

# **SOLUTION 3Ø**

**FREQUENCY CONVERTER**

## **#9380**

# **RESISTANCE WELDING CONTROL**

**UNITROL**

**ELECTRONICS, INCORPORATED**

**702 LANDWEHR ROAD**

**NORTHBROOK, ILLINOIS 60062**

**[www.unitrol-electronics.com](http://www.unitrol-electronics.com)**

**847-480-0115**



# NOTES



# UNITROL SOLUTION WELDING CONTROL

## For series 9380 control

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

The **SOLUTION** consists of two components mounted:

1. The **MICRO CONTROLLER BOARD**
2. The **POWER SUPPLY, FIRING SYSTEM, and I/O**

This **SOLUTION** welding control is designed and produced in the USA with pride by the **UNITROL** team:

System logic by Roger Hirsch

Software design by Leonard Arman

Hardware design by Leonard Arman and Greg Ioffe

### FINAL INSPECTION BY: G IOFFE

MODEL NUMBER: 9380-430

SYSTEM SERIAL NUMBER: S0911682

DATE OF MANUFACTURE: 09/28/11

SOFTWARE VERSION: PHASE 340

VOLTAGE SET WHEN SHIPPED: 440V

## OPTIONS IN SYSTEM IF CHECKED BELOW

2KVA/380 2-KVA control transformer, 110/220 sec. Mounted on outside right side

36X36U/400 Cabinet upsize with subplate and 400A circuit breaker

9381-05 DIFFERENTIAL PRESSURE TRANSDUCER

9181-7 EMERGENCY STOP switch installed on cabinet

9181-16 ELECTRONIC PRESSURE regulator system, single regulator

9381-16 ELECTRONIC PRESSURE regulator system, dual regulators for FORGE and WELD

9181-21A RS-232 serial printer PORT & upload/download port

9281-22B CURRENT MONITOR/limiter, 6" Sec.COIL, ZERO= ,SPAN=50, RANGE= KA

9281-22BH CURRENT MONITOR/limiter,10" Sec. COIL, ZERO= ,SPAN=50,RANGE= KA

9381-25 SEAM MOTOR driver option with Nimeric RG500UA-PCM regenerative drive

9381-30 24VDC valve voltage with supply

9381-34WC SOFT TOUCH safety system for cylinder head welder

9381-34WD SOFT TOUCH safety system for diaphragm head welder

9282-21/4 Remote cable size increase, 4' added

SCR MODEL: DPH7824-468

CABINET SIZE: 36" X 30" X 10"

### CONSOLE

### POWER SUPPLY & I/O

Board S/N = 7163

Board Version = 9280-2

Board S/N = 6011

Board version = 9280B-4



**SOLUTION #9380, 9380D, 9380L**  
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## STANDARD FUNCTIONS

| NAME            | OPERATION   | RANGE  | APPLICATION                               |
|-----------------|---|--|---|
| SCHEDULE MEMORY | INSTANT RECALL OF COMPLETE WELD SCHEDULES                       | 75 COMPLETE SCHEDULES  | INSTANT SET-UP OF REPETITIVE JOBS         |
| COUNTER         | COUNTS WELDS OR PARTS   | 0-65,500   | PRODUCTION CONTROL                        |
| DUAL HEAT       | TWO INDEPENDENT WELD SCHEDULES FROM 75 IN MEMORY                | -  | MULTI THICKNESS WELDING                   |
| SQUEEZE         | DWELL BEFORE FIRING   | 0-99 CY.   | ALLOWS TIPS TO FULLY CLOSE BEFORE WELDING |
| WELD            | MAIN HEAT   | 0-99.9 CY.<br>0-99 PULSES<br>0-99% HEAT<br>0-99 COOL CY.                     | ALL PROGRAMS                              |
| DECAY--WELD     | DYNAMIC LOWERING OF HEAT AFTER WELD                             | 0-99 CY.<br>0-99% HEAT   | PREVENT HEAT CRACKING                     |
| HOLD            | DWELL AFTER WELDING   | 0-99 CY.   | ALLOWS NUGGET TO COOL                     |
| PREHEAT         | SEQUENCE BEFORE WELD  | 0-99 CY.<br>0-99 PULSES<br>0-99 %HEAT<br>0-99 COOL CY.                       | TO PREHEAT HEAVY PARTS                    |
| DECAY--PREHEAT  | DYNAMIC LOWERING OF HEAT AFTER PREHEAT                          | 0-99 CY.<br>0-99 % HEAT  | REDUCES HEAT STRESS                       |
| QUENCH & TEMPER | COOL AND REHEAT AT END OF WELDING CYCLE                         | 0-99 CY. COOL<br>0-99% HEAT<br>0-99 CY. HEAT<br>0-99 PULSES<br>0-99 COOL CY. | REDUCES BRITTLINESS IN HIGH CARBON STEELS |
| REPEAT          | CONTROLS OPENING AND CLOSING OF TIPS WHILE INITIATION IS CLOSED | 0-99 CY.   | ALLOWS "AUTOMATIC" RU OF WELDER           |
| PRE-COMPRESSION | TIMED HIGH PRESSURE BEFORE FIRST HEAT                           | 0-99 CY.ON<br>0-99 CY. DELAY   | LOWER SURFACE RESISTANCE                  |
| FORGE DELAY     | DELAY OF HIGH PRESSURE  | 0-99 CY. DELAY   | REDUCE CRACKING OF                        |
| AVC             | AUTOMATIC VOLTAGE COMPENSATION                                  | +/- 1% OUTPUT<br>+/-10% LINE   | MAINTAINS WELDER OUTPUT VOLTAGE           |
| MOTOR CYCLES    | MOTOR "ON" TIME   | 0-999 CY.  | ROLL SPOT                                 |

## INITIATION MODES

1. SINGLE OR TWO LEVEL FOR FOOT SWITCH OPERATION, SINGLE OR DUAL SCHEDULE
2. TWO BUTTON ANTI-TIEDOWN, SINGLE OR DUAL SCHEDULE

## OPTIONAL FUNCTIONS

| NAME                             | OPERATION  | RANGE  | APPLICATION                                 |
|----------------------------------|--|--|---|
| 24VDC OUTPUTS                    | SUPPLY 24VDC FOR SOLENOID VALVES                         | -  |   |
| PRESSURE TRANSDUCER              | STARTS WELD WHEN TIP FORCE IS REACHED (DIFFERENTIAL PSI) | KEYPAD SET:<br>1-9,999 LB. WELD<br>1-9,999 LB. FORGE | PRECISION TIP FORCE FOR CONSISTENT WELDS    |
| ELECTRONIC AIR REGULATOR SETTING | KEYPAD SET WELD AND FORGE PRESSURES FROM PROGRAM MEMORY  | 0-99 PSI.<br>2-CHANNELS                              | ELIMINATES MANUAL SETTING OF AIR REGULATORS |
| WELD CURRENT MONITOR/LIM         | CONTROLLED HEAT AND COMPARES CURRENT TO HIGH/LOW WINDOWS | 0-150,000 AMPS<br>SECONDARY                          | QUALITY CONTROL                             |
| PRINTER PORT                     | DOCUMENTS EACH WELD                                      | -  | DOCUMENT FOR QC                             |
| PRINTER                          | PRINTS WELD VALUES                                       | -  | PRINTING FOR QC                             |

### ELECTRICAL SPECIFICATIONS

VOLTAGE RANGE=208, 230, 380, 460, 575. FREQUENCY=60 Hz. or 50 Hz.



# INSTALLATION



SOLUTION #9380, 9380D, 9380L  
INSTALLATION INSTRUCTIONS PAGE I-1

If at any time during your installation of this SOLUTION a question occurs, please do not hesitate to call the Unitrol Technical Assistance Department. We at Unitrol want to be sure that our control system operates correctly the first time! The U.S. factory number is 847-480-0115, FAX 847-480-0932.

1. Carefully unpack system and inspect for any damage. Report any problems to the factory at once. If damage is obvious from outside of the 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 and mount cabinet.
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 THAT 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 ABOVE STEP. After cleaning interior of all chips, install liquid tight or rigid conduit at all locations.
- 6.

PHASE ROTATION TEST

Before going any further, it is CRITICAL that the line voltage phase rotation be correct. If the phase rotation is not correct, this welding control will not operate properly and can cause damage to the welder!

A PHASE ROTATION TESTER has been included with this welding control. With **POWER OFF** to the weld control:

1. Connect the clamp on the BLACK wire to the terminal or bottom circuit breaker block marked L1.
2. Connect the clamp on the RED wire to the terminal or bottom circuit breaker block marked L2.
3. Connect the clamp on the WHITE wire to the remaining terminal or bottom circuit breaker block marked L3.

SOLUTION #9380, 9380D, 9380L  
INSTALLATION DIRECTIONS PAGE I-2

PHASE ROTATION TEST continued

6. continued:

4. Turn power ON. If the wires are in the correct order, all three upper yellow lights (L1, L2, and L3) will be on and the center yellow CLOCKWISE rotation light will be ON. If this is correct, the control is wired in the correct phase.
5. If the lower COUNTERCLOCKWISE yellow light glows, turn power OFF, interchange any two incoming wires, turn power ON, and check to be sure that the center yellow CLOCKWISE light is ON. If this is correct the control is wired in the correct phase.

7. Connect power wires as shown in the HEAVY POWER HOOK-UP DIAGRAM on page I-7. Incoming wire should be sized to at least handle a KVA load of: (WELDER KVA) X .707. Note that the L1, L2, and L3 power wires shown on the drawing will match those marked in the PHASE ROTATION test above.

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. Note that some three phase welders have different arrangements of the heavy power wires. Consult factory if the layout is seems different than your welder.

8. Connect foot pedal, palm buttons, or machine contacts per WIRING HOOK-UP DIAGRAM page I-8. If mechanical pressure switch (on systems that do not have the Pressure Transducer option) or transformer thermostat is used, connect per WIRING HOOK-UP DIAGRAM. If any of these are not used, install jumpers.

Note that TRANSFORMER OVERTEMPERATURE and SCR OVERTEMPERATURE thermostats should CLOSE if conditions are correct, or OPEN if temperature is too high.

9. Connect water hoses to fittings under cabinet. In/out direction of the water is not important unless a water flow switch has been ordered with this control. This water is used to cool the SCRs.

**IF THIS CONTROL IS A 9380L or 9380D series, SKIP TO STEP 13.**

10. 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 for mounting the console at the front of the welder.
11. 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.** If a printer port has been provided, plug the printer plug into the back of the console and tighten screws. If control has SECONDARY CURRENT monitoring, plug the external current coil to the pigtail socket on the console.

SOLUTION #9380, 9380D, 9380L  
INSTALLATION INSTRUCTIONS, PAGE 1-3

12. 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.
13. 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.
14. Locate wire at lower right of power supply chassis that is marked "F1" and connect to voltage terminal that most closely matches your supply.
15. 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:  
$$\text{SETTING} = (\text{KVA}/\text{Line voltage}) \times 3,000$$

where KVA is that shown on the welder nameplate.

As an example: KVA=75  
Line voltage=460

$$\text{SETTING} = (75/460) \times 3,000 = .163 \times 3,000 = 489.13$$
  
The circuit breaker should be set to the nearest higher level.

16. If optional SOLID STATE PRESSURE TRANSDUCER and ELECTRONIC PRESSURE SETTING SYSTEMS options are installed in your SOLUTION control, see the appropriate pages for installation directions.
17. Check one more time to be sure that the correct voltage has been selected at the bottom of the power supply board to match the actual incoming voltage. An error can severely damage the control and will void any warranty on the system.
18. Close the white main cabinet and turn power on to the welder. If this control has a factory circuit breaker, turn it ON.

If the SOLUTION control 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 it will display:

"PROGRAM ## READY" if a program was left in the memory.

If no display is present, check that line voltage is present and matches that selected in step 14. If Power Supply lights are on, but the control console has no readout, check both the cable at the back of the console, and the other end where this cable plugs into the power supply board. If some other phrase is displayed, the SERVICE section on page S14 to find the possible problem. Consult factory service department if difficulty is encountered at this point. Do not attempt to service control without proper information.

SOLUTION #9380, 9380D, 9380L  
INSTALLATION INSTRUCTIONS, PAGE I-4

19. It is now necessary to tell the SOLUTION control what welding mode is to be used. Note that this can be changed at any time by pressing the following keypad sequence:

PROGRAM  
95  
ENTER

Answer questions on readout to select SPOT WELD, SEAM WELD, or ROLL-SPOT.

20. Follow the directions on page U-15 to check that all three phases are being used.
21. Compensation for the weld transformer power factor has been set at the factory. If desired, press: PROGRAM, 88, ENTER. The display will first show the + and then - power factor correction value. A setting of 00 for both is standard. On very large KVA systems with deep throats, the number might have to be increased to 01 or as high as 04 if operation at high %HEAT settings is not smooth.

After the power factor lines, the setting for INVERSION will be displayed. This is a value used to bring flux down in the transformer core after a pulsation of heat that does not have DECAY in the program and the HEAT% is above 69% (factory default unless otherwise set in PROGRAM 76). A factory default of 07% should be correct for standard welders (see page I-6, paragraph 1.)

22. The system should now be ready for operation.



**SOLUTION #9380, 9380D, 9380L**  
**INSTALLATION INSTRUCTIONS, PAGE 1-5**

**SETTING LINE FREQUENCY**

This control can be used on 50Hz. or 60Hz. line frequencies. However, THE LINE FREQUENCY SET FROM THE KEYPAD MUST MATCH THAT OF YOUR INCOMING POWER.

When you first turn the SOLUTION on, one of the displays will show either 50 HZ or 60 HZ. Normally, all power systems in U.S., Canada, and Mexico are 60Hz. Systems in South America can be either, and most systems in Europe and Asia are 50Hz.

If the frequency shown during turn-on does not match that of your power system, press: PROGRAM, 87, ENTER, 71. The display will show the present setting. Then it will display the phrase CHANGE1=YES, 0=NO. To change the frequency, press 1. The new frequency will then be shown briefly.

**SETTING FOR TYPE OF WELDER**

The SOLUTION control is designed to operate three different types of welders:

- A. Welders with RETRACT using a mechanical key to lock the ram in the lowered (work) position (PMCO or similar)
- B. Welders with RETRACT without air operated mechanical key to lock the welder ram (rocker arm, non-diaphragm, etc)
- C. Welders that do not have a RETRACT system.

If you are in doubt about the style of welder, contact the Unitrol service department for assistance.

