INTERTRON INDUSTRIES,INC.

MODEL 301B CONTROLLER

REFERENCE MANUAL

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INTERTRON INDUSTRIES
INCORPORATED WARRANTY

The Model 301B Welding Controller has a limited warranty of one year parts and labor, FOB Santa Ana, California, from the time of installation. During that period, upon prepaid return to the distributor of factory, equipment proving to be defective will be repaired (or at our option, replaced) without charge for either material or labor. No responsibility will be assumed for damage to equipment through improper installation, or through attempts to operated it above its rated capacity, intentional or otherwise. This warranty does not include SCR'S contactors. The SCR'S used in the ignitron firing modules are guaranteed for ninety (90) days, if correct installation procedures are used, and the welding machine has load resistors on all primary windings and a tip arc relay. In addition, the warranty does not cover any customer equipment to which the Model 301B Controller is installed.

INTRODUCTION

Intertron Industries Incorporated Resistance Welding Controller Model 301B is a well proven welder microprocessor technology. Its design and construction is the sum total of thirty years of experience in welding controller design. The sophistication of today's electronics is used to simplify the welders operating procedures and logistics of operations. The microcomputer powers are used to greatly enhance the flexibility of programming, storing programs, wave form synthesis, and the ability to control other peripheral devices, as well as interface with other computers.

Most functions are identical to the 301A controller.

The following functions have been added:

1. A three digit motor speed control number for each schedule
2. FIRST SPOT weld schedule in SEAM and ROLL-SPOT
3. A four digit WELD SPOTS COUNTER
4. Optional constant welding wheel speed, with optical encoder feedback.

In the following pages we will attempt to give the user a working knowledge of the control system and its parameters.

CAUTION: Read carefully the installation instructions, prior to installation.

MODEL 301B UPGRADE SPECIFICATION

In 1985 Interlock Industries Inc. upgraded the Model 301 controller to a Model 301A.
In 1992 Interlock Industries Inc. upgraded the Model 301A controller to model 301B. The following are the upgrade changes from Model 301A to 301B CONTROLLER.

FRONT PANEL OPERATOR KEY ENTRY DESIGNATION

301A keys	SPOT	SEAM	ROLL SPOT	
	ON	OFF	OFF	= SPOT mode
	OFF	ON	OFF	= SEAM mode
	OFF	OFF	ON	= ROLL SPOT mode
301B keys	SPOT	SEAM		
	ON	OFF		= SPOT mode
	OFF	ON		= SEAM mode
	ON	ON		= ROLL SPOT mode

301B key function MOTOR SPEED
The key labeled ROLL SPOT on the 301A front panel is labeled MOTOR SPEED on the 301B front panel.
Momentary key depression will cause the following:
A. The LED adjacent to that key will turn on.
B. The 4 digit keyboard entry display will light up.
C. The operator can view or edit the 3 digit motor speed number.
D. The operator pushes the ENTER key to store the number in memory.
E. The MOTOR SPEED key LED will turn off.
MOTOR SPEED editing is locked out with the LOCAL / REMOTE key set in the REMOTE position.
A 0V to 10V DC analog output proportional to the 3 digit motor speed number, is used to set the desired operating speed. Most standard motor speed controllers will accept that signal as replacement of potentiometric speed dial.
WHEEL SURFACE SPEED CONTROL (optional)
An optional wheel encoder feedback connected to the driving wheel, enables closed loop CONSTANT WHEEL SURFACE SPEED.
The 3 digit motor speed number is converted from 00.0 -99.9 % of max. RPM to 0.00 - 9.99 inches of travel between weld spots made, in SEAM or ROLL SPOT.
A switch located on the operator REMOTE CONTROL BOX permits selection of the two operating modes.
A calibration switch on the operator REMOTE CONTROL BOX allows for constant surface speed calibration with different welding wheel diameters. Two HI - LOW limit LED'S will signal the operator a wheel diameter is out of the operating range for a specified wheel surface speed.
The 301C REMOTE CONTROL BOX can display the WELD SCHEDULE or % RPM motor speed or welding wheel surface speed.

301B key function WELD COUNTER

The key labeled READ on the 301A front panel is labeled WELD COUNTER on the 301B front panel.

The READ key was used to load weld schedules stored on cassette tape.

The counter decrements from a pre programmed number every time a weld spot is made. When count zero is reached, the controller stops welding. The operator releases the footswitch, and the counter presets itself to the pre programmed weld counter value.

The counter presets itself always when the foot switch is released.

A WELD COUNTER program value of 0000 will cause the controller to ignore the WELD COUNTER function.

Momentary key depression will cause the following:

A. The LED adjacent to that key will turn on.

B. The 4 digit keyboard entry display will light up.

C. The operator can view or edit the 4 digit WELD COUNTER number.

D. The operator pushes the ENTER key to store the number in memory.

E. The WELD COUNTER key LED will turn off.

WELD COUNTER editing is locked out with the LOCAL / REMOTE key set in the REMOTE position.

301B key function FIRST SPOT WELD SCHEDULE

The key labeled WRITE on the 301A front panel is labeled NEXT W.S.l on the 301B front panel.

The WRITE key was used to load 301A weld schedules to cassette tape.

Momentary depression of the FIRST SPOT will cause that LED to turn on or off.

Turn on the LED only for the weld schedule selected for FIRST SPOT operation. That weld schedule will be executed only once. Continued foot switch closure, will cause the controller to execute HEAT TIME and HEAT % parameters from the next weld schedule number.

