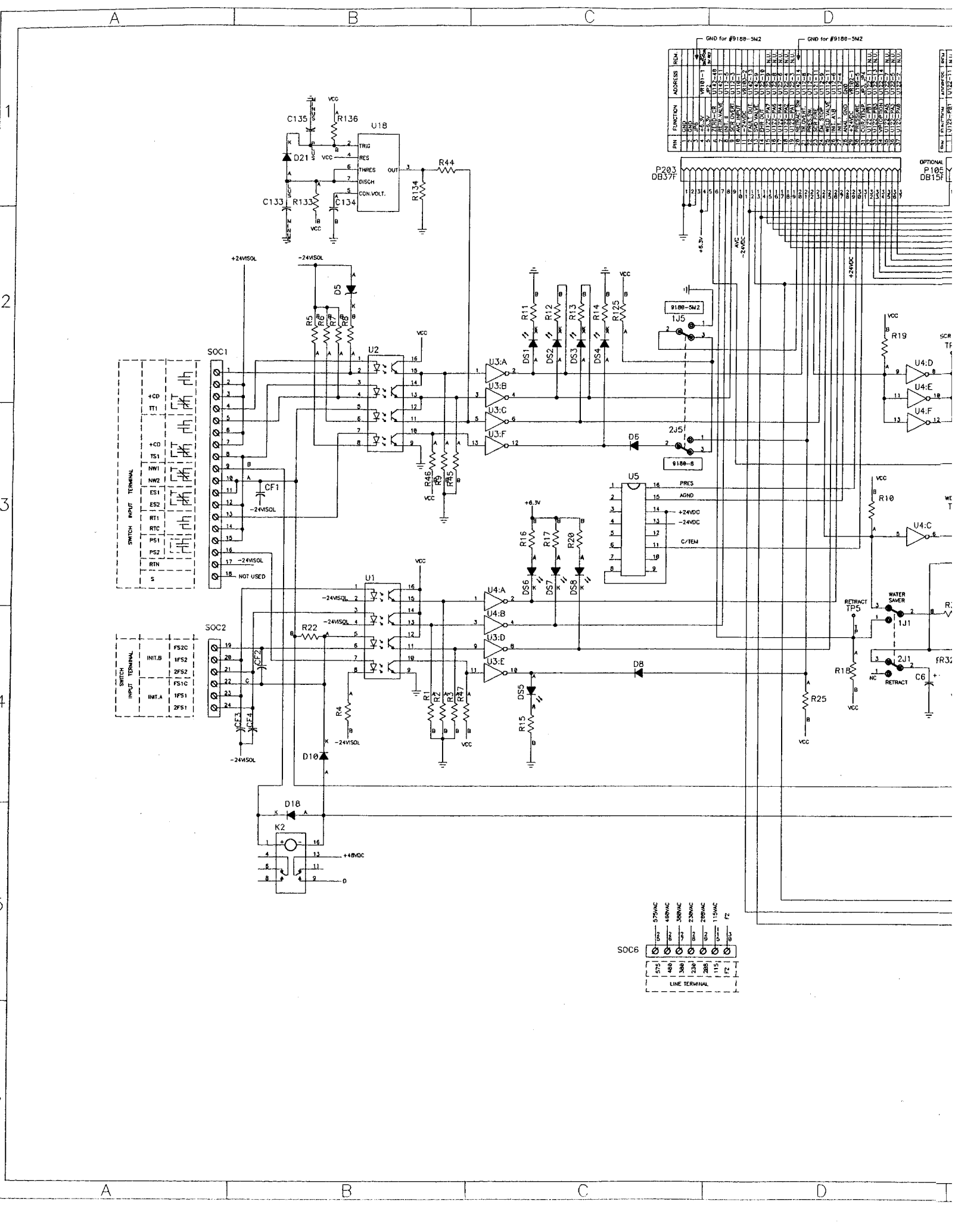
SERVICE INFORMATION

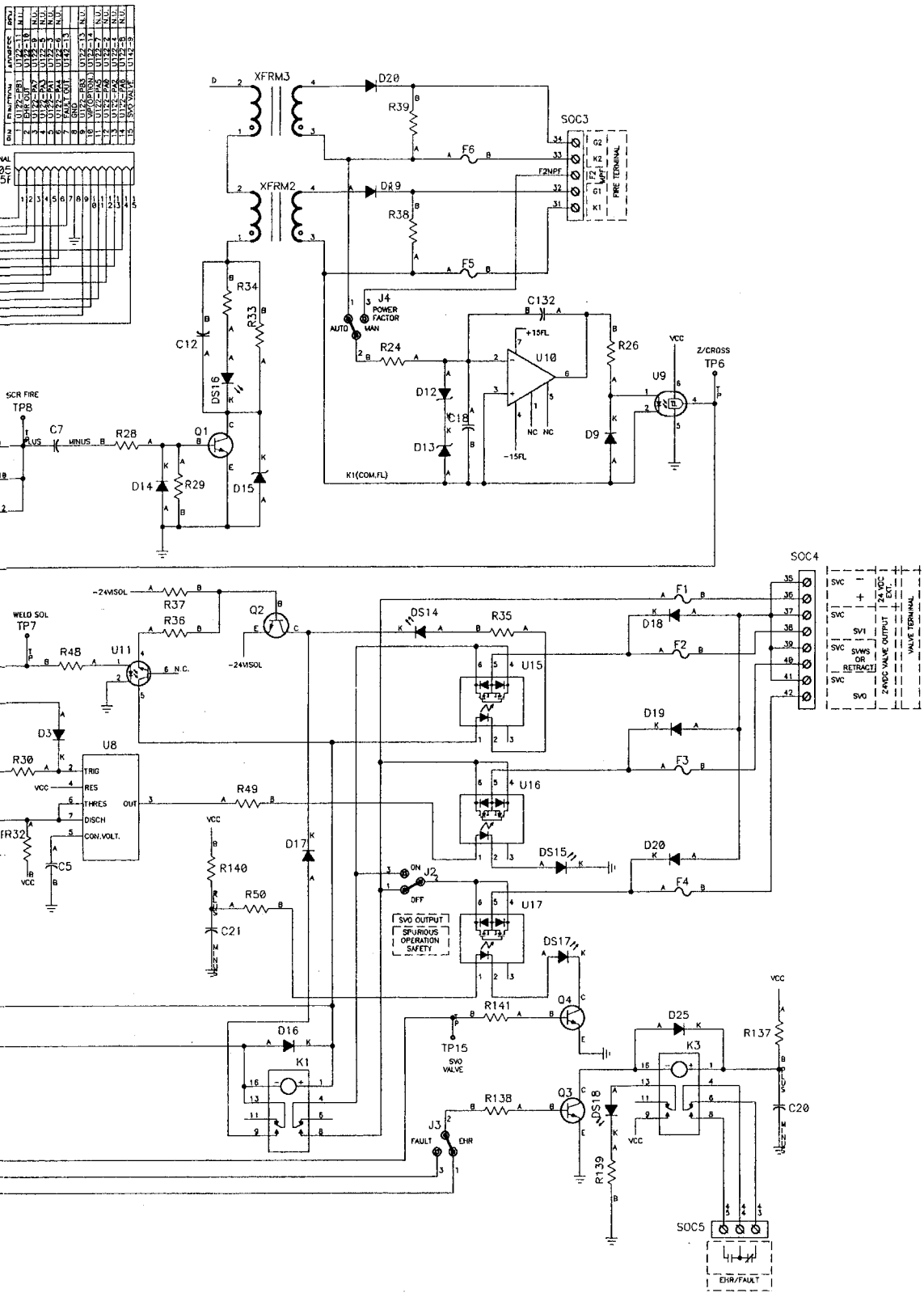


S-1

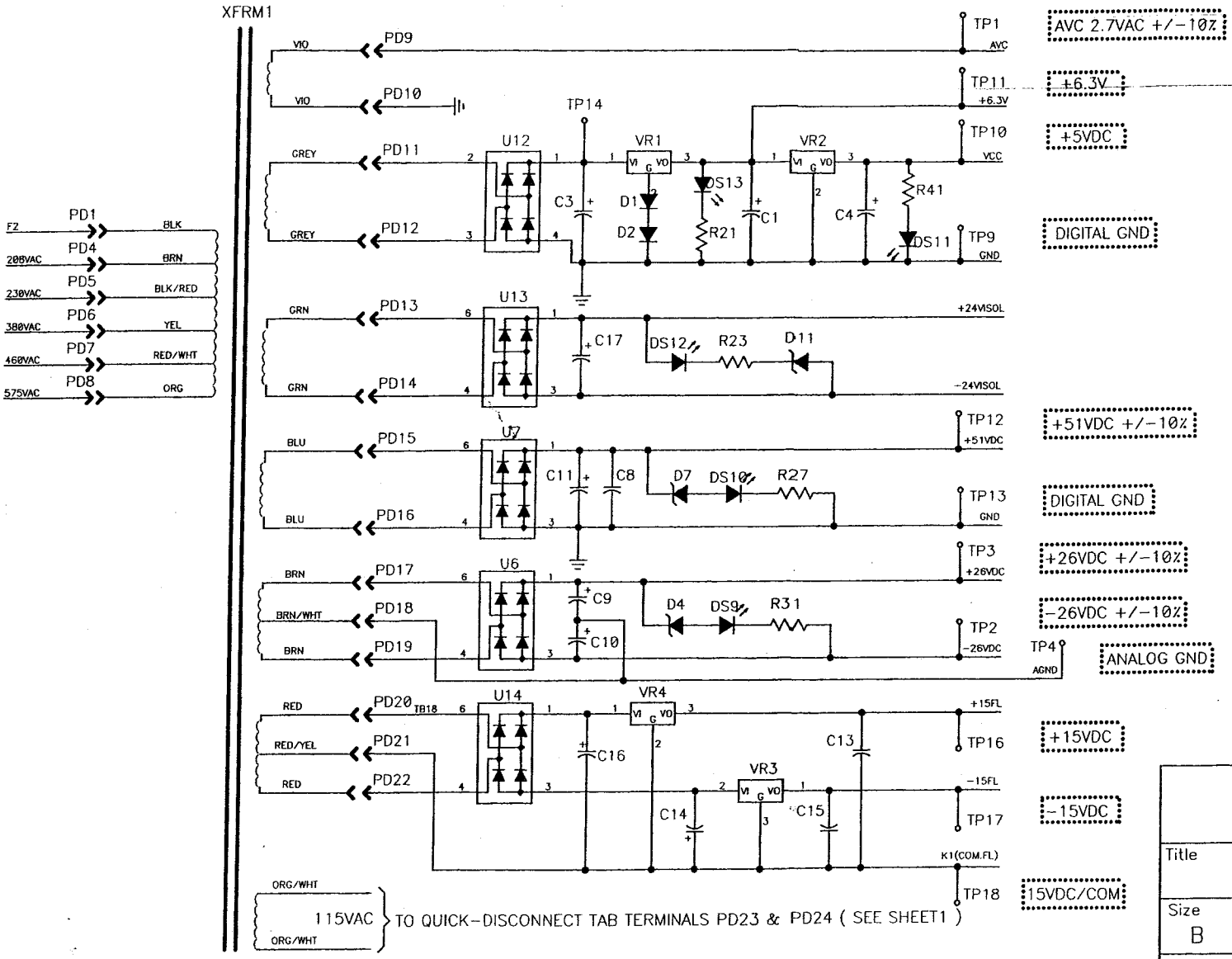
UNITROL ELECTRONICS INC. 702 LANDWEHR RD. NORTHBROOK, IL 60062		
Title	POWER SUPPLY & I/O BOARD #9810B-8 LED INDICATORS	
Size	Number #1811-L	Rev 3
Date 03.16.99	Drawn by G.I.	
Filename 9180B-8L.PCB	Sheet 1 of 1	


Title
MICROPROCESSOR BOARD #9180-8
Size
C
Number
#1583-8R3
Rev
3
Date
05.17.02
Drawn by
G.I.
Filename
9180-8R3
Sheet
of
S-2