The SOLUTION control must be set for the correct type of welder to operate correctly. To do this, press: PROGRAM 87, ENTER, 81. The display will show either SYSTEM WITH KEY or KEYLESS SYSTEM, CHANGE 1=YES, 0=NO. If the display shows the proper type of system, press 0. If the incorrect system type

Press: PROGRAM 87, ENTER, 98 and select RETRACT or NO RETRACT

**SETTING MAXIMUM WELD CYCLE COUNT TO PREVENT WELDER SATURATION**

Your frequency converter welder is designed to weld with a maximum number of cycles at a maximum %heat before saturation of the welding transformer occurs. This "K" factor is explained on page U-2.

The control was shipped from the factory with the default of 4 cycles at 99% (or any cycle and %heat combination where CYCLES X %HEAT is less than 396 (4 x 99).

IT IS IMPORTANT to check with the welder manufacturer to find the appropriate "K" for your welder. If in doubt, leave the 4 cycle default setting. If the value is known, press: PROGRAM, 87, ENTER, 91. Follow the displayed instructions to enter the correct value. If you are in doubt, leave the factory default of 4 cycles.

SOLUTION #9380, 9380D, 9380L  
INSTALLATION INSTRUCTIONS, PAGE I-6  
OPTIONAL TESTING PROCEDURE

If it is desired to check operation of the welder, and a memory oscilloscope is available, the following OPTIONAL procedure may be done:

- a. Install a new set of flat electrodes in the welder. Allow head to drop (use TIP DRESS valve, or disconnect air), and verify that the electrodes are touching across the full face area. Note that if the welder has seam wheels only, these can be used for this test. Be sure water is flowing on (or through) these wheels or electrodes.
- b. Locate the oscilloscope a minimum of 3 feet (1 meter) directly in front of the electrodes. Now check to be sure that the oscilloscope is **NON GROUNDED**. If not, use an adapter at the power plug to eliminate the ground line.
- c. Connect a small transformer with 2:1 ration or higher with one wire from the "low voltage" side to a point just above the upper electrode, and the other from the "low voltage" side to a point just below the lower electrode. This will read the voltage drop across the electrodes (or seam wheel). Be sure that the transformer is at least 3 feet (1 meter) in front of the electrodes.
- d. Connect oscilloscope probes to the "high voltage" side of the transformer in any order. This will isolate the oscilloscope from the welder frame (ground), and increase the signal to reduce "noise" in the oscilloscope display.
- e. Set the air pressure regulators so that at least 2500 pounds of tip force will be reached. If this control has the #9381-16 electronic pressure setting option, set this value as WELD FORCE in the program. Remember that:

$$\text{TIP FORCE} = (\text{top pressure} - \text{back-up pressure}) \times \text{AREA}$$

where AREA is that of the head diaphragm or cylinder. This pressure ratio is usually noted on the welder name plate. See page U-3 for more explanation of TIP FORCE.

- f. Press the following on the keypad:

PROGRAM 95  
ENTER

if SPOT WELD MODE is not displayed, follow prompts shown on readout and change to SPOT WELD MODE.

now press:  
ENTER

wait until PROGRAM NO. \_\_ is displayed. Now press:

1  
ENTER  
ENTER  
30 (squeeze time)  
ENTER

SOLUTION #9380, 9380D, 9380L  
INSTALLATION INSTRUCTIONS, PAGE I-7  
OPTIONAL TESTING PROCEDURE (CONTINUED)

1 (weld time)  
75 (weld heat)  
ENTER  
1 (decay time)  
ENTER  
35 (decay heat%)  
ENTER  
2 (weld pulses)  
ENTER  
1 (weld cool time)  
ENTER  
99 (hold time)  
NO WELD (selects No Weld operation)

- g. Set the oscilloscope at .5 volts DC per division, 20 ms./div. scan, and internal trigger on the channel being used. Note that this is a useful setup to monitor the welder under all circumstances.
- h. Press the foot switch to initiate the welder under No-Weld conditions. If the system is working correctly, the letters S W D H (representing Squeeze, Weld, Decay, and Hold) should appear on the readout for about 1-1/2 second, and the oscilloscope should trigger just as the letter W appears. Adjust the scope as necessary until it triggers correctly. Note that initiation of solenoid valves often will trigger an oscilloscope due to inductive pick-up. Therefore, it may be necessary to hold the RESET button on your scope until the weld head is down.
- i. Now push SINGLE on the SOLUTION console.
- j. After the green SINGLE LED comes on, go through the same procedure as above to show a trace on the scope. If the system is operating correctly, the oscilloscope trace should look like FIGURE A on page I-9. Note that the amplitude of the trace is dependent on the voltage drop across the welding electrodes, and the vertical volts/div. may have to be adjusted for a good picture. Also, if the test cables are not shielded or the oscilloscope is located incorrectly, signal distortion and "noise" will occur.
- k. If the oscilloscope trace looks distorted as in FIGURE B on page I-9 consult factory representative for corrective action. Welding with a system that is out of rotation will produce unknown conditions and reduce the welder power by over 75%! Also note that if the electrodes are not clean or of large enough surface contact, the secondary current could be high enough to arc and cause a distorted high voltage scan on the oscilloscope.
- l. If the second or third phase (second or third 1/2 cycle trace) is not correct, or missing, first check PROGRAM 79 to be sure that the control is set in the A B C phase. If not, follow prompts on the readout to select all three phases.

**POWER FACTOR CORRECTION:** If this is OK, then check PROGRAM 88 to set the + and - POWER FACTOR settings which are usually 0. An increase on both + and - to 01 or as high as 04 in this program might be necessary on very large welders with very deep throats.

SOLUTION #9380, 9380D, 9380L  
INSTALLATION INSTRUCTIONS, PAGE I-7  
OPTIONAL TESTING PROCEDURE (CONTINUED)

1 (weld time)  
75 (weld heat)  
ENTER  
1 (decay time)  
ENTER  
35 (decay heat%)  
ENTER  
2 (weld pulses)  
ENTER  
1 (weld cool time)  
ENTER  
99 (hold time)  
NO WELD (selects No Weld operation)

- g. Set the oscilloscope at .5 volts DC per division, 20 ms./div.scan, and internal trigger on the channel being used. Note that this is a useful setup to monitor the welder under all circumstances.
- h. Press the foot switch to initiate the welder under No-Weld conditions. If the system is working correctly, the letters S W D H (representing Squeeze, Weld, Decay, and Hold) should appear on the readout for about 1-1/2 second, and the oscilloscope should trigger just as the letter W appears. Adjust the scope as necessary until it triggers correctly. Note that initiation of solenoid valves often will trigger an oscilloscope due to inductive pick-up. Therefore, it may be necessary to hold the RESET button on your scope until the weld head is down.
- i. Now push SINGLE on the SOLUTION console.
- j. After the green SINGLE LED comes on, go through the same procedure as above to show a trace on the scope. If the system is operating correctly, the oscilloscope trace should look like FIGURE A on page I-9. Note that the amplitude of the trace is dependent on the voltage drop across the welding electrodes, and the vertical volts/div. may have to be adjusted for a good picture. Also, if the test cables are not shielded or the oscilloscope is located incorrectly, signal distortion and "noise" will occur.
- k. If the oscilloscope trace looks distorted as in FIGURE B on page I-7, consult factory representative for corrective action. Welding with a system that is out of rotation will produce unknown conditions and reduce the welder power by over 75%! Also note that if the electrodes are not clean or of large enough surface contact, the secondary current could be high enough to arc and cause a distorted high voltage scan on the oscilloscope.
- l. If the second or third phase (second or third 1/2 cycle trace) is not correct, or missing, first check PROGRAM 79 to be sure that the control is set in the A B C phase. If not, follow prompts on the readout to select all three phases.

**POWER FACTOR CORRECTION:** If this is OK, then check PROGRAM 88 to set the + and - POWER FACTOR settings which are usually 0. An increase on both + and - to 01 or as high as 04 in this program might be necessary on very large welders with very deep throats.

SOLUTION #9380, 9380D, 9380L  
INSTALLATION INSTRUCTIONS, PAGE I-8  
OPTIONAL TESTING PROCEDURE (CONTINUED)

- m. **POWER FACTOR ADJUSTMENT:** If your instrument reading of the + and - pulses shows an imbalance, you can "trim" the system by increasing either the + or - power factor number as necessary in PROGRAM 88. By increasing the value of + or -, that half cycle will decrease in RMS value.
- n. **INVERSION:** PROGRAM 88 also has a setting for INVERSION. This value is the % HEAT of a 1/2 cycle on phase A only that is fired after a weld impulse if:
  - i. No WELD DECAY is installed in the program
  - AND
  - ii. The WELD %HEAT is above the INVERSION START % in PROGRAM 76. If no value is entered into PROGRAM 76 for INVERSION START %, the control will default to 61%. This value should be usable for most welders.

This "INVERSION", is installed to bring the welder transformer core flux down rapidly at the end of a pulsation.

This should be set to 07% (factory default) for standard welders and only increased for very large KVA welders (over 250 KVA).



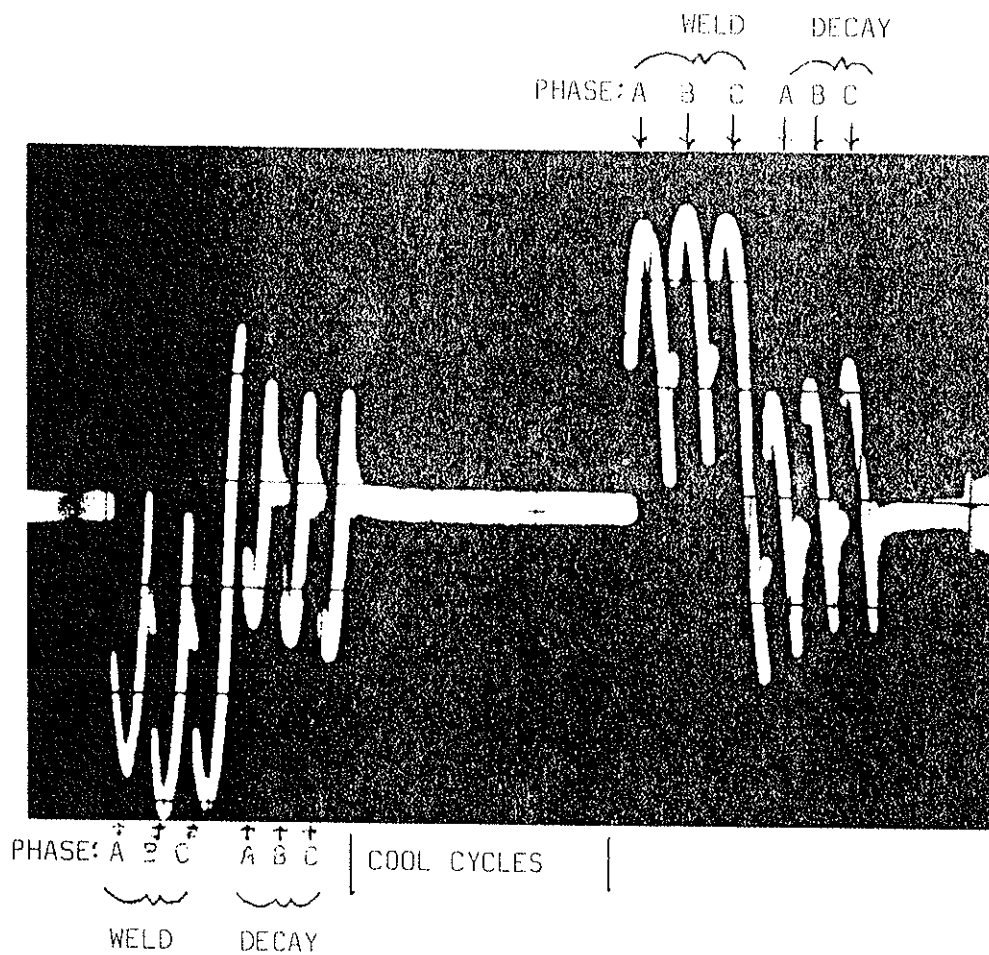


FIGURE A. CORRECT FIRING PICTURE

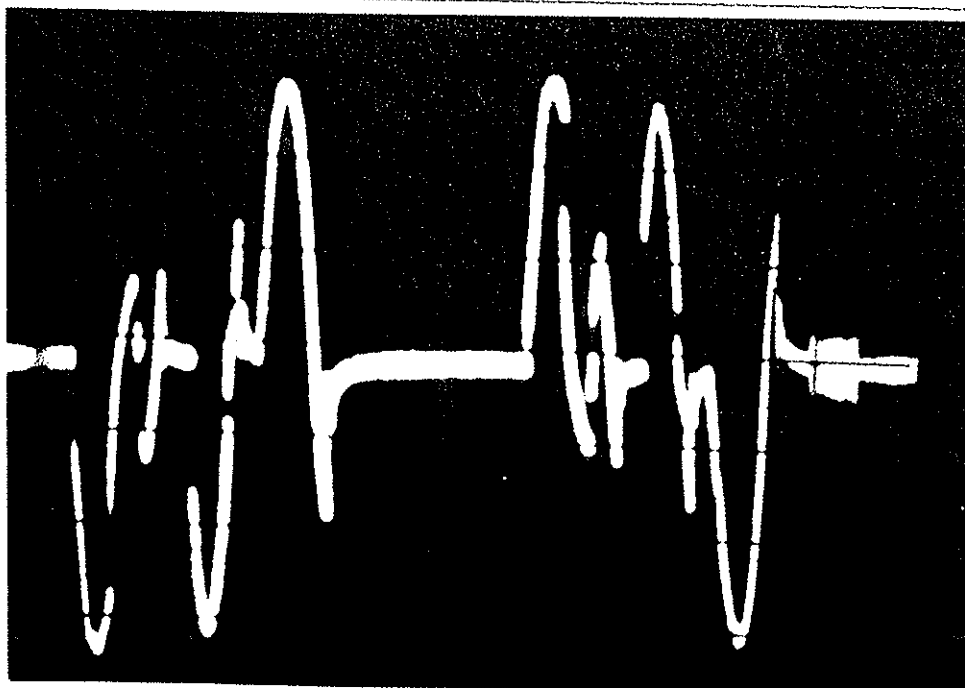


FIGURE B. INCORRECT PHASE CONNECTION





# **DIRECTIONS FOR USE**



SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-1  
UNDERSTANDING FREQUENCY CONVERTERS

A normal single phase AC (alternating current) welder reverses the current to the weld transformer once every line cycle (1/60th. of a second in 60 hz. systems, and 1/50th. of a second in 50 hz. systems). By causing the current to alternate positive and then negative, the welding transformer never SATURATES. Saturation occurs when the magnetic flux in the transformer reaches the maximum level. At that time, the transformer cannot increase its flux and, therefore, is saturated. Any additional current allowed to flow in the same direction without reversing of polarity will cause extremely high current as the windings of the transformer now look like a "dead short" to the incoming power.