MOTOR SPEED CONTROL WITH ENCODER FEEDBACK

In all standard motor speed controllers a motor power supply generates a DC voltage from zero to 90VDC, or zero to 180VDC, typically controlled via potentiometer, set from 00 to 100% of F.S. motor speed. (F.S. is a standard abbreviation for FULL SCALE). That means that the potentiometer setting is a percent of maximum RPM speed. When the 301 is operated in the "MOTOR SPEED" mode, with a speed setting of 000 to 999, the motor will turn at a speed proportional to the three digit number keyed into the 301 controller. That number is stored in the 301 controller as part of that particular weld schedule parameter. The appropriate motor speed number is initially set by the trial and error method. The driving wheel diameter, the time elapsed during one "COOL-HEAT TIME CYCLE", and the desired distance between two weld spots, are the determining factors in setting the appropriate motor speed. As the wheel diameter is being machined down for tip dress cleaning, the wheel surface circumference is decreasing. This results in a decrease in the distance between two spots. To compensate for this the motor speed must be increased by trial and error method until the distance between two spots is the same as it was prior to wheel dressing. Also, power line voltage changes can affect the motor operating speed. To counter all that, a second mode of operation is being offered. It is called "INCHES / WELD." In this mode a device called an ENCODER is coupled via a two inch diameter stainless steel wheel to the seam welder driving wheel. It measures the wheel surface speed and feeds that information to the motor controller. The motor controller also measures the time elapsed during one COOL-HEAT cycle and computes the appropriate motor speed required. The operating mode of "INCHES / WELD" is being set by the selector switch located on the operator remote control box. The distance between two spots is being keyed on the 301 controller the same way the motor speed is selected. The distance between two spots can be set from 0.01 inches to 9.99 inches. That data is stored in the 301 memory with the associated weld schedule. An initial calibration is required when a new distance is selected, or after power has been turned on. Calibration is being done in the following manner:

1. Set the selector switch to INCHES / WELD.

2. Key the desired distance between two spots into the 301 controller. If that information is available only in WELDS / INCH, use the following formula to determine INCHES / WELD.

$$\frac{1}{\text{WELDS / INCH}} = \text{INCHES / WELD}$$

$$\text{example:} \quad \frac{1}{20 \text{ WELDS / INCH}} = 0.05 \text{ INCHES / WELD}$$

3. The motor speed is internally programmed to adjust itself from 10% of maximum to 99% of maximum speed.

4. Push the momentary CALIBRATE toggle switch. The calibrate LED red light will stop flashing.

5. Observe that the encoder wheel is coupled to the welding wheel.

6. With the WELD ON switch set to the OFF position, push and hold in the welder foot switch, or the FS LOCK switch located on the operator remote control box. The motor will start, initially at 50% of maximum speed, and change speeds up or down until it has reached the ideal operating speed. At that point, the red light will turn off. Calibration is done.

7. A fixed amount of time is allowed for calibration to take place. If calibration is not achieved within that time the red light will start flashing again. It may take two or three trials for calibration to be established.

8. If calibration cannot be established because the motor speed has reached the maximum upper or lower limit, a HIGH or LOW red light will turn on also.

9. A HIGH red light on indicates that the motor went to its highest achievable speed and could not reach the required distance of INCHES between two weld spots for that wheel diameter. More time is required to achieve that distance at motor speeds close to maximum. Increase COOL TIME in SEAM mode or OFF TIME in ROLL-SPOT mode and recalibrate.

10. A LOW red light on indicates that the motor, slowed to 10% of maximum speed, could not reach the required distance of INCHES between two weld spots for that wheel diameter. Less time is required to travel that distance at the lowest allowable motor speed. Decrease COOL TIME in SEAM mode or OFF TIME in ROLL-SPOT mode and recalibrate.

The motor controller will continuously track and maintain the same distance between weld spots as the wheels are being machined down.
For applications where the wheel encoder needs to be mounted on the follower wheel, it is recommended that the operating mode be switched to MOTOR SPEED, when in ROLL-SPOT. This is due to excessive slippage of the clutch-brake mechanism.
The same holds true for applications where the wheel diameter and or cool time cannot be changed and motor speeds must be lowered to less than 10%.

SYSTEM SET-UP INSTRUCTIONS VIA SW1 SWITCH

Weld schedule selection 00-149.
Functions definition for the SW1-1 through SW1-10 MINIDIP SWITCH located on the processor board.

SW1-1 Front panel diagnostics enable.
With thumb wheel set at 77, and all other input switches off, use "." button on the keyboard to zero out memory or enter a two digit number for panel display verification.
Set SW-1 to off at the end of test.

SW1-2 Interlock override.
Set to on if no interlock is used.

SW1-3 Weld counter override.
When SW1-3 is off, it enables the WELD COUNTER to be functional.
SW1-3 in the ON position locks out the WELD COUNTER feature.

SW1-4 MS1 (key out)/MS2 (key in) override.
When set to on, it enables operation of welding machines without a key valve.

SW1-5 When set to on, it overrides TIP TRAVEL & PRECOMPRESSION TIME.

SW1-6 Cassette enable.

SW1-7 Not used.

SW1-8 DOWN LOAD location of weld schedules from computer is determined by the THUMB WHEEL switch position with SW1-8 off.

SW1-9 When off, tip travel time = 20 cyc.
When on tip travel time = 40 cyc.

SW1-10 When off, enables weld sequence on power up with FSA closed. When on, locks out head down retraction valve and sequence, if powered up with FSA closed. To continue, release momentarily FSA. The switch SW 1-10 on the Processor board must be turned on at installation time and left in that mode except during memory diagnostic tests.

DISPLAY BOARD MEMORY DIAGNOSTIC

Set thumb wheel switch to 77

Set sw 1-1 on the Processor board to ON

Set local/remote switch located on the REMOTE CONTROL BOX to position local.

Enter two digits on the keyboard followed by the period button.

Dial tumbwheel switch to 78 and back to 77. All displays shall contain the number dialed from the keyboard.

Check that all locations in memory throughout all weld schedules contain the same information.

MEMORY DIAGNOSTICS

The controller microprocessor memory is divided into two parts.