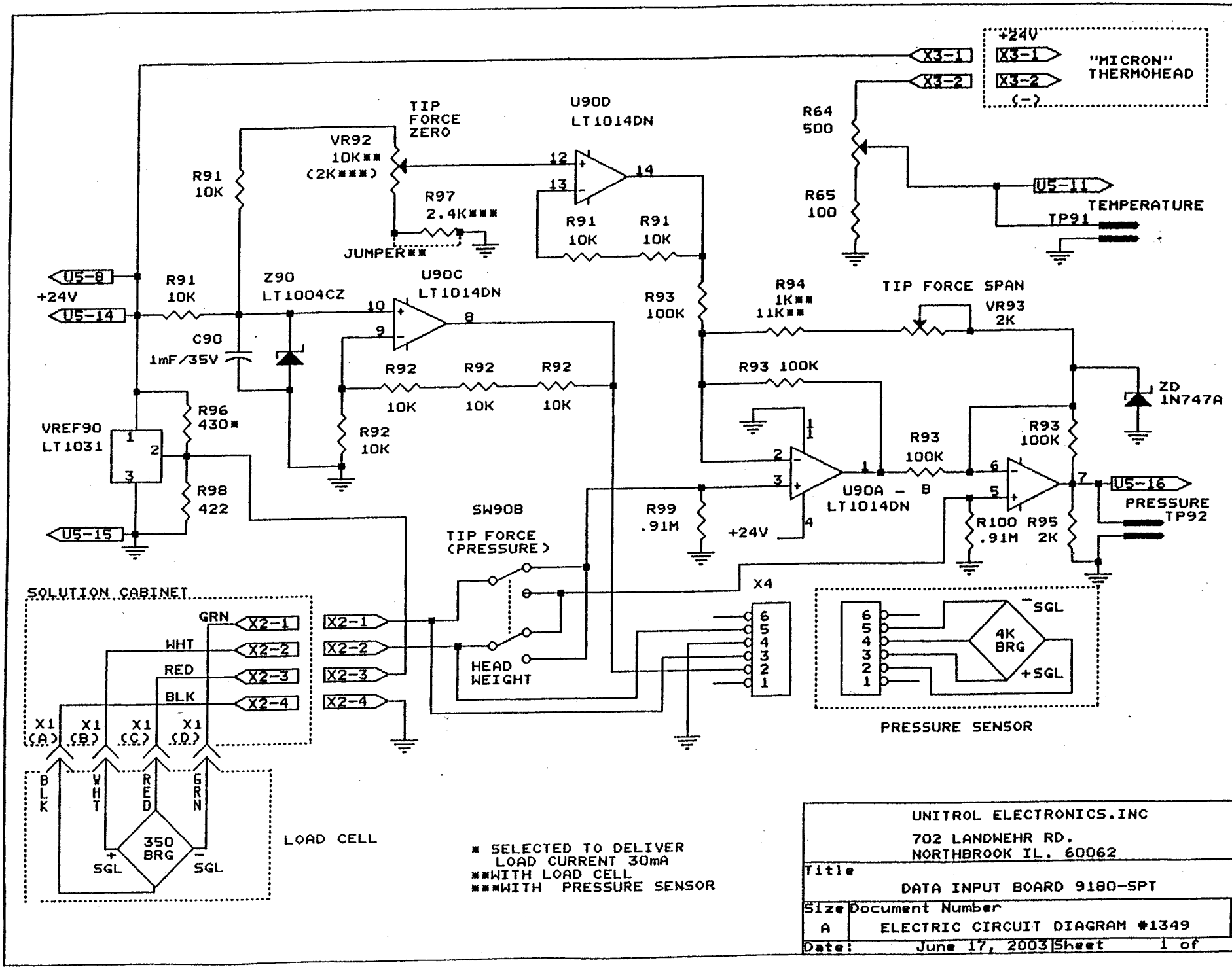

GND for #9180-5M2
GND for #9180-5M2
P203
DB37F
OPTIONAL
P105
DB15F
SOC1
SOC2
SOC6
U18
U1
U2
U5
U3:A
U3:B
U3:C
U3:F
U4:A
U4:B
U3:D
U3:E
U4:C
U4:D
U4:E
U4:F
K2
D5
D6
D8
D10
D18
D21
DS1
DS2
DS3
DS4
DS5
DS6
DS7
DS8
C135
R136
C133
R133
C134
R134
R44
R5
R6
R7
R8
R11
R12
R13
R14
R125
R19
R10
R16
R17
R20
R22
R46
R45
R4
R1
R2
R3
R47
R15
R25
R18
C6
CF1
CF2
CF3
CF4
1J5
2J5
1J1
2J1
9180-5M2
9180-8
RETRACT TP5
WATER SAVER
RETRACT
NC
SWITCH INPUT TERMINAL
LINE TERMINAL
INIT.B
INIT.A
+CD
TT1
TS1
NW1
NW2
ES1
ES2
RT1
RTC
PS1
PS2
RTN
S
FS2C
1FS2
2FS2
FS1C
1FS1
2FS1
NOT USED
PRES
AGND
+24VDC
-24VDC
C/TEM
+48VDC
575VAC
460VAC
380VAC
230VAC
208VAC
115VAC
F2
+24VISOL
-24VISOL
VCC
+6.3V



UNITROL ELECTRONICS, INC.	
702 LANDWEHR RD.	
NORTHBROOK, IL. 60062	
Title	POWER SUPPLY & I/O BOARD #9180B-8
Size D	Number 1777-2-D
Rev	2
Date	01.06.05
Drawn by	G.I.
Filename	9180B8RD.S01
Sheet	1 of 2



UNITROL ELECTRONICS,INC. 702 LANDWEHR RD. NORTHBROOK,IL. 60062			
Title	POWER SUPPLY & I/O BOARD #9180B-7		
Size B	1803-2		VER 2
Date	07.31.00	Drawn by	G.I.
Filename	SOL1B7.S02	Sheet	2 of 2



UNITROL ELECTRONICS.INC
702 LANDWEHR RD.
NORTHBROOK IL. 60062

Title: DATA INPUT BOARD 9180-SPT

Size	Document Number	REV
A	ELECTRIC CIRCUIT DIAGRAM #1349	1
Date: June 17, 2003	Sheet 1 of 1	

SOLUTION #9180
TROUBLE SHOOTING CHART
PAGE S14

Before using this chart, check page U-16 (WARNING CODES) for corrective actions.