In contrast to this, the FREQUENCY CONVERTER WELDER utilizes a special system that, on purpose, forces the weld transformer to approach SATURATION. This means that voltage is fed into the transformer primary in one direction only (positive or negative) to create extremely high levels of current. Since the transformer has a maximum flux limit determined by the core mass and design, a good three phase frequency converter control must be both accurate as well as protective of this condition.

A three phase FREQUENCY CONVERTER transformer is essentially a device with three primary windings and one secondary winding. As figure 1 below shows, three phase alternating current is fed into the welding control as phase A, B, and C (R, S, and T in European standards). The frequency converter control of this example only allows the positive half of each cycle to conduct to the welding transformer for the first two cycles (2 of each phase). At the end of these two line cycles, the control stops conducting for 1/2 cycle.

During this half cycle, the transformer flux relaxes. Now the control starts conducting the opposite (negative) half cycles for two additional line cycles. This produces an output of UNFILTERED DC POWER.

In this example, we have created two "pulses" (one "CYCLE") in a period of five line cycles (2 cycles weld, 1/2 cycle cool, 2 cycles weld, 1/2 cycle cool). Thus, we have artificially created "one cycle" in 1/12th. second (or 1/10th second in 50hz. systems), or a low frequency of 12 cycles per second (or 10 cycles per second in 50hz. systems). Thus the name FREQUENCY CONVERTER.

Figure 2 shows the effect of higher current settings. This illustration shows how the transformer current starts to rise as the transformer saturates. Note that, as mentioned above, a cool time (non conducting period) has been inserted between each of these three pulses to prevent damage to the transformer due to total saturation. In fact, your welder has a maximum number of cycles that it can conduct at 99% heat before damage will occur. The #9380 SOLUTION frequency converter control will refuse a setting that exceeds your welder's saturation level. This is set in the chip at the factory to match the maximum ability of your welder. If in doubt of this setting, contact the factory for assistance.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-2  
UNDERSTANDING "NUMBER OF WELD CYCLE X %HEAT" LIMIT ("K" Factor)

To prevent damage to the weld control and welding transformer caused by saturation, a number must be set into the system to match your welder transformer. This setting is done per directions at the bottom of page I-4 and must be done before using this weld control!

For example, if the maximum number of conducting cycles before weld transformer saturation is 4 when the %HEAT is 99%. this will allow a maximum of 396 as a product of WELD TIME X % WELD HEAT (99 X 4). Therefore, 6 cycles at 66%, 5 cycles at 79%, etc. would be accepted.

If a higher value is entered into a program, the display will show:

% X CYCLE TOO HIGH

when the SINGLE, NO WELD, or REPEAT button is pushed while exiting from a program. The upper row of display will show the part of weld program (PREHEAT, WELD, TEMPER) that contains a value in excess of the maximum allowed.

The SOLUTION control will not allow welding to proceed. Either the TIME or % HEAT (or both) must be reduced. Note that if the maximum number of cycles at the required WELD HEAT is not enough to make a successful weld, increase the number of IMPULSES. This is typically required when welding steel components.

Some welders have a 10 or 12 cycle ability as directed by the design of the welding transformer. These are typically welders designed for steel welding (rather than aluminum).

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-3  
UNDERSTANDING TIP FORCE

### SETTING HEAD WEIGHT:

First, the HEAD WEIGHT for your welder must be entered into the SOLUTION so that calculation of TIP FORCE will be accurate. This is the actual weight of the welding head assembly when all air pressure has been removed. If a force gauge is available, place it between the electrodes and then either push the TIP DRESS valve/switch (if on welder), or remove all incoming air from the welder to allow the head to drop by gravity. Typical head weights are 75lb. to 250 lb. If a suitable measuring system is not available, consult welder manufacturer for this value.

Once this value is known, press: PROGRAM, 80, ENTER and follow instructions on the readout.

### UNDERSTANDING TIP FORCE

On typical three phase welders with diaphragm heads, the TIP FORCE is represented by the following formula:

$$\text{TIP FORCE} = \text{HEAD WEIGHT} + \text{CYLINDER AREA} \times (\text{TOP AIR PSI.} - \text{BACK-UP PSI})$$

HEAD WEIGHT = the dead weight of the welder ram

TOP AIR PRESSURE = the air pressure applied to the upper portion of the welding cylinder (or diaphragm)

BACK-UP AIR PRESSURE = the air pressure applied to the underside of the same cylinder (diaphragm).

If air is placed only on the lower (BACK-UP) port on the diaphragm, the head will lift. This is the position between welds (or "work position"). At this point, the electrodes will be a maximum of 1/2" clear.

If air is exhausted from this lower port, the welding head will drop by gravity. This is the TIP DRESS position.

If air is now applied to the upper port as well as the lower port with the upper air setting higher than the lower air setting), tip force will be applied according to the above formula. This amounts to the DIFFERENCE between force applied to the top and bottom of the weld cylinder (diaphragm). This is the WELD FORCE.

Additionally, if air is applied ONLY to the upper port (bottom port is exhausted), a higher tip force will be generated per the above formula (BACKUP AIR PRESSURE = 0). This creates PRECOMPRESSION FORCE and FORGE FORCE. Note that PRECOMPRESSION and FORGE FORCE are the same value but used at different points in the welding sequence.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-4  
UNDERSTANDING TIP FORCE (CONTINUED)

### SETTING BACK-UP AIR PRESSURE

If a FORGE FORCE and WELD FORCE is chosen in a particular program, the SOLUTION control will automatically calculate the required air pressure for both the upper (TOP) and lower (BACK-UP) air regulators. Note that in the case of systems with the #9381-16 PROGRAMMABLE AIR option, the SOLUTION control will actually set the air regulators. The formulas are as follows:

$$\text{TOP AIR PRESSURE} = \frac{\text{FORGE FORCE}}{\text{CYLINDER AREA}}$$

$$\text{BACK-UP AIR PRESSURE} = \frac{(\text{FORGE FORCE} - \text{WELD FORCE})}{\text{CYLINDER AREA}}$$

As an example, to attain :

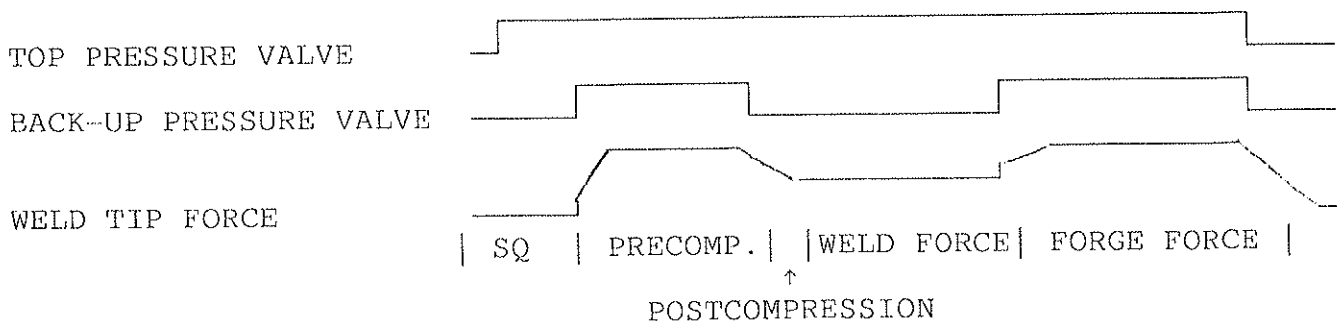
2000 lbs. WELD FORCE  
3300 lbs. FORGE FORCE

with cylinder having an area of 53 in<sup>2</sup> and a HEAD WEIGHT of 200 lbs., the calculations would be:

$$\text{TOP AIR PRESSURE} = \frac{3100}{53} = 58.5 \text{ psi.}$$

$$\text{BACK-UP AIR PRESSURE} = \frac{(3100 - 1800)}{53} = \frac{900}{53} = 24.5 \text{ psi.}$$

The following diagram illustrates the valve sequence to create both WELD FORCE and FORGE FORCE. Keep in mind that the magnitude of force created during PRECOMPRESSION is equal to that produced during FORGE.



The TOP SOLENOID VALVE is of the N.C. (Normally Closed) variety (only passes air when energized).

The BACK-UP SOLENOID VALVE is of the N.O. (Normally Opened) variety (air passes when not energized, and exhausts when energized)

**SOLUTION #9380, 9380D, 9380L**  
**DIRECTIONS FOR USE PAGE U-5**  
**UNDERSTANDING TIP FORCE (CONTINUED)**

**OPERATION SEQUENCE WITH RETRACT VALVE**

This control is designed to operate with a RETRACT valve. If your welder does not have a retract valve, this function must be turned off as directed on page I-4. This function will bring the weld head (or welder arm) to a position that will allow a small space between electrodes (usually less than 1/2").

Welding can be started either from the full retracted (open) position or from the "work" position (small electrode opening).

**OPERATION SEQUENCE FROM "WORK" POSITION**

It is first necessary to bring the electrodes to the "work" position where electrodes are spaced 1/2" or less.

**BRINGING ELECTRODES TO "WORK" POSITION**

If the RETRACT VALVE is on, the electrodes will be opened a small amount (typically 1/2" or less). The sequence will be:

1. The RETRACT SWITCH on the welder is closed and maintained closed. If a foot switch is being used, this will be done using a latch mechanism.
2. RETRACT VALVE is energized to lower welder head assembly (or welder arm) to the "work" position. The letter R will show on the small red window of the keypad.
3. HEAD DOWN limit switch closes on welder. If this limit switch does not close for any reason, the sequence will wait while displaying: HEAD DN LS OPEN.
4. If system is in KEYLESS SYSTEM mode (set in PROGRAM 87/81) skip the rest of these steps. Otherwise, KEY FORWARD VALVE is energized to bring key forward. Note on ROCKER ARM welders, this step is not used. The letter K will show on the small red window of the keypad.
5. As head KEY moves to lock the welder head, the KEY BACK limit switch opens.
6. When the key goes all the way forward to the lock position, the KEY FORWARD limit switch closed. If this limit switch does not close for any reason, the head sequence will wait while displaying: KEY FWD LS OPEN.

**WELDING SEQUENCE FROM "WORK" POSITION**

The control will now wait for initiation to start the weld sequence as follows:

1. Welding foot switch (or hand buttons) is closed.
2. The TOP PRESSURE valve is closed to bring the tips together. The letter W will show on the small red window of the keypad.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-6  
UNDERSTANDING TIP FORCE (CONTINUED)

**WELDING SEQUENCE FROM "WORK" POSITION (continued)**

3. If the second level of the foot switch is closed, the welder will now go through the selected welding sequence of the program being used.

NOTE: If the #9381-05 DIFFERENTIAL PRESSURE TRANSDUCER option is being used, the display will show: TIP FORCE IS LOW until the differential force measured by the control reaches (or exceeds) the WELD FORCE as shown in the program.

4. After the weld has been completed, the TOP PRESSURE VALVE will be released. The letter W goes off from the display.

**BRINGING THE ELECTRODES TO THE FULL OPEN "RETRACT" POSITION**

When it is desired to open the electrodes fully for removal of a part:

1. The RETRACT switch on welder is opened.
2. If system is in KEYLESS SYSTEM mode (set in PROGRAM 87/81) the RETRACT VALVE will be released and the letter R will go off from the display (skip rest of steps). Otherwise, the KEY FORWARD VALVE will now be released. The letter K goes off from the display.
3. If the key does not move, the display will show: KEY FWD LS CLOSED and wait.
4. Once the KEY FORWARD limit switch has opened, the KEY BACK limit switch will open. If it does not, the display will show: KEY BACK LS OPEN.
5. When the KEY BACK limit switch opens, the RETRACT VALVE will be released. The letter R goes off from the display.

If the HEAD DOWN limit switch does not open, the display will show: HEAD DN LS CLOSED and wait. When this limit switch opens, the system resets for the next weld.

**OPERATION SEQUENCE FROM FULL RETRACTED POSITION:**

With the RETRACT SWITCH in the OPEN position (retract valve not energized)

1. Welding foot switch (or hand buttons) is closed.
2. RETRACT VALVE is energized to lower welder head assembly (or welder arm) to the "work" position. The letter R will show on the small red window of the keypad.
3. HEAD DOWN limit switch closes on welder. If this limit switch does not close for any reason, the sequence will wait while displaying: HEAD DN LS OPEN.



SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-7  
UNDERSTANDING TIP FORCE (CONTINUED)

**OPERATION SEQUENCE FROM FULL RETRACTED POSITION (continued)**

4. If system is in KEYLESS SYSTEM mode (set in PROGRAM 87/81), skip to step 7. Otherwise, KEY FORWARD VALVE is energized to bring key forward. Note on ROCKER ARM welders, this step is not used. The letter K will show on the small red window of the keypad.
5. As head KEY moves to lock the welder head, the KEY BACK limit switch opens.
6. When the key goes all the way forward to the lock position, the KEY FORWARD limit switch closed. If this limit switch does not close for any reason, the head sequence will wait while displaying: KEY FWD LS OPEN.
7. The TOP PRESSURE VALVE will now close to bring the electrodes closed. The letter W will show on the small red window of the keypad.
8. If the second level of the foot switch is closed, the welder will now go through the selected welding sequence of the program being used.

NOTE: If the #9381-05 DIFFERENTIAL PRESSURE TRANSDUCER option is being used, the display will show: TIP FORCE IS LOW until the differential force measured by the control reaches (or exceeds) the WELD FORCE as shown in the program.

9. After the weld has been completed, the TOP PRESSURE VALVE will be released. The letter W goes off from the display.
10. The KEY FORWARD VALVE will now be released. The letter K goes off from the display.
11. If the key does not move, the display will show: KEY FWD LS CLOSED
12. Once the KEY FORWARD limit switch has opened, the KEY BACK limit switch will open. If it does not, the display will show: KEY BACK LS OPEN.
13. When the KEY BACK limit switch opens, the RETRACT VALVE will be released. The letter R goes off from the display.

If the HEAD DOWN limit switch does not open, the display will show: HEAD DN LS CLOSED and wait. When this limit switch opens, the system resets for the next weld.