1. The READ ONLY MEMORY (ROM) which has been programmed at the factory. It contains all the instructions which makes it specialized to receive input commands and operate all the outputs required on a Resistance Welding Machine.
   These instructions cannot be altered, except when a malfunction function occurs due to partial failure of one of the memory circuits.

2. The RANDOM ACCESS MEMORY (RAM)
   This memory contains all the information programmed by the welding machine operator for all the 150 weld schedules.
   The memory is divided into 150 pages, each page being a 150 mirror image of all the informations seen visually on the front panel. That information is programmed in RAM via the keyboard or the PC.

   A bad load from the computer could introduce undesirable information in RAM which could have an adverse effect on the welders operation. It is best to erase the entire RAM by programming the value “zero” in all the locations in memory.

The ROM contains a routine which allows the maintenance personnel to write any number from 00 to 99 in all locations in RAM that can also be displayed by turning the front panel thumb wheel switch to all 150 positions.

MEMORY DIAGNOSTIC PROCEDURE
ZERO OUT MEMORY ROUTINE

1. Turn SW1-1 switch located in the upper left section on the processor board to "ON".

2. Set the controller in the Front Panel Mode so it can be programmed via the keyboard.

3. Set weld schedule thumb wheel switch to "77".

4. Push "88" on the keyboard and the period button.

5. Examine all weld schedules in memory. They should be programmed with the number "88" in all locations.

6. Repeat steps 3, 4 and 5 with the number "00" on the keyboard followed by the period button. All memory locations should display "00" and Spot, Seam, Roll Spot and Forge Delay lamps should be off.

7. Turn SW1-1 to OFF and resume programming the controller.

INSTALLATION

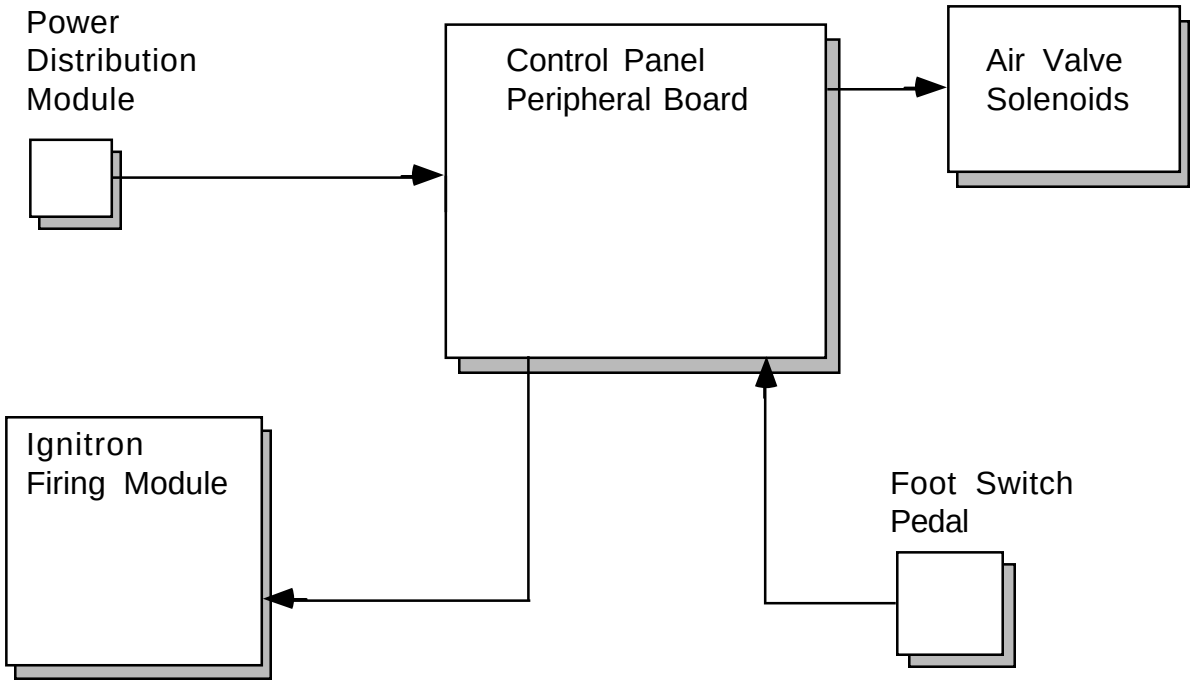
The Resistance Welding Controller, Model 301B is designed to interface with Sciaky Spot Weld/Seam Weld frequency converter type welding machines; however, it is not limited to these types only. A FC / DC switch on the peripheral board will switch the operating mode from FREQUENCY CONVERTER type machines, to D.C. type machines. It is important that the switch position is verified prior to powering up the welding machine.

An installation wiring diagram DRW. NO. 1030-092-01 is supplied with each manual.

It is recommended that this drawing be studied carefully prior to installation.

Unlike other models manufactured by others, every input and output of the welding machine is under the software control of the microprocessor. For example, the retraction mechanism using a locking key in solenoid, is controlled so as to prevent a race condition and frequent damage to the key as it occurs with other model controllers.

The installation diagram below, shows the minimum required basic package.