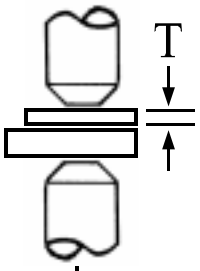
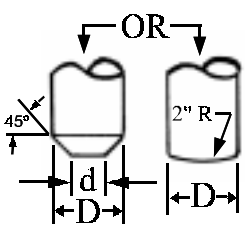
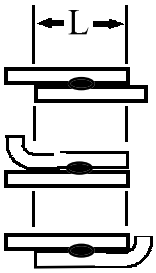
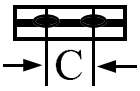
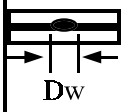
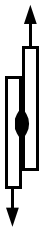
Also, check page S-12 for list of indicator lights and test points to aid in servicing. Consult factory if a problem cannot be resolved.

The factory number is 1-800-621-4244.

PROBLEM	PROBABLE REASON
No readout on display, **and** no pilot lights on power supply	1. No incoming power 2. Fuses F1 or F2 blown (check voltage selection for correct position) 3. CIRCUIT BREAKER or HIGH SPEED FUSE open
No readout on display **only**	1. Plug on CORD BETWEEN CONSOLE AND BACK OF POWER SUPPLY not fully connected on both ends 2. F1 WIRE (LINE IN VOLTAGE SELECT) on wrong terminal
EMERGENCY STOP is on display and will not clear	1. Input to ES terminals 11 & 12 open 2. Line voltage input to system is more than 20% below volt. selection jumper
TRANSF. OVERHEAT shows on readout, will not clear	1. Left hand GREEN INPUT PLUG on POWER SUPPLY not fully inserted 2. Failure of CHIPS U2 OR U3
SCR OVERTEMP., TRANSF.OVERTEMP or **LIM/PRES SWITCH OPEN** displays will not clear	1. Failure in chips U2 or U3
INIT. IS CLOSED on displayed on readout	1. Foot switch or hand buttons are closed when power is first turned on.
KEYBOARD LOCKED shows on readout, will not clear	1. Bad connection on KEY SWITCH PLUG 2. Bad KEYSWITCH
WELDER SOLENOID will not operate when green SOLENOID LIGHT ON CONSOLE is on	1. Blown fuse F1 on power supply 2. Failure of U15 or K1 relay
SCR SYSTEM FAULT is displayed during turn-on diagnostics or during AVC setup procedure	1. No AC input on TP1; bad transformer 2. Bad chips U110, U105, or U106
Welder welds ONCE but will not operate on second time	1. Initiation switch not opening (ANTI-REPEAT CIRCUIT)

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

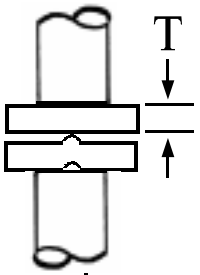
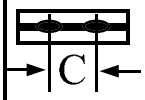
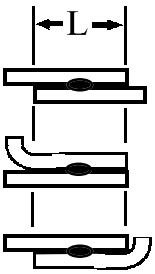
* **Starting values** shown are based on industry experience. Adjust these values as needed to reach required weld quality.

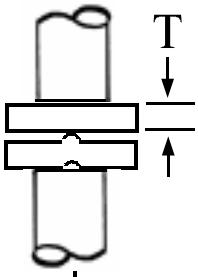
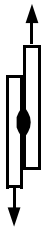
- Type of steel: **SAE 1008-1010**
- Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4"T"
- Material should be free from scale oxides, paint, grease, and heavy oil
- Electrode material: **RWMA CLASS 2**

UNITROL ELECTRONICS
702 LANDWEHR ROAD
NORTHBROOK, IL 60062

Phone: 847-480-0115
Fax: 847-480-0932
www.unitrol-electronics.com

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

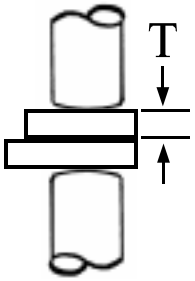
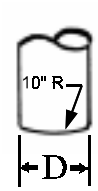
* **Starting values** shown are based on industry experience. Adjust these values as needed to reach required weld quality.