**TIP DRESS SEQUENCE**

IF THE WELD HEAD IS IN THE FULLY RETRACTED POSITION

1. The TIP DRESS switch is closed.
2. The sequence will follow all steps of BRINGING ELECTRODES TO "WORK" POSITION on page U5.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-8  
UNDERSTANDING TIP FORCE (CONTINUED)

3. After step 6, the BACK-UP PRESSURE VALVE will be energized. The letter B will show on the small red window of the keypad. This will allow the electrodes to close by gravity.

**IF THE WELD HEAD IS IN THE "WORK" POSITION**

1. The TIP DRESS switch is closed.
2. The BACK-UP PRESSURE VALVE will be energized. The letter B will show on the small red window of the keypad. This will allow the electrodes to close by gravity.

**PRECOMPRESSION**

This function places a short duration of high pressure just after SQUEEZE time and before heat cycles have started. This reduces the part interface resistance to allow higher current without metal expulsion. While this function is in operation the phrase PRECOMPRESSION will be shown on the upper display.

To use this PRECOMPRESSION:

1. Continue to push the STEP button in the program being set until the display shows PRECOMPRESS 00 CY.
2. Enter the desired period of this high force and press ENTER once. A typical value is 2 to 4 cycles. If no value is entered (00), no precompression will occur.

Note that, if the optional #9381-05 PRESSURE TRANSDUCER option is installed in this control, the system will wait until the requested precompression has been reached, and hold it there for the period of time selected above.

3. The display will now show POSTCOMP. 00 CY. This will be the period of time (typically 2 cycles) after the solenoid controlling the high force has been turned off and the first heat cycle starts. This time allows the tip force to lower to the WELD FORCE level prior to the start of weld current.

Note that, if the optional #9381-05 PRESSURE TRANSDUCER option is installed in this control, the system will wait as the tip force lowers until the requested WELD FORCE has been reached. Therefore no POSTCOMPRESSION time is really needed if this option is being used.

**FORGE DELAY**

It is often desirable, near or at the end of a weld, to have a period of high tip force to minimize nugget cracking due to different rates of cooling through the nugget. This is called FORGE, and your SOLUTION control contains this function.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-9  
UNDERSTANDING TIP FORCE (CONTINUED)

To use, first push PROGRAM 93, ENTER on the keypad. The readout will show:

CONSTANT HIGH = 1 (or other phrase)  
CHANGE 1=YES, 0=NO

If this phase is shown, it indicates that, even if a FORGE DELAY value has been entered in a particular program, no forge will occur.

If it is desired to use the FORGE function, press #1, and the display will show:

CONSTANT HIGH =1  
CONSTANT LOW =2  
FORGE--PREHEAT =3  
FORGE--WELD = 4  
FORGE--TEMPER = 5

If #1 is pressed, the maximum available force from the welder will be applied. This will place the full high force on the electrodes all through the weld sequence. Since the high force will always be there, the system will have no change during FORGE or PRECOMPRESSION. This mode should only be used where the maximum force available in the welder is needed.

In CONSTANT HIGH operation, the control will energize the TOP solenoid valve for 10 cycles to allow the electrodes to close softly, then energize keep the TOP solenoid on and also turn on the BACK-UP solenoid to exhaust air from the underside of the diaphragm and provide full force.

If #2 is pressed, there will be NO FORGE even if a FORGE DELAY time is selected in the program since the BACK-UP valve will never be energized. This is the normal mode for welders where FORGE DELAY is not needed.

If #3 is pressed, the forge timing will start at the beginning of the first PREHEAT cycle if one PREHEAT pulse is in use, or the first PREHEAT cycle of the last PREHEAT pulse if more than one PREHEAT pulse is being used. If FORGE DELAY = 0, no FORGE will occur.

If #4 is pressed, the forge timing will start at the beginning of the first WELD cycle if one WELD pulse is in use, or the first WELD cycle of the last WELD pulse if more than one WELDING pulse is being used. If FORGE DELAY = 0, no FORGE will occur. This is the normal mode for welders where FORGE DELAY is desired at the end or near the end of the WELD sequence.

If #5 is pressed, the forge timing will start at the beginning of the first TEMPER cycle if one TEMPER pulse is in use, or the first TEMPER cycle of the last TEMPER pulse if more than one TEMPER pulse is being used. If FORGE DELAY = 0, no FORGE will occur.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-10  
UNDERSTANDING TIP FORCE (CONTINUED)

FORGE DELAY(continued)

Note that if a FORGE force is selected in the individual program that is lower than the WELD force, the system will show:

FORGE<WELDFORCE

and send you back to the WELDFORCE line in the program. It will refuse to operate until the error has been corrected.

Also, if the difference between the FORGE FORCE and the WELD FORCE is less than the required force needed to lift the weld head, the electrodes will not retract properly between welds.

If no FORGE FORCE value has been entered in the program being used (FORGE = 0000LB), the SOLUTION control will automatically assume the default back-up pressure (BACKUP PR. ##PSI.) at the start of PROGRAM 96 to allow pressure necessary to lift the weld head. See TIP FORCE MEASUREMENT SYSTEM section of these directions for setting instructions.

# SOLUTION #9380, 9380D, 9380L

DIRECTIONS FOR USE PAGE U-11

## SETTING CONTROL

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.

The factory phone number is: 847-480-0115.

Email: techsupport@unitrol-electronics.com.

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

**DIAGNOSTIC TEST**  
**UNITROL SOLUTION**  
**HOLDING MODE**  
**PRESS. TRANSD. OFF = 1**  
**PHASE A,B,C = 1**  
**AVC OFF**  
**EPSON PRINTER**

This indicates that the system has loaded the software correctly and is ready for weld schedule (program) entry.

2. Press: **PROGRAM, ##, ENTER**, where **##** is your choice of number for the welding program you are about to enter.
3. If this is the first time data is being entered into this program number, the display will show:

**PROGRAM ## EMPTY**

If data was entered into this program number, the display will show:

**PROGRAM ## READY**

If data is already in this program number, you can write over or select another program number that is empty.

4. Press **STEP/ENTER** and the display will show:

**SPOT WELD MODE=1**  
**CHANGE 1=YES,0=NO**

If the weld process is SPOT (not seam or roll spot), press 0 to leave this mode.

If the weld process is **not** SPOT, press 1. The display will scroll through the following:

**SPOT WELD MODE=1**

**ROLL-SPOT MODE=2**

**SEAM WELD MODE=3**

PRESS the number that matches the desired welding mode for this program. Note that the first line in each of the 75 programs will ask the same question. In this way you can have a mixture of welding modes left in memory.

**GO TO THE DESIRED WELDING MODE IN THE FOLLOWING THREE PAGES TO SEE WHAT THAT PROGRAM LINES EACH MODE CONTAIN.**

# SOLUTION #9380, 9380D, 9380L

DIRECTIONS FOR USE PAGE U-12

## SPOT WELD MODE

When 1 is pushed to select SPOT WELD MODE, the following lines will be displayed in order.

Press **STEP** to move to the next line.

Press **BLOCK** to jump to the next block as shown in the chart below

Press **BACK** to go to the previous line

Press and HOLD the **STEP** button and the control will show only lines that have data entered.

| STEP | CONTROL DISPLAY    | FUNCTION  | BLOCK |
|------|--------------------|---|-------|
| 1    | INIT SQUEEZE = 00  | Time delay after initiation for first weld if in REPEAT until start of heat   | 1     |
| 2    | SQUEEZE TIME=00    | Time delay after initiation for start of weld. If in REPEAT, this will be the delay for all welds AFTER the first.  |       |
| 3    | WELD TIME = 00     | Number of cycles of heat. If using WELD PULSES, this is the number of cycles of heat in EACH of the WELD PULSES   |       |
| 4    | WELD HEAT = 00%    | Heat percentage used for each of the WELD cycles  |       |
| 5    | WELD DECAY T=00    | Number of cycles of DECAY used at the d of WELD TIME.   |       |
| 6    | WELD DECAY =00%    | Final heat percentage for DECAY WELD. Note that if the weld heat percent is lower than 61% and no WELD DECAY has been entered here, the control will automatically set one cycle of the A phase only to help bring flux down in the transformer core. This is called "INVERSION". |       |
| 7    | WELD PULSES = 00   | Number of pulses of weld. A "pulse" contains the number of cycles of heat set in WELD TIME.   |       |
| 8    | WELD COOL = 00     | Number of line cycles between WELD PULSES.  |       |
| 9    | HOLD TIME = 00     | Number of line cycles after the end of the last heat sequence before the electrodes are opened.   |       |
| 10   | PREHEAT TIME= 00   | Number of cycles of heat in a sequence before WELD TIME. If PREHEAT PULSES are used, this is the number of heat cycles in each PULSE.   | 2     |
| 11   | PREHEAT = 00%      | Heat percentage used for each of the PREHEAT cycles   |       |
| 12   | PREHEAT DECAY=00   | Number of cycles of PREHEAT DECAY at the end of PREHEAT TIME.   |       |
| 13   | PREHEAT DECAY=00%  | Final heat percentage for PREHEAT DECAY   |       |
| 14   | PREHEAT PULSE= 00  | Number of pulses of PREHEAT. A "pulse" contains the number of cycles of heat set in PREHEAT TIME.   |       |
| 15   | PREHEAT COOL = 00  | Number of line cycles between PREHEAT PULSES  |       |
| 16   | QUENCH TIME = 00   | Number of line cycles of non-heat time before TEMPER  |       |
| 17   | TEMPER TIME – 00   | Number of cycles of heat in a sequence after QUENCH TIME. If TEMPER PULSES are used, this is the number of heat cycles in each PULSE.   |       |
| 18   | TEMPER HEAT = 00%  | Heat percentage used for each of the TEMPER cycles  |       |
| 19   | TEMPER DECAY = 00  | Number of cycles of TEMPER DECAY used at the end of each TEMPER TIME.   |       |
| 20   | TEMPER DECAY = 00% | Final heat percentage for TEMPER DECAY  |       |
| 21   | TEMPER PULSE = 00  | Number of pulses of TEMPER. A "pulse" contains the number of cycles of heat set in TEMPER TIME.   |       |
| 22   | TEMPER COOL = 00   | Number of line cycles between TEMPER PULSES.  |       |
| 23   | REPEAT = 00 CY OFF | If the control is in REPEAT mode, this is the number of line cycles of time between release of the weld solenoid and the turn on of the weld solenoid. For continuous welding when the foot switch remains closed.  | 3     |
| 24   | WELD FORCE=0000LB  | Electrode force when air is on top and bottom of the welding diaphragm or cylinder. When using the 9381-05C DIFFERENTIAL TRANSDUCER option, welding will start when this (calculated) force has been reached.   | 4     |
| 25   | FORGE = 0000LB     | Electrode force when air is on top of the welding diaphragm or cylinder, and air on the bottom has been exhausted. This will be used when FORGE DELAY TIME has been entered, the control is set to CONSTANT HIGH in PROGRAM 93, or PRECOMPRESSION is used.                        |       |
| 26   | FORGE DEL=00.0CY   | Number of line cycles delay time from the START of WELD HEAT. If the control uses WELD PULSES, this is the time after the START of the LAST of the WELD PULSES.   | 5     |
| 27   | PRECOMPRESS=00CY   | Number of line cycles after SQUEEZE TIME when full FORGE FORCE is applied between the electrodes.   | 6     |
| 28   | POSTCOMPRES=00CY   | Number of line cycles after PRECOMPRESS is released and before the next sequence (PREHEAT or WELD) starts.  |       |

# SOLUTION #9380, 9380D, 9380L

DIRECTIONS FOR USE PAGE U-13

## ROLL-SPOT MODE

When 2 is pushed to select ROLL-SPOT MODE, the following lines will be displayed in order.

Press **STEP** to move to the next line.

Press **BLOCK** to jump to the next block as shown in the chart below

Press **BACK** to go to the previous line

Press and HOLD the **STEP** button and the control will show only lines that have data entered.

| STEP | CONTROL DISPLAY                                | FUNCTION   | BLOCK |
|------|--|--|-------|
| 1    | SQUEEZE TIME=00                                | Time delay after initiation for start of weld.   | 1     |
| 2    | WELD TIME = 00                                 | Number of cycles of heat. If using WELD PULSES, this is the number of cycles of heat in EACH of the WELD PULSES  |       |
| 3    | WELD HEAT = 00%                                | Heat percentage used for each of the WELD cycles   |       |
| 4    | WELD DECAY T=00                                | Number of cycles of DECAY used at the d of WELD TIME.  |       |
| 5    | WELD DECAY =00%                                | Final heat percentage for DECAY WELD. Note that if the weld heat percent is higher than 61% and no WELD DECAY has been entered here, the control will automatically set one cycle of the A phase only to help bring flux down in the transformer core. This is called "INVERSION". |       |
| 6    | WELD PULSES = 00                               | Number of pulses of weld. A "pulse" contains the number of cycles of heat set in WELD TIME.  |       |
| 7    | WELD COOL = 00                                 | Number of line cycles between WELD PULSES.   |       |
| 8    | HOLD TIME = 00                                 | Number of line cycles after the end of the last heat sequence before the electrodes are opened.  |       |
| 9    | PREHEAT TIME= 00                               | Number of cycles of heat in a sequence before WELD TIME. If PREHEAT PULSES are used, this is the number of heat cycles in each PULSE.  | 2     |
| 10   | PREHEAT = 00%                                  | Heat percentage used for each of the PREHEAT cycles  |       |
| 11   | PREHEAT DECAY=00                               | Number of cycles of PREHEAT DECAY at the end of PREHEAT TIME.  |       |
| 12   | PREHET DECAY=00%                               | Final heat percentage for PREHEAT DECAY  |       |
| 13   | PREHEAT PULSE= 00                              | Number of pulses of PREHEAT. A "pulse" contains the number of cycles of heat set in PREHEAT TIME.  |       |
| 14   | PREHEAT COOL = 00                              | Number of line cycles between PREHEAT PULSES   |       |
| 15   | QUENCH TIME = 00                               | Number of line cycles of non-heat time before TEMPER   |       |
| 16   | TEMPER TIME – 00                               | Number of cycles of heat in a sequence after QUENCH TIME. If TEMPER PULSES are used, this is the number of heat cycles in each PULSE.  |       |
| 17   | TEMPER HEAT = 00%                              | Heat percentage used for each of the TEMPER cycles   |       |
| 18   | TEMPER DECAY = 00                              | Number of cycles of TEMPER DECAY used at end of each TEMPER TIME.  |       |
| 19   | TEMPER DECAY = 00%                             | Final heat percentage for TEMPER DECAY   |       |
| 20   | TEMPER PULSE = 00                              | Number of pulses of TEMPER. A "pulse" contains the number of cycles of heat set in TEMPER TIME.  | 3     |
| 21   | TEMPER COOL = 00                               | Number of line cycles between TEMPER PULSES.   |       |
| 22   | MOTOR = 000 CYC                                | Number of line cycles that the seam motor will operate between welds   |       |
| 23   | SEAM SPEED = 00.0%<br>or<br>SPEED = 000 IN/MIN | Speed of part movement between welds during MOTOR CYCLES.<br>If PROGRAM 87/70 is set for "USE SPEED = %", percent of maximum rpm.<br>If PROGRAM 87/70 is set for "USE SPEED = IN/MIN", linear speed.   |       |
| 24   | WHEEL DIAMETER                                 | The seam wheel diameter. This is used for speed calculations   |       |
| 25   | WELD FORCE=0000LB                              | Electrode force when air is on top and bottom of the welding diaphragm or cylinder. When using the 9381-05C DIFFERENTIAL TRANSDUCER option, welding will start when this (calculated) force has been reached.  | 4     |
| 26   | FORGE = 0000LB                                 | Electrode force when air is on top of the welding diaphragm or cylinder, and air on the bottom has been exhausted. This will be used when FORGE DELAY TIME has been entered, the control is set to CONSTANT HIGH in PROGRAM 93, or PRECOMPRESSION is used.                         |       |
| 27   | FORGE DEL=00.0CY                               | Number of line cycles delay time from the START of WELD HEAT.<br>If the control uses WELD PULSES, this is the time after the START of the LAST of the WELD PULSES.   | 5     |
| 28   | PRECOMPRESS=00CY                               | Number of line cycles after SQUEEZE TIME when full FORGE FORCE is applied between the electrodes.  | 6     |
| 29   | POSTCOMPRES=00CY                               | Number of line cycles after PRECOMPRESS is released and before the next sequence (PREHEAT or WELD) starts.   |       |

# SOLUTION #9380, 9380D, 9380L

DIRECTIONS FOR USE PAGE U-14

## SEAM WELD MODE

When 3 is pushed to select SEAM WELD MODE, the following lines will be displayed in order.