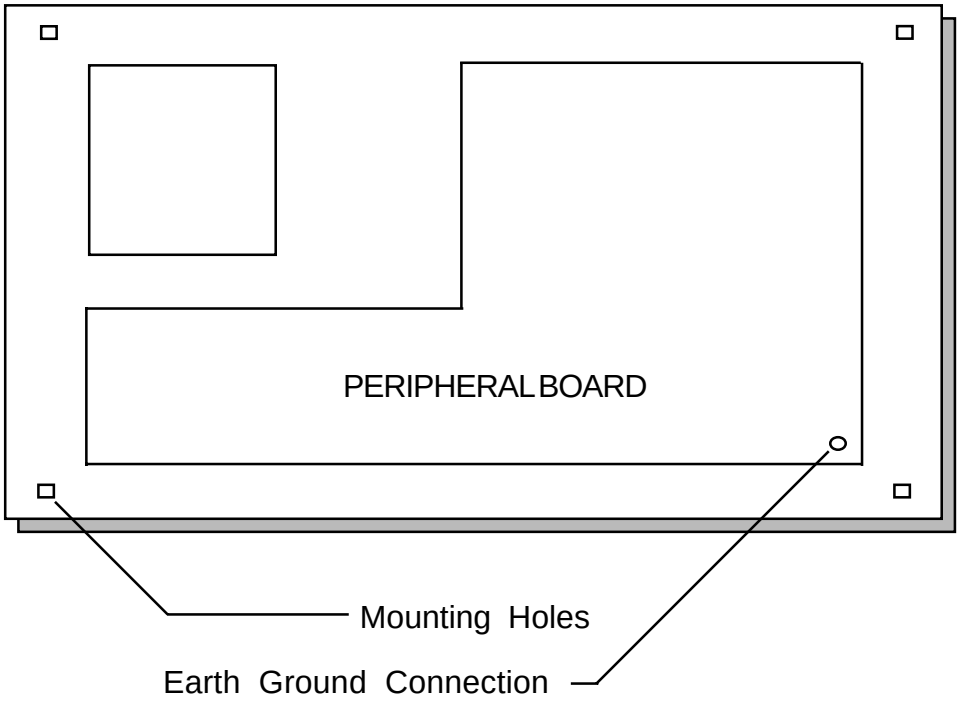


LOCATION OF BASIC COMPONENTS

1. The control panel is best located on the right handside of the welding machine, as viewed from the front. If there is room, locate the control panel next to the head, to give the operator quick access to all the most used switches during operation, such as “water on by-pass” and “tip dress”.

   In case the control panel has to be located more toward the center portion of the welding machine, connect 3 wires to connector ”P7" to remote the ”tip dress” and “water on by-pass” to the immediate reach of the operator. (NOTE: The “water on by-pass” switch defeats the one minute timer which is being automatically shut off when the head is raised.)

   Use four (4) 1/4x20 screws to mount the control panel on the wall of the welding machine.

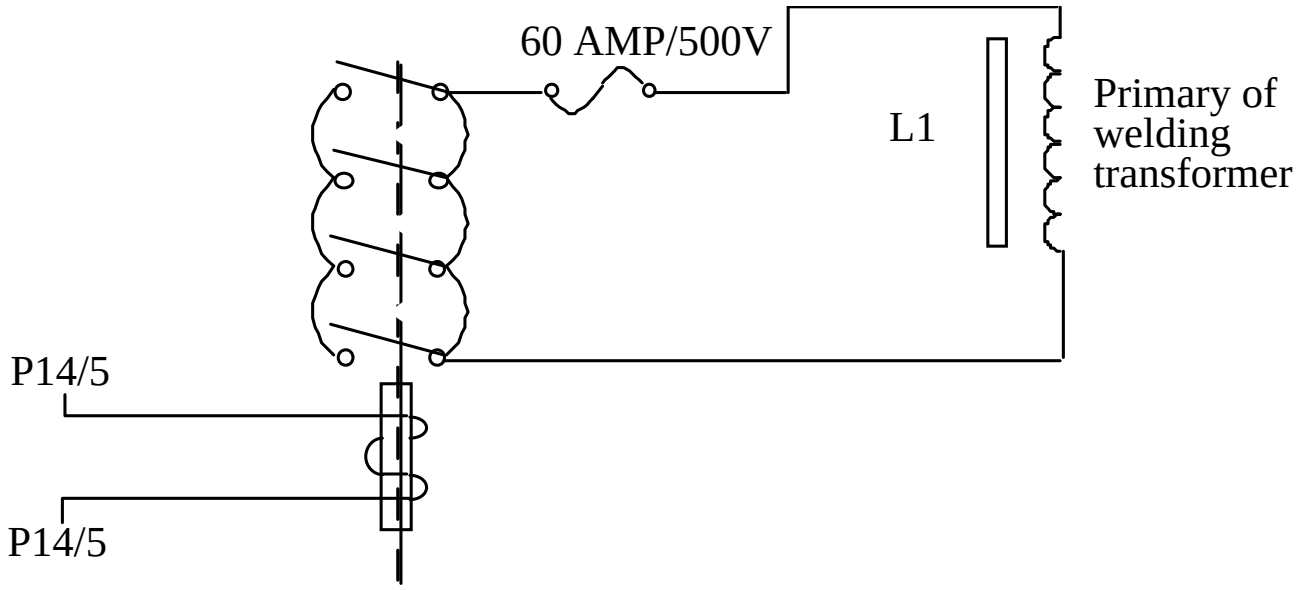


The ignitron firing module package is supplied with six 5 OHM, 100 watt resistors. They should be located in the proximity of the ignitrons, whenever possible.

It is recommended on a new installation where and old controller has been removed and it's ignitrons were fired by thyratrons, that the ignitrons be replaced with new ones. If an old ignitron is hard and slow in firing, is will damage the SCR's in the ignitron firing module.

Use 20 OHM 5 Kilowatt Power Resistors built for this application across each primary.

For a TIP ARC RELAY it is recommend to use the Square "D" type HO-40 Series D Class 8501, with 110V AC coil.
This relay has 4 reversible poles with a current carrying capacity of 20 Amps per pole. Prior to installation, reverse the poles to normally closed, and connect them in parallel, as shown in diagram below.