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

UNITROL ELECTRONICS
702 LANDWEHR ROAD
NORTHBROOK, IL 60062

Phone: 847-480-0115
Fax: 847-480-0932
www.unitrol-electronics.com

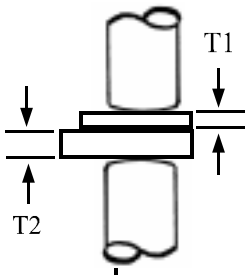
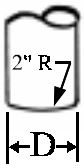
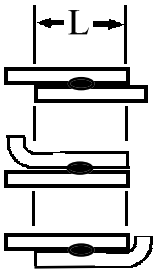
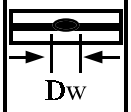
LOW CARBON STEEL SPOT WELDING DATA FOR SINGLE-PULSE WELDS IN HEAVY PLATES

Plate Thickness	Electrode Major Diameter and Shape	Net Electrode Force	Net Forge Force	Weld Time (Single pulse)	Welding Current*	Minimum Tensile-Shear Strength
						
THICKNESS Inch (mm)	D. MIN. Inch	POUNDS	POUNDS	CYCLES (60 HZ)	AMPERES (approx.)	POUNDS
1/8 (3.18)	5/8	6,000	6,000	45	27,300	9,850
3/16 (4.75)	3/4	6,000	10,000	60	29,400	13,960
1/4 (6.35)	7/8	6,000	12,500	240	25,800	22,800
3/8 (9.52)	1	6,500	13,500	360	26,000	33,780
1/2 (12.70)	1-1/4	6,500	13,500	400	31,100	45,600

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

- Type of steel: **SAE 1018-1010**
- Material should be free from scale oxides, paint, grease and heavy oil
- Minimum weld spacing: 1/8" to 3/16" plate = 2", 1/4" to 1/2" plate = 4"
- Electrode material: **RWMA CLASS 2**

LOW CARBON STEEL SPOT WELDING DATA FOR MULTIPLE-PULSE WELDS IN HEAVY PLATES

Combination Of Thicknesses To Be Welded		Electrode Major Diameter and Shape	Net Electrode Force	For Each Pulse: Weld Time 20 Cycles (60 Hz) | Cool Time 5 Cycles			Welding Current*	Minimum Contacting Overlap	Diameter of Fused Zone	Minimum Tensile-Shear Strength
				NUMBER OF PULSES						
				First Weld	Additional Welds: Distance To Adjacent Weld					
T1 Inch (mm)	T2 Inch (mm)	D. MIN Inch	POUNDS		1 inch to 2 inches	2 inches to 4 inches	AMPERES (approx.)	INCH	INCH (approx.)	POUNDS
1/8 (3.18)	1/8 (3.18)	1	1,800	3	5	4	18,000	7/8	3/8	5,000
1/8 (3.18)	3/16 (4.75)	1	1,800	3	5	4	18,000	7/8	3/8	5,000
1/8 (3.18)	1/4 (6.35)	1	1,800	3	5	4	18,000	7/8	3/8	5,000
3/16 (4.75)	3/16 (4.75)	1-1/4	1,950	6	20	14	19,500	1-1/8	9/16	10,000
3/16 (4.75)	1/4 (6.35)	1-1/4	1,950	6	20	14	19,500	1-1/8	9/16	10,000
3/16 (4.75)	5/16 (7.92)	1-1/4	1,950	6	20	14	19,500	1-1/8	9/16	10,000
1/4 (6.35)	1/4 (6.35)	1-1/4	2,150	12	24	18	21,500	1-3/8	3/4	15,000
1/4 (6.35)	5/16 (7.92)	1-1/4	2,150	12	24	18	21,500	1-3/8	3/4	15,000
5/16 (7.92)	5/16 (7.92)	1-1/2	2,400	15	30	23	24,000	1-1/2	7/8	20,000

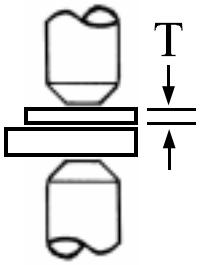
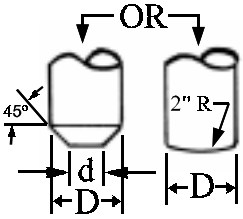
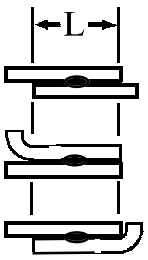
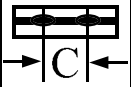
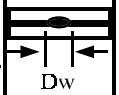
* **Starting values** shown are based on experience of member companies. Adjust these values as needed to reach required weld quality.

- Type of steel: **SAE 1008-1010**
- Material should be free from scale oxides, paint, grease, and heavy oil
- Minimum weld spacing: 1/8" to 3/16" plate = 2", 1/4" to 5/16" plate = 4"
- Electrode material: **RWMA CLASS 2**

UNITROL ELECTRONICS
702 LANDWEHR ROAD
NORTHBROOK, IL 60062

Phone: 847-480-0115
Fax: 847-480-0932
www.unitrol-electronics.com

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*		Minimum Contacting Overlap	Minimum Weld Spacing[1]	Diameter of Fused Zone	Minimum Tensile-Shear Strength		
						FOR MATERIAL WITH TENSILE STRENGTH							
						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.