Press **STEP** to move to the next line.

Press **BLOCK** to jump to the next block as shown in the chart below

Press **BACK** to go to the previous line

Press and HOLD the **STEP** button and the control will show only lines that have data entered.

| STEP | CONTROL DISPLAY                                | FUNCTION  | BLOCK |
|------|--|---|-------|
| 1    | SQUEEZE TIME=00                                | Time delay after initiation for start of weld   | 1     |
| 2    | WELD TIME = 00                                 | Number of cycles of heat. If using WELD PULSES, this is the number of cycles of heat in EACH of the WELD PULSES   |       |
| 3    | WELD HEAT = 00%                                | Heat percentage used for each of the WELD cycles  |       |
| 4    | WELD DECAY T=00                                | Number of cycles of DECAY used at the d of WELD TIME.   |       |
| 5    | WELD DECAY =00%                                | Final heat percentage for DECAY WELD. Note that if the weld heat percent is lower than 61% and no WELD DECAY has been entered here, the control will automatically set one cycle of the A phase only to help bring flux down in the transformer core. This is called "INVERSION". |       |
| 6    | WELD COOL = 00                                 | Number of line cycles between WELD TIME pulses  |       |
| 7    | HOLD TIME = 00                                 | Number of line cycles after the end of the last heat sequence before the electrodes are opened.   |       |
| 8    | SEAM SPEED = 00.0%<br>or<br>SPEED = 000 IN/MIN | Speed of part movement between welds during MOTOR CYCLES.<br>If PROGRAM 87/70 is set for "USE SPEED = %", percent of maximum rpm.<br>If PROGRAM 87/70 is set for "USE SPEED = IN/MIN", linear speed.  | 2     |
| 9    | WHEEL DIAMETER                                 | The seam wheel diameter. This is used for speed calculations  |       |
| 10   | WELD FORCE=0000LB                              | Electrode force when air is on top and bottom of the welding diaphragm or cylinder. When using the 9381-05C DIFFERENTIAL TRANSDUCER option, welding will start when this (calculated) force has been reached.   | 3     |
| 11   | FORGE = 0000LB                                 | Electrode force when air is on top of the welding diaphragm or cylinder, and air on the bottom has been exhausted. This will be used when CONSTANT HIGH has been selected in PROGRAM 93.  |       |



## CONTROL FUNCTIONS

### RUN/REPEAT BUTTON:

#### USED WITH SPOT WELD MODE:

Pressing the RUN/REPEAT button will light up the ORANGE LED above this button. When the initiation switch is pushed, the first weld will be made. If the initiation switch remains closed, the control will release the weld solenoid for time set in **REPEAT = ##** program time, and then turn on the weld solenoid to bring the electrodes closed again. This sequence will continue until the initiation switch has been released before the end of HOLD TIME.

If the **NO WELD** button is pushed twice, the YELLOW LED above this button as well as the ORANGE LED above RUN/REPEAT button will light up. In this condition the welder will work as shown above, but no weld heat will be created. This can be used to check and adjust welding speed without actually welding.

#### USED WITH SEAM WELD or ROLL SPOT MODES:

Pressing the RUN/REPEAT button will light up the ORANGE LED above this button. When the initiation switch is pushed, the seam operation will begin. The initiation switch can be released and welding will continue. When it is desired to stop the welding sequence, close the initiation switch one time.

This feature allows welding of very long parts without having to hold a footswitch closed. When two footswitches are wired in parallel to the initiation input, one pedal at the starting end of the part can be pushed, and a second at the other end can be pushed when the part has been completed.

### COUNTER SYSTEM, PROGRAM 91:

#### FOR SPOT WELD MODE:

The electronic counter system can be used in three ways:

1. **COUNT INDIVIDUAL WELDS:** This is the default mode. Set **WELDS/PART = 00** in PROGRAM 91. The counter will show: **WELDS MADE = ##,###** every time a single weld has been made.
2. **NOT COUNT WELDS:** Select **COUNTER OFF** in PROGRAM 91.  
The display will show: **S W H** or other letters representing the first letter in the welding function that was just used. If this is left on the display, it confirms that the counter is OFF.
3. **COUNT COMPLETED PARTS:** Set **WELDS/PART** in PROGRAM 91 to the number of welds that will be made on a single part. At the end of the selected number of welds, The display will show: **PARTS MADE = ##,###**.

## SOLUTION #9380, 9380D, 9380L

DIRECTIONS FOR USE PAGE U-16

### FOR SEAM WELD and ROLL SPOT MODES:

The electronic counter system can be used in three ways:

4. **COUNT INDIVIDUAL SEAMS:** This is the default mode. Set **SEAMS/PART = 00** in PROGRAM 91. The counter will show: **SEAMS MADE = ##,###** every time a single seam has been completed.
5. **NOT COUNT WELDS:** Select **COUNTER OFF** in PROGRAM 91.  
The display will show: **S W H** or other letters representing the first letter in the welding function that was just used. If this is left on the display, it confirms that the counter is OFF.
6. **COUNT COMPLETED PARTS:** Set **SEAMS/PART** in PROGRAM 91 to the number of welds that will be made on a single part. At the end of the selected number of seams, The display will show: **PARTS MADE = ##,###**.

### FOREIGN LANGUAGE PROMPTS, PROGRAM 92:

This feature allows words used by the operator to be in either English or Spanish. These phrases are limited to operator warnings and starting information.

To use, press: **PROGRAM, 92, ENTER**. The display will show:

**LANGUAGE-ENGLISH  
CHANGE1=YES,0=NO**

To leave the system in English, press 0.

To change language to Spanish, press 1. The display will now show:

**LANGUAGE-SPANISH  
CHANGE1=YES,0=NO**

### INITIATION MODES, PROGRAM 90.

The control can be used with two initiation modes:

#### HOLDING INITIATION MODE:

This mode requires that the initiation switches be kept closed until the start of welding heat. If the initiation switches are opened prior to that time, the electrodes will be released. **This is the mode can be used even if the space between the electrodes is more than 1/4"** since releasing the initiation will allow the electrodes to open at any time before the start of actual welding heat. If in doubt, this is the initiation mode that should be used to protect the operator.

#### MOMENTARY INITIATION MODE:

In this mode, once the initiation switch has been closed, the sequence will continue even if the welder is not into the actual weld heat sequence. **This mode should only be used if space between the electrodes is less than 1/4" or if the welder is guarded by the SOFT TOUCH safety system.** Because releasing the initiation switch while the electrodes are moving will not stop movement, be cautious when using MOMENTARY INITIATION mode.

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DIRECTIONS FOR USE PAGE U-17

To select the INITIATION MODE, press: **PROGRAM, 90, ENTER**. The display will show:

**HOLDING MODE**  
**CHANGE1=YES,0=NO**

If you want to leave the initiation in HOLDING mode, press **0**.

If you want to change the initiation mode to MOMENTARY mode, press **1** and the display will show:

**MOMENTARY MODE**  
**CHANGE1=YES,0=NO**

## KEYBOARD LOCK SYSTEM:

If the key switch on the keypad is in the **LOCK** position, and any change is attempted to any welding or set-up program, the control will refuse to make the change, and the display will show:

**KEYBOARD LOCKED**

When the key is in the **LOCK** position, only selection of a new PROGRAM can be made.

## PHASE ASSIGNMENT, PROGRAM 79:

Your frequency converter welder is normally uses all three line phases (A, B, C). If it is desired to reduce heat for welding of light materials and it is found that the weld heat percent is lower than 50%, eliminating one or two of the phases can be used successfully. To select the desired phase usage, press: **PROGRAM, 93, ENTER**. The display will show:

**PHASE ASSIGNMENT**

**PHASE A, B, C = 1**  
**CHANGE1=YES,0=NO**

To leave the control using all three phases, press **0**.

To select the use of fewer phases, press **1** and the display will scroll:

**PHASE A, B, C = 1**

**PHASE A & B = 2**

**PHASE A ONLY= 3**

Produces 2/3 power

Produces 1/3 power

Press the number that matches the phase group you want to use.

## DIRECT ACCESS CODES

### DIRECT SELECT, OR PROGRAM 87, ENTER, 0

Service programs of the SOLUTION control can be modified in two ways:

1. **DIRECT SELECT.** Press: **PROGRAM, ##, ENTER** where **##** is the PROGRAM NUMBER shown below. This will take you directly to the service program.
2. **FULL LIST SELECT.** Press: **PROGRAM, 0, ENTER.** The control will now show one service program at a time in numerical order each time you press the **STEP** button.
  - a. Once you see the desired service program, push **PROGRAM** and the service program will be displayed.
  - b. After you have entered desired data into the selected program, you can press **SINGLE** to exit service programs, or just press **STEP** to go to the next service program.

| PROGRAM NUMBER | FUNCTION                           | HOW FUNCTION IS USED   | USED WITH OPTION                            | SEE PAGE |
|----------------|------------------------------------|--|---|----------|
| 75             | SET MOTOR SPEED AND GEAR BOX RATIO | Sets values used to calculate required motor speed for SEAM and ROLL SPOT modes.   | 9381-25                                     | U-21     |
| 76             | INVERSION START %                  | Starting point for inversion (forced decay) when weld heat % is higher than 61% and no DECAY has been entered.   | -   | I-8      |
| 77             | PRINT PROGRAMS DATA                | Sends listing of setup entries to the printer port   | 9181-21A                                    | U-44     |
| 78             | UNIT NUMBER SETUP                  | Assigns number to welder for printing  | 9181-21A                                    | U-44     |
| 79             | CHOOSE PHASE A/B/C                 | Selects use of all phases, 2/3, or 1/3 for welding thin metal  | -   | U-17     |
| 80             | HEAD WEIGHT                        | Enter dead weight of welder head for TIP FORCE calculation.  |   | U-3      |
| 81             | PRINT FAULTS or WELDS              | Select printing of ALL WELDS or just welds with FAULTS   | 9181-21A                                    | U-44     |
| 82             | FAULT RESET MODE                   | Select function that will happen after a Current or Force Fault has been detected. This chooses to close a fault relay and continue, or to keep the electrodes closed until the initiation switch is closed again. | 9381-05<br>9181-21A<br>9381-22A<br>9381-22B | U-40     |
| 83             | CURRENT BLANKING                   | Does not measure welding current for selected first cycles   | 9381-22A<br>9381-22B                        | U-37     |
| 84             | CURRENT READ MODES                 | Selects current READ ONLY, READ & REACT, READ OFF  | 9381-21A<br>9381-22B                        | U-38     |
| 85             | CURRENT CALIBRATION                | Adjust current reading to match standard   | 9381-22A<br>9381-22B                        | U-36     |
| 86             | SOFTWARE VERSION                   | Shows system software version number   | -   | -        |
| 87             | SECURE PROG. AREA                  | Enters secure area. Push: PROGRAM, 87.<br>The display will show: UNITROL SOLUTION.<br>Now enter the number after the / below to select the desired setup program.  | -   | -        |
| 87/70          | SELECT MOTOR SPEED MODE            | Selects between entering MOTOR SPEED in percentage of maximum motor RPM, or in part movement in IN/MIN   | -   | U-22     |
| 87/81          | KEY/KEYLESS select                 | Set to match type of welder ram mechanism  | -   | I-5      |
| 87/92          | MAX. % X WELD TIME                 | Sets maximum values to prevent saturation of the welding transformer. Factory default is 4 cycles at 99%.  | -   | I-5      |
| 87/97          | COMMUNICATION SETUP                | Choose PRINTER or UPLOAD/DOWNLOAD modes  | 9181-21A                                    | -        |
| 87/98          | RETRACT VALVE ON/OFF               | Set to match welders WITH and WITHOUT RETRACT  | -   | I-5      |
| 87/99          | SECONDARY CURRENT RANGE SETUP      | Selects current range to match setting on DIPswitch current range setting  | 9381-22A<br>9381-22B                        | U-36     |

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| PROGRAM<br>NUMBER | FUNCTION                                | HOW FUNCTION IS USED   | USED<br>WITH<br>OPTION          | SEE<br>PAGE |
|-------------------|---|--|---------------------------------|-------------|
| 88                | POS/NEG BALANCE<br>INVERSION PERCENTAGE | Adjusts amplitude of positive and negative pulses. Factory default = 0% for positive and negative. Sets percentage of INVERSION. Factory default = 07% | -                               | I-8         |
| 89                | AVC VOLTAGE SETUP                       | Enter measured line voltage to set reference point for Automatic Voltage Compensation. Then be sure to turn the function on in PROGRAM 98.             | -                               | U-33        |
| 90                | INITIATION MODE SETUP                   | Selects HOLDING or MOMENTARY initiation  | -                               | U-16        |
| 91                | COUNTER SETUP                           | Select to count WELDS or PARTS. Turns counter ON or OFF.   | -                               | U-15        |
| 92                | LANGUAGE SELECT                         | Selects English or Spanish for operator displays   | -                               | U-16        |
| 93                | FORGE SETUP                             | Selects point that FORGE timing starts   | -                               | U-8         |
| 95                | SINGLE OR DUAL PROG.                    | Allows one weld program to be assigned to INITIATION A and a second to INITIATION B  | -                               | U-26        |
| 96                | PRESSURE SETUP                          | Set area of cylinder or diaphragm. Used to calculate required TOP and BACKUP pressure to achieve desired WELD FORCE and FORGE FORCE                    | -                               | U-27        |
| 96                | TRANSDUCER SETUP                        | Read WELD FORCE and FORGE FORCE. Turn transducer function ON and OFF   | 9381-05                         | U-29        |
| 97                | FAULT RELAY ASSIGNMENT                  | Assigns CURRENT, FORCE, and LINE VOLTAGE faults to separate fault relays   | 9381-05<br>9281-22A<br>9281-22B | U-41        |
| 98                | AVC ON/OFF                              | Turns Automatic Voltage Compensation ON or OFF   | -                               | U-33        |
| 99                | MASTER MEMORY ERASE                     | Clears all programs and settings. Requires security code   | -                               | -           |

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-20

## SEAM AND ROLL-SPOT SPEED SETUP

**FUNCTION:** After entering information on motor speed, gearing, and seam wheel diameter, entry of desired welding speed will produce a calculated percentage of maximum motor speed needed to match the selected welding speed.