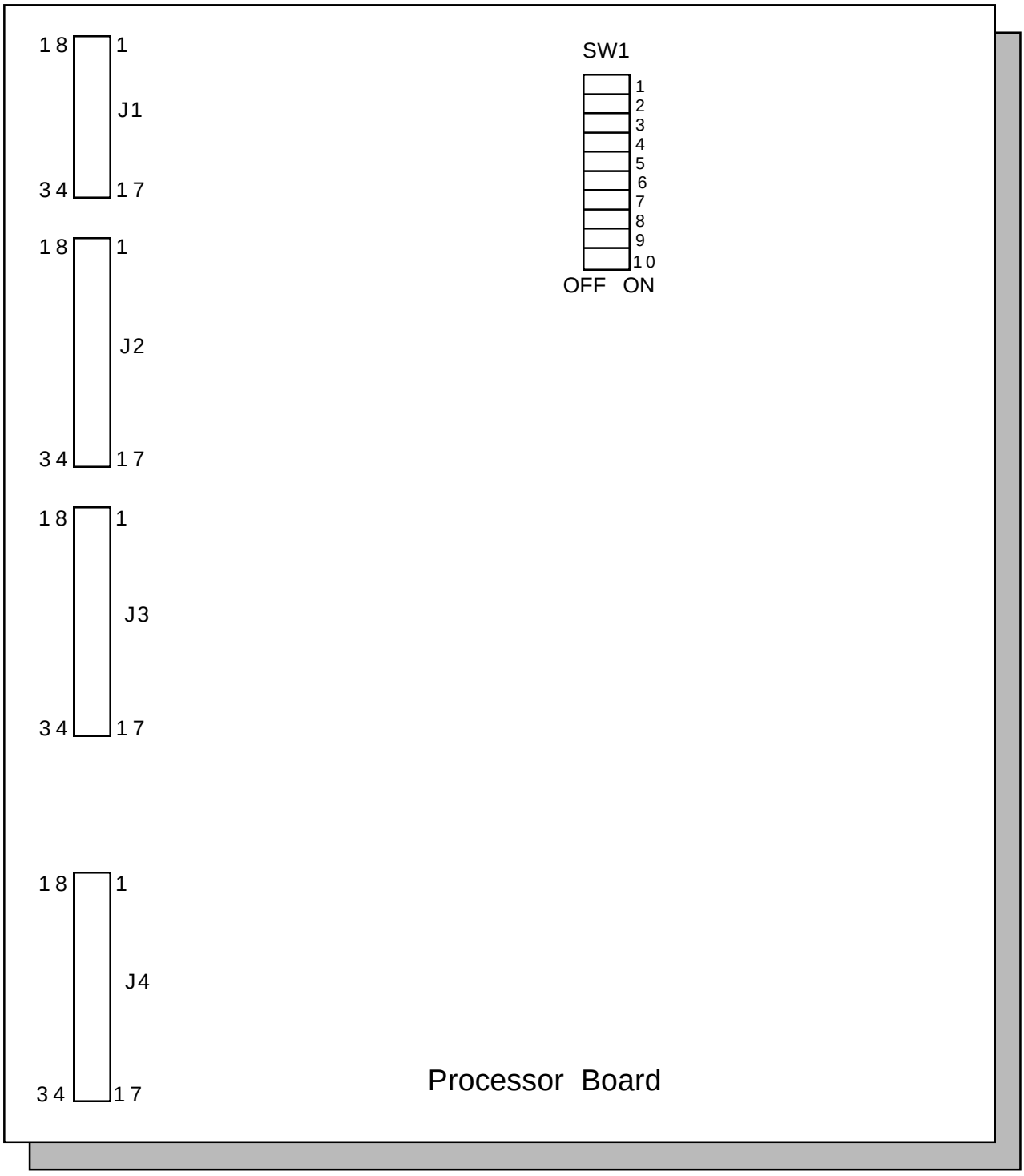
Install the power distribution module wherever convenient within the welding machine.

P1 accepts AC power from 200V AC 60HZ to 500V AC 60HZ. Fuse P1 inputs with 1 AMP 600V FNM type fuses. Prior to installation connect phase A of transformer to proper voltage tap. Failure to do so will result in damage or improper or marginal operation of the system. Measure line voltage between L1 and L2 with an AC volt meter and connect tap to the closest appropriate place. It is important to observe correct phase wiring as shown in wiring diagram. Failure to do so could result in cross firing and possible damage to contactors or ignitron firing modules.

For best assurance that the power distribution module has been properly connected to the power source, measure the AC voltage on J1-1/J1-2 which should be 115V AC. If a phase meter is not available, use an oscilloscope to check the isolated 3 phase, low voltage reference signals at P2-7/P2-8/P2-9/P2-10 for proper phasing.

The installation drawing illustrates the interconnection to the retraction system. All solenoids must be 110V AC operation and the micro switches MS1,MS2 and MS3 connected across their normally open contacts. For retraction systems not using a key solenoid, ignore MS1 and MS2.

The computer must know that the retraction system does not employ a key solenoid and the MS1, MS2 micro switches are not in use. To do that, push SW1 switch No. 4 to ON. This switch is located in the upper left area on the processor board. (SEE ILLUSTRATION BELOW)



Connect 20 VA water solenoid 110V AC to connector P14-7/P14-8. Water shall flow when solenoid is energized.

Connect normally open water flow switch to P6-1/P6-2. Switch will close when water is flowing.
(NOTE: The controller will sound an alarm and inhibit operation if switch is not closed.)

The installation diagram shows the following air valves:

Head Up Valve N.O. Solenoid Coil 110V AC 20VA

Weld Valve N.C. Solenoid Coil 110V AC 20VA

Forge Valve N.O. Solenoid Coil 110V AC 20VA

Motor Clutch/ N.O. Solenoid Coil 110V AC 20VA
Brake Valve Brake is ON When Solenoid is Deenergized

All solenoids using 110V AC shall have a power rating no greater than 30 VA each.

Two S.P.D.T. 3 AMP 110V AC relay poles are provided via connector P9 to ”remote control” from the controller the “Motor On” and “Forward/Reverse” operation of a conventional motor speed control.