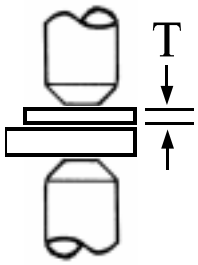
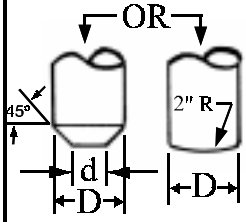
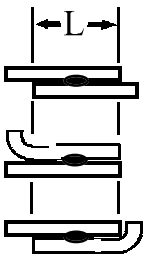
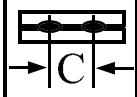
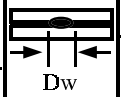
1. Minimum spacing shown is for the welding of two pieces. Increase spacing by 30% when welding three pieces. Smaller minimum spacing requires higher current. Electrode material: **RWMA CLASS 2 or CLASS 3**

- 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"

UNITROL ELECTRONICS
702 LANDWEHR ROAD
NORTHBROOK, IL 60062

Phone: 847-480-0115
Fax: 847-480-0932
www.unitrol-electronics.com

RECOMMENDED PRACTICES FOR MULTIPLE-PULSE SPOT WELDS IN STAINLESS STEEL

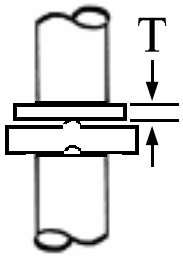
Thickness of Thinnest Outside Piece	Electrode Major Diameter and Shape		Net Electrode Force	Weld Time		Welding Current*		Minimum Contacting Overlap	Minimum Weld Spacing[1]	Diameter of Fused Zone	Minimum Tensile-Shear Strength	
				HEAT 15 CYCLES	COOL 2 CYCLES	FOR MATERIAL WITH TENSILE STRENGTH					 Ultimate Tensile Strength of Metal	
						Below (150 kpsi)	Above (150 kpsi)				From 90 to 150 kpsi	150 kpsi & up
THICKNESS Inch (mm)	D. MIN. Inch	d. MAX. Inch	POUNDS	NUMBER OF PULSES		AMPS (approx.)	AMPS (approx.)	INCH	INCH	INCH (approx.)	LBS	LBS
5/32 (3.96)	1	1/2	4,000	4		20,700	17,500	1-1/4	1-7/8	.440	7,600	10,000
3/16 (4.75)	1	1/2	5,000	5		21,500	18,500	1-1/2	2	.500	9,750	12,300
13/64 (5.16)	1	5/8	5,500	6		22,000	19,000	1-5/8	2-1/8	.530	10,600	13,000
1/4 (6.35)	1	5/8	7,000	7		25,000	20,000	1-3/4	2-3/8	.600	13,500	17,000

* **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 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"

MANUFACTURING DATA FOR PROJECTION WELDS IN STAINLESS STEEL

Thickness of Thinnest Outside Piece		Net Electrode	Weld Time (Single	Welding Current*	Hold Time
					
MFG GAUGE	THICKNESS Inch (mm)	POUNDS	CYCLES (60 HZ)	AMPERES (approx.)	CYCLES (60 HZ)
28	.014 (0.36)	300	7	4,500	15
25	.021 (0.53)	500	10	4,750	15
22	.030 (0.76)	700	15	5,750	15
19	.042 (1.07)	700	20	6,000	15
16	.060 (1.52)	1,200	25	7,500	15
14	.075 (1.91)	1,900	30	10,000	30
13	.090 (2.29)	1,900	30	10,000	30
12	.105 (2.67)	2,800	30	13,000	45
11	.120 (3.05)	2,800	30	14,000	45

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

* Electrode material: **RWMA CLASS 3 or CLASS 11**

- 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
- Projection geometry should be similar to chart on PROJECTION WELDS IN LOW CARBON STEEL

UNITROL ELECTRONICS
702 LANDWEHR ROAD
NORTHBROOK, IL 60062

Phone: 847-480-0115
Fax: 847-480-0932
www.unitrol-electronics.com

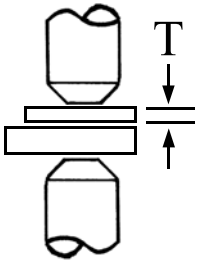
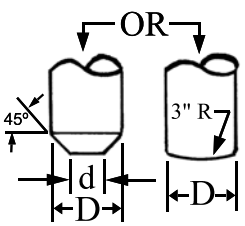
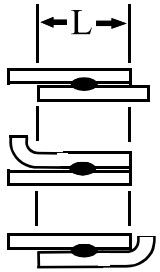
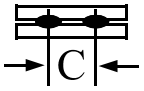
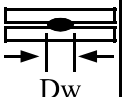
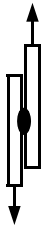
RECOMMENDED PRACTICES FOR SINGLE-PULSE SPOT WELDS IN GALVANIZED STEEL

The following **GALVANIZED STEEL** schedule uses a **PREHEAT— COOL TIME — WELD** sequence and can only be used with welding controls having this ability.