If this control does NOT have motor control option #9381-25 installed, skip to page U-21.

If this control has option #9381-25 installed the equipment is described below:

**HARDWARE:** This option consists of:

- A. A DC regenerative drive control with an isolated input module
- B. An interface between the SOLUTION controller and the DC regenerative drive to control motor speed in response to entry into the SOLUTION control.

### **INSTALLATION:**

1. The motor controller and interface component is factory installed and interconnected on this control.
2. Connect DC motor field and armature as shown on drawing 1677-AC-DC3R. This is for a standard 200VDC field and a 0-180VDC armature.
  - i. If during the first test the motor runs in reverse of the desired direction, reverse connection of the armature wires.
  - ii. Note: If the motor has winding voltage requirements not covered by the above values, consult with the Unitrol service department about changing the wiring.
3. If a motor tachometer is being used, connect as shown on the same drawing. *Read notes on this drawing for cautions on connection of this component.*

**SOLUTION #9380, 9380D, 9380L**  
**DIRECTIONS FOR USE PAGE U-21**

## SEAM AND ROLL-SPOT SPEED SETUP

The SOLUTION control has the ability to calculate the required motor speed to achieve the desired part movement during welding. This is useful when using part speed from a welding chart to produce desired nugget spacing in SEAM WELDING or the speed between welds in ROLL-SPOT WELDING.

If option #9381-25 (motor speed control) is installed on this control, this same data is used to actually set the motor speed in response to the entry in the welding program.

### INITIAL SETUP:

1. On the SOLUTION keypad, press: **PROGRAM, 75, ENTER**. The display will show:

**MAX. MOTOR SPEED**  
**0000 RPM**

**CHANGE1=YES,0=NO**

Press 1 and then enter the nameplate maximum DC motor speed.

**NOTE:** The last digit is a FIXED 0. Be sure that your speed is shown before pressing ENTER.

2. Press ENTER and the display will show:

**GEAR RATIO**  
**0000:1**

**CHANGE1=YES,0=NO**

Enter the gear ratio between the DC motor shaft speed and the speed of the seam wheel shaft. This will be a number that represents how many times the motor rotates to make the seam wheel turn one time.

- If the DC motor has a gear reduction head with an output directly coupled to the seam wheel shaft, use the nameplate gear ratio.
- If the DC motor has a gear reduction head that is connected to another gearbox, multiply the nameplate gear ratio on the DC motor drive by the nameplate ratio of the external gearbox.
- If the DC motor has a gear reduction head that is connected to a pulley and belt system, multiply the nameplate gear ratio on the DC motor drive by the ratio of the pulley diameters (diameter on DC motor side divided by diameter on the seam wheel shaft).

3. Press ENTER and the display will very briefly show:

**CALC. SPEED=##.##%**

and exit the setup program.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-22

SEAM AND ROLL-SPOT SPEED SETUP

4. Press: **PROGRAM**, **87**, **ENTER**, **70**. The display will show:

**MOTOR CONTROL**  
**USE SPEED = %**

**CHANGE1=YES,0=NO**

If you want to enter seam wheel speed as a percentage of the maximum speed, press **0** to not change. The system will now exit this setup program.

If you want to enter seam wheel speed in part speed, press **1**. The display will now show:

**MOTOR CONTROL**  
**USE SPEED = IN/MIN**

and exit this setup program. This selection can be changed in the future at any time.



## SOLUTION #9380, 9380D, 9380L

DIRECTIONS FOR USE PAGE U-23

### SEAM AND ROLL-SPOT SPEED SETUP

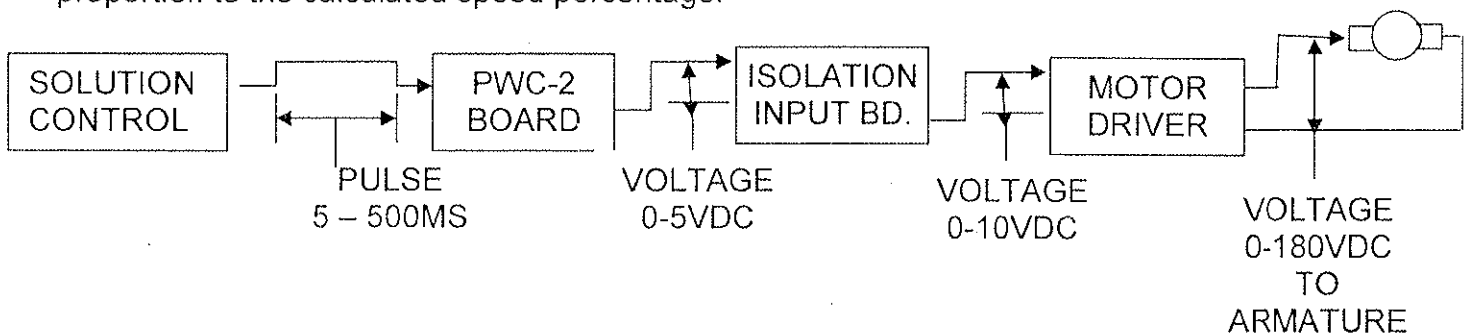
**IF YOU HAVE OPTION #9381-25 MOTOR SPEED OPTION** installed in this control, selection of weld speed % or weld in/min in each of the 74 programs will automatically change the seam motor speed.

#### HOW OPTION #9381-25 SYSTEM WORKS:

At this time, the SOLUTION computer will send a voltage pulse to the Unitorl pulse width converter #9180-PWC-2. The width of this pulse will determine a voltage (0-5VDC) that is sent from this board to the input of the Isolation Input Board mounted on top of the motor controller.

The Isolation Input Board will now send a voltage (0-10VDC) to the input of the Regenerative DC Drive board.

The Regenerative DC Drive board will now set an armature voltage between 0-180VDC in proportion to the calculated speed percentage.



SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-24

SEAM AND ROLL-SPOT SPEED SETUP

**SETTING MOTOR SPEED FOR PRODUCTION:**

1. Select a welding PROGRAM from the 74 available that will be used to store data for the part to be welded.
2. Answer the first question to select either SEAM or ROLL-SPOT mode.
3. Enter the desired values for the program lines until you get to:

**SPEED=0000 IN/MIN**

OR

**SPEED = 00.0%**

**HINT:** If you want to get to this line quickly after pressing: **PROGRAM, ##, ENTER:**

In **SEAM** mode, press the **BLOCK** button twice to get to this line.

In **ROLL SPOT** mode, press the **BLOCK STEP** button three times to get to the **MOTOR = 0000 CY** line. Then push **STEP** once.

This display depends on the choice made in **PROGRAM 87/70**. This selection can be changed as desired. Note that when changing this selection the value in all programs will follow this choice.

If a program was originally set for **SPEED = %**, and then changed to **SPEED = 0000 IN/MIN**, the value shown on this line will be 0000 IN/MIN until you enter a value.

If a program was originally set for **SPEED = IN/MIN** and then changed to **SPEED = %**, the value shown on this line will be 00.0% until you enter a value. It will not calculate backwards.

In this way you can keep different percentage and speed settings in each program and not lose them when making the change in entry mode.

5. Now press **SINGLE, NO WELD, or RUN/REPEAT**. The display will briefly display:

**CALC. SPEED=##.##%**

and then show that the program is ready. If this control includes option #9381-25 motor speed control, motor rpm will now be automatically set at this percentage of maximum motor speed.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-25

SEAM AND ROLL-SPOT SPEED SETUP

**FAULT INDICATION:** If a welding speed (IN/MIN) has been entered that will require the DC motor to operate at an RPM above its maximum speed, the display will show:

CALC.ERROR>99.9%

WELDING SPEED  
0000 IN/MIN

CHANGE1=YES,0=NO

6. Press 1 to change, and then enter a speed that will be within the motor's rpm ability.
7. Press SINGLE and the system will now be ready to operate at the selected motor speed to produce the selected part movement speed at the seam wheels.

**CALIBRATION:** If the system is operating correctly, the output voltage to the DC motor armature at terminals A1 and A2 on the motor controller should be set at:

**180V X DISPLAYED PERCENTAGE**

For example, if the display indicates:

CALC. SPEED 66.5%

the voltage out of the motor controller to the DC motor armature should be:

$$180V \times .665 = 119.7VDC$$

If the output of the motor driver is not reasonably at the correct voltage for the percentage calculation shown on the readout, contact the Unitrol service department for instructions.

# UNITROL SOLUTION DIRECTIONS FOR USE PAGE U-26 DUAL HEAT 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 1FS1 and 2FS1 on the power supply. Note that in all cases, each set of initiation (foot switch or palm buttons) will act independently.

To use DUAL HEAT:

B. Call PROGRAM #95 and proceed as follows

| STEP | PRESS   | CONTROL WILL DISPLAY                  |
|------|---------|---------------------------------------|
| 1.   | —       | SPOT WELD (or other mode) =1          |
| 2.   | —       | CHANGE 1=YES, 0=NO                    |
| 3.   | 1       | SPOT WELD MODE =1                     |
| 4.   | —       | DUAL HEAT = 2                         |
| 5.   | 2       | PROG A =--- & B=---                   |
| 6.   | —       | CHANGE 1=YES, 0=NO                    |
| 7.   | 1       | PROGRAM A=---                         |
| 8.   | 1 to 75 | PROGRAM A=##                          |
| 9.   | ENTER   | PROGRAM B=---                         |
|      |         | or                                    |
|      |         | PROGRAM A EMPTY**                     |
| 10.  | 1 to 75 | PROGRAM B=##                          |
| 11.  | ENTER   | FOOT PEDAL =1(or selected initiation) |
|      |         | or                                    |
|      |         | PROGRAM B EMPTY**                     |
| 8.   | MODE    | PROGRAM A=##, B=##                    |
| 9.   | —       | FOOT PEDAL =1(or selected initiation) |

\*\* 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 is the SAMPLE PROGRAM (page U-10 for spot, U-12 for SEAM) to program this number. You cannot use the dual program system with an "empty" program. Once you have finished, return to the DUAL HEAT 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 #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-27  
TIP FORCE MEASUREMENT SYSTEM

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

Some welders list the WELD PRESSURE RATIO on the name plate. This number, when multiplied by air pressure, will yield the actual force between the welding electrodes (tips). On these machines, press PROGRAM 96, press ENTER. If the #9381-05 PRESSURE TRANSDUCER OPTION is installed in this control, the display will show:

PRESS. TRANSD. OFF(or ON)  
CHANGE 1=YES, 0=NO

If "OFF" is shown, press #1. If "ON" is shown, press #0. The display will now show:

BACKUP PR. ## PSI (## ATM)

If this number is less than that required to raise the welder head (usually 20 psi. or 1.4 atm.), install the correct value by first pressing #1 (YES) and then the desired pressure value. This is the value that the SOLUTION will use if no FORGE PRESSURE is selected in a particular welding schedule (default value).

Now press "ENTER". The display will show:

--.- LB. FORCE\PSI. ( \_ \_ \_ KG FORCE\ATM)

Enter the WELD PRESSURE RATIO shown on the welder nameplate. The SOLUTION control will use this ratio for calculations.

If no ratio is shown on the nameplate, first calculate the diaphragm area(or cylinder area if not an aircraft welder) as follows:

$$\text{AREA} = .785 \times (\text{diameter})^2$$

For example, with a 10" diameter diaphragm:

$$\begin{aligned}\text{AREA} &= .785 \times (\text{diameter})^2 \\ &= .785 \times (10 \times 10) \\ &= .785 \times 100 \\ &= 78.5 \text{ square inches}\end{aligned}$$

Now press the following:

PROGRAM 96  
ENTER  
ENTER  
ENTER

and the display will show:

\_\_.\_ LB FORCE/PSI ( \_ \_ \_ KG FORCE\ATM)

UNITROL SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-28  
TIP FORCE MEASUREMENT SYSTEM (CONTINUED)

If you are operating a PRESS WELDER, enter the number calculated above.

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

$$\text{ARM LEVERAGE} = (A/B)$$

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, using the cylinder in the above example, but on a ROCKER ARM WELDER 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"):

$$\begin{aligned}\text{ARM LEVERAGE} &= 18/24 \\ &= .75\end{aligned}$$

$$\begin{aligned}\text{XX LB FORCE/PSI} &= \text{ARM LEVERAGE} \times \text{AREA} \\ &= .75 \times 78.5 \\ &= 58.9 \text{ (rounded out)}\end{aligned}$$

This value 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).

To determine the correct pressure gage settings 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 FORGE FORCE.
2. Enter these values in steps #17 and #19 as shown in the sample program on page U-10 or U-12. This will have to be separately entered in each program.
3. If no value for FORGE has been entered in a particular program, the SOLUTION control will use the default value as entered in program #96 as the back-up pressure.