These outputs are not used with MOTOR CONTROLLERS where the motor rotation direction requires that the armature voltage be switched via external relays.
(See manual wiring diagrams for these applications).

The Resistance Welding Controller Model 301B can accept up to four foot switches with FSI of each foot switch connected directly to P1-3/P2-3/P3-3/P4-3, or up to fifteen foot switches with FSI connected externally in binary fashion. (the latter format is an option not provided as standard)
All inputs are low voltage, low current and with GND as common.

FSA - N.O. Head UP/DN

FS1 - N.O. First Stage Initiation (Selects weld sch. No.)

FS2 - N.O. Second stage Initiation

The electronic air pressure controller Model 350A should be mounted on top of the welding machine up front, or in the vicinity of where the air gauges are to be located. Four 6/32 mounting holes are provided at the base for bracket type mounting. This controller provides an accurate air pressure reference proportional to and input voltage generated by the Resistance Welding Controller Model 301B. The air input is connected oil filter remover. A unidirectional check valve should be installed in line with the oiler. For proper installation see diagram 151-009-01. An input voltage of 0V to 10V DC will generate an output pressure of 0 PSIG to 100 PSIG. Shop air requirements are 120 to 160 PSIG.
The connection from P11 of the Welding Controller to P3 of the air controller are three wires 18 gage. These are the 0 - 10 VOLT signals from the 301B controller to the WELD and FORGE pressure regulators.
The connection from P2 of the Power distribution module to P3 of the air controller are two wires 18 gage. This is the 20VDC power supply input to the air controller.

INTERLOCK SCANNER INTERCONNECTION

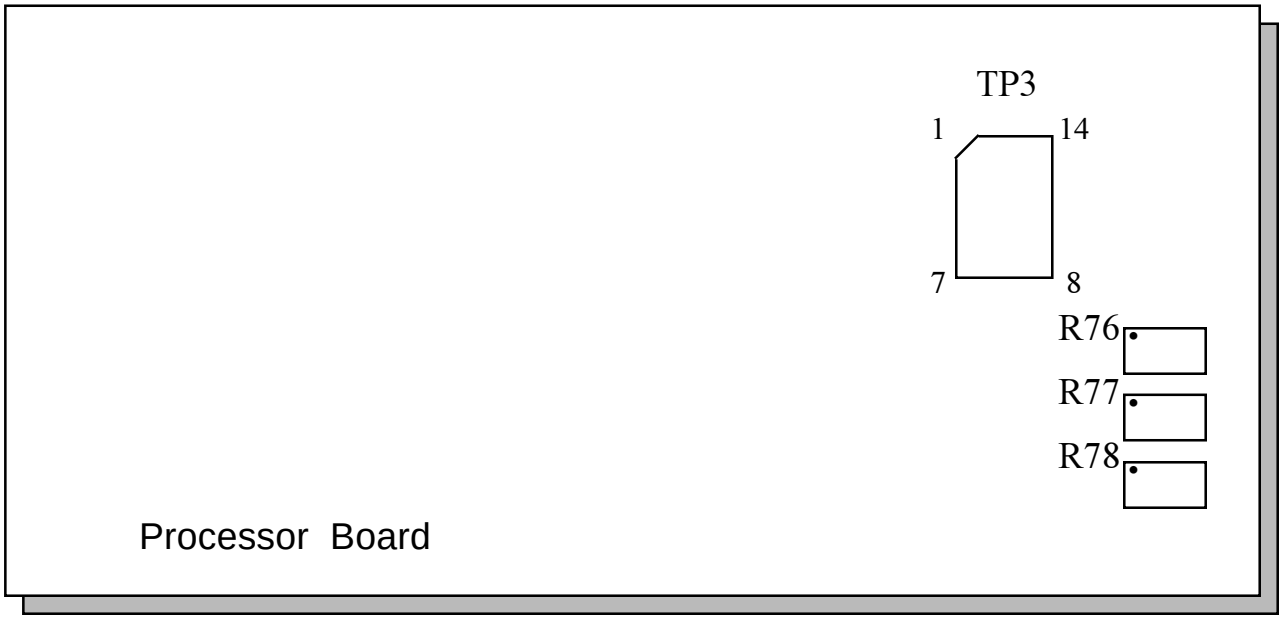
Use two twisted pairs of wires to interconnect P10 of the model 301 Welding Controller to the “Interlock Scanner” as shown in the wiring diagram.

Set SW1-2 on the processor board to “off”, otherwise the scanner will be ignored. Connect ”Interlock Scanner” to standard 110V AC outlet. The scanner provides optical isolation between welding controllers so as to eliminate ground loops.
(NOTE: If welding controllers are operating near by Arc welding machines generating RF in a wide spectrum, it is recommended that wires between scanner and welding controllers be installed in water conduits, and have the conduits grounded to earth ground.)

It is recommended that startup and initial check out be done with terminal 1 of the ignitron firing module 2 pin terminal strip disconnected.
After assurance that the controller is operating the welding machine properly, and the Tip arc relay opens during weld time (beginning of Squeeze till end of Hold), connect terminal 1 of each ignitron firing module one at a time and verify proper heat control on each phase independently.