A. The PREHEAT liquefies the galvanized coating but does not have enough current to start the weld.

B. The COOL TIME allows time for a majority of the liquefied galvanized coating to be “squeezed” away from the weld zone and from under the electrodes.

C. The WELD TIME does the actual welding with minimal interference of the galvanized coating.

Thickness of Thinnest Outside Piece		Electrode Major Diameter and Shape		Net Electrode Force	Weld Time (Single pulse)	Welding Current*	Preheat Time (Single Pulse)	Preheat Current*	Cool Time⊥	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.)	CYCLES (60 HZ)	AMPERES (approx.)	CYCLES (60 HZ)	INCH	INCH	INCH (approx.)	POUNDS
26	.022 (0.50)	1/2	.193	350	8	12,500	6	6,200	3	3/8	1/4	.156	510
24	.028 (0.71)	1/2	.193	450	10	12,760	6	6,300	3	7/16	3/8	.162	660
22	.034 (0.86)	1/2	.250	550	12	13,000	6	6,500	3	7/16	1/2	.193	1,050
20	.040 (1.02)	5/8	.250	710	13	13,500	8	6,700	4	1/2	3/4	.218	1,310
18	.052 (1.32)	5/8	.250	780	18	14,000	8	7,000	4	9/16	7/8	.220	1,730
16	.064 (1.63)	5/8	.250	910	22	15,000	8	7,500	4	5/8	1-1/16	.240	2,000
14	.078 (1.98)	5/8	.312	1,300	24	18,600	8	9,300	5	11/16	1-3/8	.281	2,950
13	.093 (2.36)	5/8	.380	1,400	30	19,500	11	9,700	5	3/4	1-5/8	.340	4,000
12	.108 (2.74)	5/8	.380	1,900	37	19,600	12	9,800	6	13/16	1-13/16	.400	5,200
11	.123 (3.10)	5/8	.380	2,100	42	19,700	15	9,800	6	7/8	2	.480	6,800

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

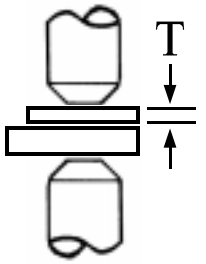
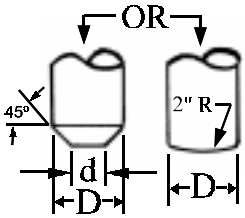
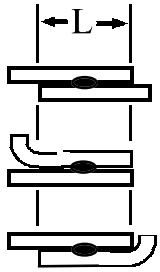
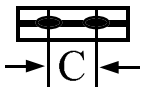
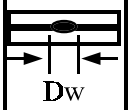
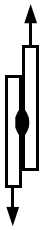
⊥ COOL TIME is the delay time between the last cycle of PREHEAT and the first cycle of WELD

- Type of steel: **Galvanized G90**
- 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**

UNITROL ELECTRONICS
702 LANDWEHR ROAD
NORTHBROOK, IL 60062

Phone: 847-480-0115
Fax: 847-480-0932
www.unitrol-electronics.com

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"

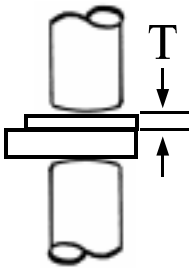
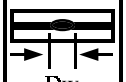
2 Electrode material: **RWMA CLASS 2**

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

UNITROL ELECTRONICS
702 LANDWEHR ROAD
NORTHBROOK, IL 60062

Phone: 847-480-0115
Fax: 847-480-0932
www.unitrol-electronics.com

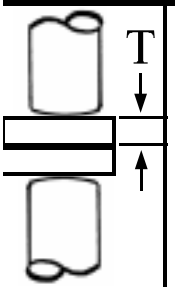
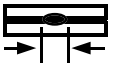
RECOMMENDED PRACTICES FOR SPOT WELDING ALUMINUM ALLOYS ON SINGLE PHASE MACHINES

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		
							 Ultimate Tensile Strength of Metal		
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 hinnest Outside Piece	Electrode Major Diameter and Shape		Net Electrode Force		Heat Time			Current*			Minimum Tensile Shear Strength	Diameter of Fused Zone
												 Dw
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.

UNITROL ELECTRONICS
702 LANDWEHR ROAD
NORTHBROOK, IL 60062

Phone: 847-480-0115
Fax: 847-480-0932
www.unitrol-electronics.com