If your control has the #9381-05 PRESSURE TRANSDUCER OPTION installed, this number will be used to set the point at which the control will start the welding process. See page U-22.

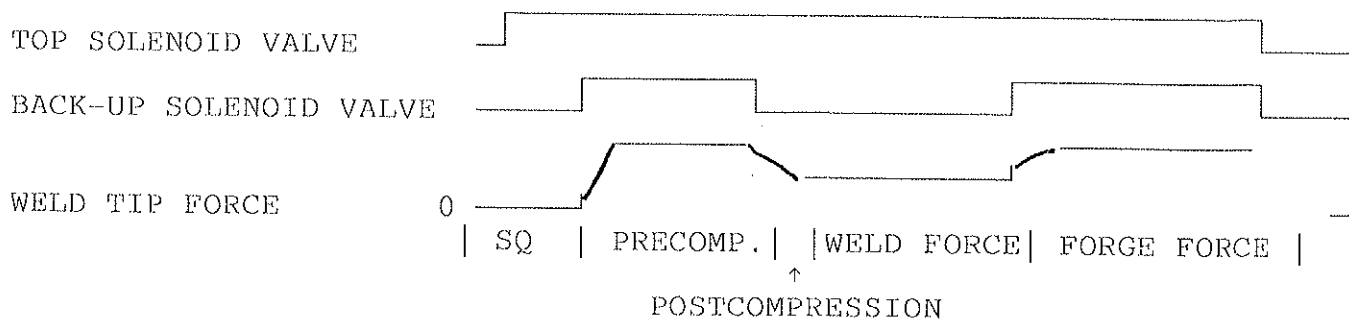
SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-29  
SOLID STATE PRESSURE TRANSDUCER  
OPTION #9381-05

This option utilizes a DIFFERENTIAL (double side) PRESSURE TRANSDUCER connected to the top and bottom sides of the welding cylinder (diaphragm). The transducer will read the exact air cylinder internal differential pressure and will allow welding only when the desired TIP FORCE, as entered on in step #17 on page U10 or U12, has been reached.

To use, turn the PRESSURE TRANSDUCER on in PROGRAM 96. If, after the initiation is pressed the pressure is lower than this setting, the readout will display:

TIP FORCE IS LOW

and will also display the exact section of the weld pressure sequence as discussed on page U-4, and as shown in this diagram:



If PRECOMPRESSION is being used, the control will energize the BACK-UP PRESSURE SOLENOID (exhaust air from the bottom of the weld cylinder) and wait until the correct force (the same as FORCE FORCE) has been reached. At this time, the upper display will show :

**PRECOMPRESSION**

and hold this until the chosen PRECOMPRESSION TIME has passed.

The system will now release the BACK-UP PRESSURE SOLENOID and wait start.

NOTE THAT IF THE AIR REGULATORS ARE SET TO GIVE A WELD FORCE THAT IS MORE THAN 2 PSI (.2 ATM) HIGHER THAN THAT SELECTED IN THE PROGRAM, THE CONTROL WILL WAIT IN THE PRESSURE HAS BEEN LOWERED. THE SYSTEM CAN BE RELEASED AT THIS TIME BY PUSHING ANY BUTTON ON THE KEYPAD.

The control will now go into the DELAY TIME AFTER PRECOMPRESSION and display:

**POSTCOMPRESSION**

If the pressure transducer option is being used, there is usually no need to have any POSTCOMPRESSION TIME entered as welding will not start until the lower level has been reached.

The welder will now go through the heat cycles as specified in that individual program.

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DIRECTIONS FOR USE PAGE U-30  
SOLID STATE PRESSURE TRANSDUCER (CONTINUED)  
OPTION #9381-02

The #9381-05 option will allow checking of tip WELD FORCE and FORGE FORCE without the use of a force measuring gauge.

**TO CHECK WELDING TIP FORCE:**

Press PROGRAM 96, ENTER.

Press the ENTER button until the readout displays:

**READ WELD FORCE?**

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

**PLEASE INITIATE**

and wait for the foot switch or hand buttons to be closed. Once this is done, the welding tips will stay closed automatically while you adjust the pressure gage to the desired WELD FORCE. Keep in mind that the WELD FORCE value displayed includes the HEAD WEIGHT (as previously entered in PROGRAM 85). To release, press STEP. Note that, while the display shows readings every 1/2 second, the computer is updating continuously.

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

Follow the above instructions, but respond with a #0 after the question READ WELD FORCE?. The display will now show

**CHECK WELD PSI? (CHECK WELD ATM?)**

Respond with a #1, and the display will now show

**PLEASE INITIATE**

Initiate the welder. The reading will be the DIFFERENCE between the TOP AIR PRESSURE setting and the BACK-UP PRESSURE air setting.

Continue pressing the STEP button to check the FORGE FORCE and FORGE PSI (ATM.) readings.

The FORGE PSI (ATM.) reading is made when both the TOP PRESSURE solenoid valve and BACK-UP PRESSURE solenoid valve are energized. This causes the air on the underside of the cylinder to exhaust, and the air at top of the cylinder to be on. The pressure will therefore be the maximum value that is used for both FORGE and PRECOMPRESSION sequences.

The FORGE FORCE is this FORGE PSI multiplied by the cylinder area as entered in PROGRAM 96.



SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-31  
WARNING CODES

| DISPLAY                           | MEANING  | REQUIRED ACTION   |
|-----------------------------------|--|---|
| TRANSFORMER OVERTEMP              | THERMOSTAT ON WELDER<br>TRANSFORMER TRIPPED  | CHECK WATER FLOW<br>IN TRANSFORMER                      |
| SCR OVERTEMP                      | THERMOSTAT ON SCR  | CHECK WATER FLOW<br>IN SCR                              |
| EMERGENCY STOP                    | EMERGENCY STOP PUSHED  | RELEASE SWITCH  |
| CHOOSE MODE                       | NO MODE HAS BEEN<br>SELECTED   | PUSH SINGLE, NO-<br>WELD OR REPEAT                      |
|                                   | INITIATION CLOSED ON<br>POWER UP   | CHECK AND OPEN<br>SWITCHES                              |
| PB RELEASED EARLY                 | INITIATION RELEASED<br>BEFORE WELD SEQUENCE  | HOLD BUTTONS TO<br>END OF SQUEEZE                       |
| KEYBOARD LOCKED                   | KEY SWITCH IN LOCKED<br>POSITION   | INSERT KEY AND<br>ROTATE TO OPEN                        |
| INCORRECT ENTRY                   | INAPPROPRIATE ENTRY<br>MADE  | USE ONLY NUMBERS<br>SHOWN IN QUESTION                   |
| PLEASE PROGRAM                    | TRYING TO WELD WITHOUT<br>SPECIFYING PROGRAM                                       | ENTER DESIRED<br>PROGRAM NUMBER                         |
| HEAD DN LS OPEN                   | RETRACT LIMIT SWITCH<br>NOT CLOSED   | CHECK SWITCH  |
| HEAD DN LS CLOSED                 | RETRACT LIMIT SWITCH<br>HAS NOT OPENED   | CHECK SWITCH  |
| PLEASE INITIATE                   | WAITING FOR INITIATION<br>ON TIP FORCE OPTION                                      | CLOSE FOOT SW. TO<br>READ FORCE                         |
| CHECK WELD<br>% X CYCLES TOO HIGH | NUMBER OF WELD CYCLES<br>WITHOUT REVERSAL OF<br>POLARITY EXCEEDS<br>WELDER MAXIMUM | EITHER REDUCE # OF<br>CYCLES OR % HEAT                  |
| FRG < TIP FORCE                   | FORGE FORCE WAS SET AT<br>A LEVEL BELOW WELD<br>FORCE                              | INCREASE FORGE<br>FORCE OR REDUCE<br>WELD FORCE         |
| -- . --LB FORCE\PSI               | NO VALUE ENTERED IN<br>SYSTEM OF FORCE RATIO                                       | ENTER IN PROGRAM<br>#96 AS DIRECTED<br>ON PAGE U-24     |
| CHECK SCR/Z CROSS                 | NO ZERO CROSS ON<br>PHASE A  | CHECK ZERO CROSS<br>SIGNAL. REPLACE<br>CHIPS U-9 & U-10 |

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-32  
WARNING CODES (CONTINUED)

| DISPLAY           | MEANING  | REQUIRED ACTION                                    |
|-------------------|--|--|
| TIP FORCE IS LOW  | WELD PRESSURE NOT REACHED  | INCREASE TOP PRE-SURE OR DECREASE BACK-UP PRESSURE |
| TIP FORCE IS HIGH | PRESSURE NOT DROPPED FROM PRECOMPRESSION TO WELD PRESSURE LEVEL  | DECREASE TOP PRE-SURE OR INCREASE BACK-UP PRESSURE |
| KEY FWD LS OPEN   | KEY LOCK LIMIT SWITCH HAS NOT BEEN CLOSED WITH THE KEY FORWARD   | CHECK KEYLOCK SW<br><br>BE SURE KEY IS FORWARD     |
| KEY FWD LS CLOSED | KEY LOCK LIMIT SWITCH HAS NOT BEEN OPENED WITH THE KEY FORWARD   | CHECK KEYLOCK SW<br><br>BE SURE KEY IS FULLY BACK  |
| KEYBACK LS OPEN   | KEY LOCK LIMIT SWITCH HAS NOT BEEN CLOSED WITH THE KEY BACK(OUT) | CHECK KEYLOCK SW<br><br>BE SURE KEY IS FULLY BACK  |
| KEYBACK LS CLOSED | KEY LOCK LIMIT SWITCH HAS NOT BEEN OPENED WITH THE KEY BACK(OUT) | CHECK KEYLOCK SW<br><br>BE SURE KEY IS FULLY BACK  |
| NO WATER FLOW     | WATER FLOW SWITCH IS OPEN (OPTION)                               | CHECK WATER FLOW AND SWITCH                        |
| NO LEVEL 2 INIT.  | WAITING FOR SECOND LEVEL OF FOOT SWITCH TO BE CLOSED             | CLOSE FOOT SWITCH<br><br>CHECK SWITCH              |
| TIP DRESS         | TIP DRESS SWITCH IS CLOSED                                       | OPEN SWITCH<br><br>CHECK SWITCH                    |

**SOLUTION #9380, 9380D, 9380L**  
**DIRECTIONS FOR USE PAGE U-33**  
**VOLTAGE COMPENSATION (AVC)**

**PURPOSE:** To maintain welder output within  $\pm 1\%$  with an input voltage variation of  $\pm 10\%$ .

**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.

**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 your particular line voltage.

- 1a. Press PROGRAM #89.
- 2a. The display will show: "VOLT. CALIBRATION"
- 3a. The display will now show: "SYSTEM VOLT.= \_ \_ \_."
- 4a. Carefully measure the incoming voltage on the power terminals using an accurate voltage meter (digital if available).
- 5a. Enter this value on the keyboard (round upward).
- 6a. Press ENTER.
- 7a. Readout will now show: "READING VOLTAGE" for 20 seconds.
- 8a. Readout will now show: "SYSTEM VOLT.=###", where ### is the value set in step 4a above. The system is now calibrated.

**TO USE AVC FUNCTION:**

Step through PROGRAM #0, or use direct access program #98. Operate as follows:

- 1b. Display will show: "VOLTCOMP. IS OFF".
- 2b. Display will show: "CHANGE 1=YES, 0=NO".
- 3b. To use this option, press "1".
- 4b. Display will show: "VOLTCOMP. IS ON".

The system is now in automatic voltage compensation mode (AVC).

**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.

**SOLUTION #9380, 9380D, 9380L**  
**DIRECTIONS FOR USE PAGE U-34**  
**VOLTAGE COMPENSATION (AVC) OPTION**

However, if the new location has a voltage that is  $\pm 5\%$  different than the original location, you may wish to use the following sequence to reset the reference point. Note that, under this condition, all existing programs will probably have to be adjusted for % heat to compensate.

To make this change, follow this sequence:

- 1c. Press PROGRAM #89.
- 2c. Display will show: "SYSTEM VOLT.=###, where ### is the value set in 4a. on the previous page.
- 3c. System will show: "CHANGE 1=YES, 0=NO.
- 4c. Press 0.
- 5c. Display will show: "REFER. VOLT.=### where ### is the value set in 4a. on the previous page.
- 6c. Display will show: "CHANGE 1=YES, 0=NO.
- 7c. Press #1.
- 8c. Display will now show: "SAMPLE=0, INPUT=1.
- 9c. If you want to use an artificial reference point (unusual case), press #1 and enter the desired reference voltage. Otherwise, press #0 ("sample").
- 10c. If you pressed #0 above, the display will show "READING VOLTAGE" for 20 seconds, then show "REFER. VOLT=###" where ### is the actual voltage the SOLUTION control has read as an average over this 20 second period.
- 11c. The control is ready for AVC welding.

**MAJOR CHANGE OF VOLTAGE:**

If a console is moved from one voltage machine to another, say from a 230V. to 460V. system, use the following sequence:

- 1d. Press PROGRAM 89.
- 2d. Display will show: "VOLT CALIBRATION"
- 3d. Display will show: "SYSTEM VOLT.=###, where ### is that of the last location.
- 4d. Display will show: "CHANGE 1=YES, 0=NO"
- 5d. Press #1.
- 6d. Display will show: "SYSTEM VOLT.= \_ \_ \_".
- 7d. Follow steps 4a. through 8a. of the previous page.

**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.

**ACCURACY OF SYSTEM:**

This option will hold the welder RMS voltage to within  $\pm 1\%$  with a line voltage change of  $\pm 10\%$  as long as there is "head room" as discussed in the note above. This occurs when %heat is less than 89% on all sequences.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-35  
CURRENT MONITOR/LIMITER OPTION #9181-22B

PURPOSE:

This option allows the setting of upper and lower limits for current measurement on each weld. If the average RMS current measured during the WELD IMPULSES portion only is either ABOVE or BELOW the customer set window, the SOLUTION control will keep the electrodes closed, and the display will show the average RMS current measured during the WELD. A weld out of range will also close a FAULT relay for use by an external system.

IMPORTANT NOTE: If your control was not ordered with the CURRENT MONITOR/LIMITER option, and there are HIGH CURRENT and LOW CURRENT lines in each welding program, these can be used as "scratch pad" to compare against an external current monitor system connected to the welder. If the option is turned on in program 84 without the input circuitry, the control may see a "fault" on each weld and lock out.