LINE VOLTAGE COMPENSATOR ADJUSTMENT

The Resistance Welding Controller Model 301 has built in means to make continuous line voltage measurements and make phase angle firing corrections for each phase independently.
3 test points and 3 potentiometric adjustments are made available on the lower right hand area on the processor board. (SEE DIAGRAM BELOW)



Use proper clip to prevent accidental shorting between test points.
Use high impedance DC Voltmeter to measure
Phase A between TP3-1 and TP3-7
Phase B between TP3-2 and TP3-7
Phase C between TP3-3 and TP3-7
Potentiometer R76 sets Phase A
Potentiometer R77 sets Phase B
Potentiometer R78 sets Phase C
Set each phase for the following DC voltages.
4 VDC = 10% below nominal line voltage
4.5 VDC = nominal line voltage
5 VDC = 10% above nominal line voltage
If in doubt as to what the nominal line voltage is set all 3 phases for 5.00 VDC.
Direct AC measurements of the line voltage can be made by connecting an AC Voltmeter:
Across TP3-4 and TP3-7 for phase A
Across TP3-5 and TP3-7 for phase B
Across TP3-6 and TP3-7 for phase C
The voltage reading is precisely 1/40 of the actual line voltage. (480 AC will read as 12V AC)

OPERATING FEATURES AND DESCRIPTION

PROGRAMMABLE AND FIXED TIMING OF EVENTS OF A PREARRANGED SEQUENCE IN A WELD SCHEDULE

Tip travel time - fixed at 20 cycles or 40 cycles
(1 cycle of time = 1/60 of one second)

Precompression time - Fixed at 4 cycles
Squeezes time - Variables from 0 to 99 cycles
Preheat time - Variables from 0 to 99 impulses
(1 impulse = N cool cycles + N heat cycles + heat decay cycles)
Cool time - Variables from 0 to 99 cycles
Heat time - Variables from 0 to 99 cycles
Heat % - Variables from 0 to 99 %
Heat Decay time - Variables from 0 to 99 cycles
Heat Decay % - Variables from 0 to 99 %

Weld time - Variable from 0 to 99 impulses
(1 impulse = N cool cycles + N heat cycles + N heat decay cycles)
Cool time - Variable from 0 to 99 cycles
Heat time - Variable from 0 to 99 cycles
Heat % - Variable from 0 to 99 %
Heat Decay time - Variable from 0 to 99 cycles
Heat Decay % - Variable from 0 to 99 %

Post Heat Time - Variable from 0 to 99 impulses
(1 impulse = N cool cycles + N heat cycles + heat decay cycles)
Cool time - Variable from 0 to 99 cycles
Heat time - Variable from 0 to 99 cycles
Heat % - Variable from 0 to 99 %
Heat Decay time - Variable from 0 to 99 %
Heat Decay % - Variable from 0 to 99 %

Quench time - Variable from 0 to 99 cycles

Temper time - Variable from 0 to 99 impulses
(1 impulse = N cool cycles + N heat cycles + N heat decay cycles)
Cool time - Variable from 0 to 99 cycles
Heat time - Variable from 0 to 99 cycles
Heat % - Variable from 0 to 99 %
Heat Decay time - Variable from 0 to 99 %
Heat Decay % - Variable from 0 to 99 %

Hold time - Variable from 2 to 99 cycles
Off time - Variable from 0 to 99 cycles

FORGE PROGRAM

Forge ”HI”
Initiates forge valve from beginning of “precompression” till end of “hold”.
Forge “LOW”
Holds forge valve in “OFF” position all the time.

Forge “VARIABLE”
Turns on forge valve during precompression time.
Initiates forge delay timer at the beginning of PREHEAT or WELD or POST HEAT or QUENCH or TEMPER or HOLD.

Forge delay time - Variable from 0 to 999.9 cycles.
Forge valve will be turned on at the end of the forge delay timer and stay on until the end of hold time.

WELD PSI - FORGE PSI

Weld pressure setting - Variable 0 to 99 PSIG.
Sets pressure on piston head toward electrode.
Forge pressure setting - Variable 0 to 99 PSIG.
Sets pressure against piston, subtracting from weld pressure setting.
Actual weld force is the difference between the two pressure settings times the area of the piston.
The forge pressure is called so because it is the pressure that is being dumped in order to create the forge force.

SPOT-SEAM-ROLL SPOT

Selection of operating mode can be set on the front panel. The welding controller is equipped to handle all 3 modes at a touch of a button.

FRONT PANEL mode selection
SPOT LED ON only selects spot operation mode.
SEAM LED ON only selects seam operation mode.
SPOT and SEAM LED'S ON selects roll spot operation mode.

In roll spot weld pressure will be maintained during "OFF" time allowing a motor to index the part for the next weld. This operation will continue with the repeat switch in the repeat mode and the foot switch depressed. Tip travel time and Precompression time is bypassed after the first weld spot.
In "SEAM" the main sequences will be reduced to:

A. Tip travel time
B. Precompression time
C. Cool - heat - heat decay (in weld impulse frame only) for the duration that the foot switch is depressed.
D. Hold time
E. Off time

In "SEAM" motor will start with the second stage of the foot switch.

PHASE REVERSAL DURING IMPULSE OPERATION

Phase reversal occurs at the beginning of each impulse time. (Minimum 1 cycle time required)
Minimum COOL TIME of 1 cycle required to allow transformer magnetic flux built up to decay. Phase reversal will not take place if COOL TIME is set to zero.
Two LED's on the front panel indicate positive or negative firing.
The Controller memory will remember during power shut down the last firing polarity.

LINE VOLTAGE COMPENSATOR

The L.V.C. touch button on the front panel allows the operator to weld at maximum heat capacity when the LVC lamp is off.
When the LVC lamp is "ON", the firing angle of % heat is advanced or retarded by the computer to compensate for line voltage variation.

SLOPE (WAVE FORM SYNTHESIS)

For applications where the heat settings are required to vary with each cycle of heat the slope button is used.
When ”ON”, it extends that column into the next weld schedule page, and so on. In that mode, phase reversal will occur if the cool setting is other than zero.
Slope programming should start with the Weld Schedule selector switch set at 10. Weld schedule pages 00 to 09 will be wiped out during slope operation.

Detailed description of the slope synthesis operation will be discussed in a later chapter.

PROGRAM SETTING

Each function which has a variable number can be seen as a two digit number lit in the window associated with that function.

Each function has adjacent to the window a white square where the number unit value is printed on.
The white square serves also as a touch button.