THE SOLUTION SOFTWARE EXCLUDES CURRENT COMPARISON DURING PREHEAT 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. IF A PRINTER OPTION HAS BEEN INSTALLED IN THIS CONTROL, EACH INDIVIDUAL IMPULSE OF PREHEAT, WELD, AND TEMPER WILL BE MEASURED AND RECORDED.

THE VALUES MEASURED BY THE SOLUTION WILL TYPICALLY BE HIGHER THAN THOSE ON PORTABLE CURRENT MONITORS IF PREHEAT AND/OR TEMPER IS USED BECAUSE THESE OTHER CYCLES ARE NOT AVERAGED INTO THE CALCULATION.

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.

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 console.

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 contact the Unitrol Service Department for recommendation.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-36  
CURRENT MONITOR/LIMITER OPTION #9181-22B

1. FOR MODEL 9380 CONTROLS (with remote console): open the back of the console (keypad unit). Locate a four section DIP switch (SW151) on the right side of the circuit board.

FOR MODEL 9380L CONTROLS (keypad on left side of main enclosure), remove the four screws holding the white metal keypad plate to the cabinet. Lift slightly and rotate the control out from the top. Locate the four section DIP switch (SW151) on the top of the front circuit board. The switch fingers will be protruding above the board.

FOR MODEL 9380D CONTROLS (with keypad on door of main enclosure), open the enclosure door. Locate the four section DIP switch (SW151) on the top of the front circuit board. The switch fingers will be protruding above the board.

2. Push the one switch down next to the maximum current range that will be seen by the welder. These are (from top to bottom or right to left): 150,000 amps, 90,000 amps, 60,000 amps, and 30,000 amps. The other three switches must be in the down position to the right (away from the markings).
3. 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), and the display will show: I MAX 90,000 A (or other value). This indicates that the control presently is set for a maximum of 90,000 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!.

3. The system is now set.

CALIBRATING THE CURRENT SYSTEM

This control was factory calibrated to match the Unitrol standard. If you want to change this calibration to match another standard, do the following.

1. Press:

PROGRAM 85  
ENTER

I CALIBRATION - ##  
CHANGE 1=YES, 0=NO

2. Press 1 to change.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-37  
CURRENT MONITOR/LIMITER OPTION #9181-22B

3. Set the I-CALIBRATION to 10.
4. Skip to SETTING CURRENT LIMITS on page U-34. Follow those steps while making a weld and note the reading on the PORTABLE WELD CURRENT MONITOR and that on the SOLUTION readout. Then calculate the value for I-CALIBRATION as follows:

$$I \text{ CALIBRATION} = \frac{\text{PORTABLE WELD CURRENT MONITOR READING}}{\text{SOLUTION READOUT}} \times 10.$$

As an example, if the current monitor reads 6,850 amps, and the SOLUTION display is 1340 amps, then:

$$I \text{ CALIBRATION} = \frac{6,850}{1340} \times 10 = 51$$

Enter this calculated number (round up if necessary) as I-CALIBRATION.

**SETTING CYCLE BLANKING:**

Before measuring welding current, it is necessary to decide if any portion of the welding sequence is to be blanked. On a typical Frequency Converter, this number should be set to zero (0). If it is desired to not read the first few cycles of each impulse, press:

PROGRAM 83  
ENTER

and the display will show:

BLANK 00 HALF CYC

Enter the desired number of HALF cycles. Again, the normal number is 00 for a frequency converter.

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

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-38  
CURRENT MONITOR/LIMITER OPTION #9181-22B

### SETTING CURRENT 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

If the display will shows:

I-READ ONLY = 1  
CHANGE 1=YES, 0=NO

press 0 (to not change setting).

If another phrase is on the readout or if it is desired to check the available options, press #1 to display the following:

I-READ ONLY = 1 (read and display current only)  
I-READ & REACH = 2 (compare reading to program limits)  
I-READ OFF = 3 (current read/react system off)

Now select I-READ ONLY by pressing 1.

2. Set the desired welding schedule and make welds on coupons until an acceptable weld has been achieved. 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 limits of current above and below that observed in step #2 above. To do this, make welds as you continue to LOWER the %HEAT setting in 1% steps until the weld has fallen below minimum desired strength. Increase the displayed current value slightly and write down this number as the LOW I (low current) number in that program.

Now go back to the original %HEAT 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.

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

HIGH I = 00000 A

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



SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-39  
CURRENT MONITOR/LIMITER OPTION #9181-22B

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.

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

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.

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

#### MEASURING CURRENT DURING PRODUCTION

Follow the following procedure to utilize the current comparison QC system during production.

1. Press:

PROGRAM 84  
ENTER

and the display will now show:

I-READ ONLY  
CHANGE 1=YES, 0=NO

Press 1, and the display will show:

I-READ ONLY = 1 (read and display current only)  
I-READ & REACH = 2 (compare reading to program limits)  
I-READ OFF = 3 (current read/react system off)

Press 2 (READ & REACT).

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.

NOTE: When the READ & REACT function is active in the SOLUTION, an "\*" will show on the upper right corner of the display. 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.

3. If the current, as shown on the upper display, is ABOVE or BELOW that in the weld schedule, the weld control will respond as shown in the FAULT RESPONSE section on page U-40.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-40  
CURRENT MONITOR/LIMITER OPTION #9181-22B

4. If it is desired to turn the current reading system OFF, press:

PROGRAM 84  
ENTER

The display will now show:

I-READ ONLY (or other function)  
CHANGE 1=YES, 0=NO

Press 1, and the display will show:

I-READ ONLY = 1 (read and display current only)  
I-READ & REACH = 2 (compare reading to program limits)  
I-READ OFF = 3 (current read/react system off)

and then 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 the comparison feature will not be functional. In this situation, no QC function will be in operation.

FAULT RESPONSE

The SOLUTION use various options to monitor various parameters during each weld. They are:

- A. CURRENT FAULT: current out of HIGH I/LOW I window
- B. FORCE FAULT: Computed electrode force is above or below program variation
- C. LINE VOLTAGE: Measured line voltage is out of +/-10% window from baseline

When any of these errors is detected, the system has two possible modes of response:

1. **MANUAL RESET:** Stop the weld sequence, keep the electrodes closed, close FAULT RELAY outputs for 150ms. The initiation switch must be opened and closed again to release the electrodes. Welding will continue when the initiation switch has been closed one additional time.

This mode is typically used on manually operated welders where the operator will

2. **AUTOMATIC RESET:** Close FAULT RELAY outputs for 150ms but allow the sequence to continue.

This mode is typically used on automatic systems where the FAULT RELAYS are being monitored for action by a PLC or other external system.

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DIRECTIONS FOR USE PAGE U-41  
CURRENT MONITOR/LIMITER OPTION #9181-22B

ASSIGNING FAULT RELAYS

Each fault detected can cause a FAULT RELAY to close as noted above. The user is able to assign each fault to any of three FAULT RELAYS.

To assign a fault to a selected FAULT RELAY, press: PROGRAM, 97, ENTER. The display will now show the particular FAULT on the upper display (CURRENT, FORCE, or VOLTAGE). The lower display will show the present assignment for this fault.

These FAULT RELAYS are located on the power supply board and marked: MAJOR FAULT and MINOR FAULT. A jumper can be set next to each FAULT RELAY selecting that the relay contact closes for 100 ms. on a fault condition (NO), or opens for 100 ms. on a fault condition (NC).

If the assignment is not as desired, press 1 (to change), and select from the menu. If the assignment is correct, press 0 (to not change), and the next FAULT RELAY assignment will be shown.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-42

PRINTER PORT OPTION #9181-21A

PURPOSE:

This option allows export of welding data from the SOLUTION console directly to a printer.

INSTALLATION:

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

SPECIFICATIONS:

System includes an RS-232C 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. Wiring for this cable is shown on page FOUR of this direction set.

Printer settings:

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

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 708-480-0115.

USE:

This option will print data as follows:

1. Complete weld schedule each time it is changed
2. Weld (or part) number
3. Tip Force at the end of the weld sequence if option #9181-05 (Differential Pressure Transducer) or #9181-05D (strain Gauge) is installed
4. RMS current measurement of each IMPULSE of PREHEAT, WELD, and TEMPER. Note that the control will display the average of the weld impulses only on the upper readout after each weld.
5. 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.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-43

PRINTER PORT OPTION #9181-21A (continued)

TYPICAL PRINT-OUT:

When the control is first turned on, the solution will show the following to indicate condition of the entire system as well as the last weld program used when the control was turned off.

Note that if a function (ie. PREHEAT) has all values set to 00, that line will not be sent to the printer.

---

\*\*\* UNITROL SOLUTION \*\*\*

60 HZ SYSTEM  
HOLDING MODE  
POSITIVE START  
TRANSDUCER ON  
037 LB FORCE\PSI  
PRES.COMPARE OFF  
"EPSON" PRINTER  
PRINT ALL WELDS  
I-READ & REACH  
I CALIBRATION=40  
AVC IS ON  
VOLT.COMPARE ON

\*\*\* PROGRAM #04 \*\*\*  
\*\*\*

SQUEEZE TIME 25  
WELD TIME 02  
WELD HEAT 78%  
WELD PULSES 02  
WELD COOL 01  
HOLD TIME 05  
WELDFORCE 1200LB  
FORGE = 2000 LB  
HIGH I =66,000 A (high current window for WELD impulses only)  
LOW I =63,000 A (low current window for WELD impulses only)  
PREHEAT TIME 01  
PREHEAT 23%  
PREHEAT PULSE 02  
PREHEAT COOL 01  
QUENCH TIME 15  
TEMPER TIME 08  
TEMPER HEAT 15%  
TEMPER PULSES 03  
TEMPER COOL 02

A typical printout for the weld using the above schedule would be:

#00166:FORCE=2,037LB;VOLTAGE=443V;PH01=005,800,PH2=005,800,WH01=065,200A,  
WH2=062,700A, TH1=002,000, TH2=002,000, TH3=002,100 I FAULT

**SOLUTION #9380, 9380D, 9380L**  
**DIRECTIONS FOR USE PAGE U-44**

**PRINTER PORT OPTION #9181-21A (continued)**

The print-out on the previous page shows that on weld number 166:

- a. Before the first weld, the control was set to use PROGRAM #04 with the data as shown.
- b. The first PREHEAT impulse had an RMS current of 5,800 amps.
- c. The second PREHEAT impulse had an RMS current of 5,800 amps.
- d. The first WELD impulse had an RMS current of 65,200 amps.
- e. The second WELD impulse had an RMS current of 62,700 amps. This weld was below the LOW-I window and was therefore shown in bold as a fault condition.
- f. The first TEMPER impulse had an RMS current 2,000 amps.
- g. The second TEMPER impulse had an RMS current of 2,000 amps.
- h. The third TEMPER impulse had an RMS current of 2,100 amps

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:** Every time a weld schedule is checked or changed, the printer port will send the complete weld PROGRAM as shown on the previous page. This prevents local change in weld schedules to be made without a permanent record being made.

**PRINT ALL WELDS OR ONLY FAULT WELDS:** 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.

To choose printing on either ALL WELDS or FAULT WELDS only, press: PROGRAM, 81, ENTER, and respond to the display question.

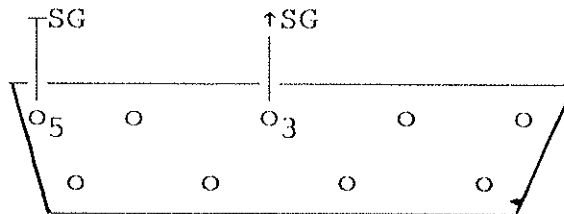
**PRINT ALL PROGRAMS:** To print data from all of the 75 PROGRAMS that have any data, press: PROGRAM, 77, ENTER. The display will show that this being sent and will not allow operation of the system until the transmission has been completed.

**SELECT WELDER NUMBER:** If more than one welder has data being sent to the same printer or computer, enter the welder number in PROGRAM 78.

SOLUTION #9380, 9380D, 9380L  
DIRECTIONS FOR USE PAGE U-45

PRINTER PORT OPTION #9181-21A (continued)

CABLE WIRING DIAGRAM



Wire other end of cable according to requirements of printer.





# **SERVICE INFORMATION**



SOLUTION #9280, 9380L, 9380D  
TROUBLE SHOOTING CHART  
PAGE S8

NOTE: Before using this chart, check page U-31 (WARNING CODES) for corrective actions. Consult factory if problem cannot be resolved.

| PROBLEM  | PROBABLE REASON   |
|--|---|
| NO READOUT ON CONSOLE, AND NO PILOT LIGHTS ON POWER SUPPLY             | <ol style="list-style-type: none"> <li>1. NO INCOMING POWER</li> <li>2. FUSES F1 OR F2 BLOWN</li> <li>3. CIRCUIT BREAKER OR HIGH SPEED FUSE OPEN</li> </ol>   |
| NO READOUT ON CONSOLE ONLY   | <ol style="list-style-type: none"> <li>1. PLUG ON CORD BETWEEN CONSOLE AND BACK OF POWER SUPPLY NOT FULLY CONNECTED ON BOTH ENDS</li> <li>2. F1 WIRE ( LINE IN VOLTAGE SELECT) ON WRONG TERMINAL</li> </ol> |
| EMERGENCY STOP SHOWS ON READOUT, WILL NOT CLEAR                        | <ol style="list-style-type: none"> <li>1. LEFT HAND INPUT PLUG ON POWER SUPPLY NOT FULLY INSERTED</li> <li>2. FAILURE OF CHIPS U3</li> </ol>  |
| SCR OVERTEMP., TRANSFORMER OVERTEMP, OR HEAD DN LS OPEN SILL NOT CLEAR | <ol style="list-style-type: none"> <li>1. FAILURE IN CHIPS U3, U4, OR U5</li> <li>2. LEFT HAND INPUT PLUG ON POWER SUPPLY NOT FULLY INSERTED</li> </ol>   |
| KEYBOARD LOCKED SHOWS ON READOUT, WILL NOT CLEAR                       | <ol style="list-style-type: none"> <li>1. BAD CONNECTION ON KEY SWITCH PLUG</li> <li>2. BAD KEYSWITCH</li> </ol>  |
| A SOLENOID WILL NOT OPERATE EVEN WHEN THE GREEN SOLENOID LIGHT IS ON   | <ol style="list-style-type: none"> <li>1. FAILURE OF U8 OR SSR FOR THAT OUTPUT CHANNEL</li> </ol>   |
| WELDER WELDS ONCE BUT WILL NOT OPERATE A SECOND TIME                   | <ol style="list-style-type: none"> <li>1. INITIATION SWITCH NOT OPENING (ANTI-REPEAT CIRCUIT)</li> </ol>  |