In the stand by mode, all windows are lit with numbers with exception of Forge Delay (if not in variable) and the keyboard.

To change the value of a number, simply touch lightly the white square adjacent to the window. The number will start flashing at a low rate, giving a visual feedback as to which number is to changed. Enter two digits at the keyboard located at the right lower corner on the front panel. Press the Enter key. The number displayed at the keyboard display shall disappear and the new number shall appear in the window which was previously flashing.

Digits are moving right to left so most significant digits must be entered first.

WELD COUNTER SETTING

Momentary key depression will cause the following:
A. The LED adjacent to that key will turn on.
B. The 4 digit keyboard entry display will light up.
C. The operator can view or edit the 4 digit WELD COUNTER number.
D. The operator pushes the ENTER key to store the number in memory.
E. The WELD COUNTER key LED will turn off.

WELD COUNTER editing is locked out with the LOCAL / REMOTE key set in the REMOTE position.
The minidip switch SW1-3 located on the processor board will disable that function when the switch is in the ON position.

MOTOR SPEED / WHEEL SURFACE SPEED SETTING

The 3 digit selection of motor speed or wheel surface speed is set on the 301B REMOTE CONTROL BOX.
Momentary key depression will cause the following:
A. The LED adjacent to that key will turn on.
B. The 4 digit keyboard entry display will light up.
C. The operator can view or edit the 3 digit motor speed / wheel surface speed number.
D. The operator pushes the ENTER key to store the number in memory.
E. The motor speed key LED will turn off.

MOTOR SPEED editing is locked out with the LOCAL / REMOTE key set in the REMOTE position.

WELD SCHEDULE SETTING

At the lower front of the cabinet is a two digit thumb wheel switch called the weld schedule selector.

To best understand this function, imagine all the function seen on the front panel duplicate 150 times.
To do so, a technique called multiplexing is used.

The computer memory is divided into 150 equal sections, each being capable of storing all the variables programmed on the front panel. If we imagined that to be a page of a book, we could dial 150 pages with different programs simply by dialing the weld schedule selector switch from 00 to 149.

All weld schedule programs are retained in the computer memory when power is turned off. A back up rechargeable battery will maintain the memory alive in excess of 6 months.

REMOTE/LOCAL PROGRAMMING

The 301B microprocessor has the capability to receive program instructions from the front panel as described in the previous paragraphs of from another computer via an RS232 serial transmission line. To enable full transmission of all weld schedules to and from a remote PC computer, the minidip switch SW1-8 must be in the ON position.

With the Remote/Local Switch set in the Local Position, the 301B can be programmed from either location.

With the switch set in the Remote position, front panel programming is inhibited, with the exception of % heat in the Weld impulse column. This variable can be programmed only ±5 counts from the setting originally programmed when the switch was in the local position.

301B REMOTE CONTROL BOX SWITCHES

Motor on - Turns motor and clutch on in standby mode, at 50% of max. motor operating speed.

Motor forward - off - reverse - Reverses direction of motor.

F.S. Lock - Maintains foot switch status quo during long weld operation, makes continuous foot switch depression unnecessary.

Repeat - Maintains continuous sequence of welding machine for as long as the foot switch is depressed.

Weld on - Enables contractors to pass electrical energy into primary of welding transformer.

Tip Dress - Dumps Forge pressure, which normally holds the electrodes separated. The weight of the upper ramp provides sufficient pressure to clean electrodes by conventional Tip Dress means. In SEAM / ROLL SPOT also initiates wheel drive at 50% of max. motor speed.

Weld Schedule Selector - Selects weld schedule to be used from a menu of 150 weld schedules.

Local / Remote - Locks out the operator ability to edit weld parameters, except for WELD heat %.

Three digit display - Displays the selected weld schedule from 000 to 149, or % of F.S. motor speed RPM from 000 to 999, or wheel surface travel between to weld spots from 0.00" to 9.99", in seam or roll spot.
Note: At initial installation, the selector switch S1 located on the WHEEL SURFACE SPEED board located inside the 301B controller, must be set to:

A. W.S. to display weld schedule only
B. M.S. to display motor speed or wheel surface speed

Motor speed / inches per weld - Selects the motor controller operating mode.

Calibrate (CAL) switch and LED - When pushed on, it turns the LED above it ON. Turn Weld switch OFF. Push foot switch to operate the 301B controller and turn the welding wheels. Within seconds, the will motor will calibrate itself for the appropriate speed. The LED will turn OFF when calibration is completed. This procedure is required when wheel diameters are changed, or the 301B controller if turned ON.

Hi / Low limit LED's - They indicate when the desired operating speed is beyond the motor controller operating limits. Change welding wheel diameter up or down as indicated, or "cool time" in seam, or "off time" in roll spot.

MULTIPLE FOOT SWITCH OPERATION

The foot switch is comprised of the three level switches operated sequentially within the foot pedal.

F.S.A. is the first switch which controls the retraction mechanism of the welding machine. This switch is also mechanically locked within the foot switch.

F.S.1 is the second switch which initiates movement of welding electrodes under pressure into the Tip Travel stage of the welding sequence. This switch is not mechanically locked, so release of foot pressure by the operator will return the welding machine to "OFF"
(Stand by mode)

F.S.2 is the third switch and the last to be activated in the sequence of foot pedal depression. It initiates the sequence of events by starting the count down of the Tip Travel timer.
F.S.2 can be released for return to "OFF" (stand by mode) until the "Squeeze" timer has timed out. Beyond that time the foot switches will be electronically locked in the "ON" position until the completion of on full sequence and returned to "OFF".

When it is desired to weld several weld schedules on the same part with different thicknesses, multiple foot switches can be used.

The peripheral board of the controller has 4 connectors for 4 foot switches:

Pedal 1 to connector P1
Pedal 2 to connector P2
Pedal 3 to connector P3
Pedal 4 to connector P4

The FSA, FS2 and common lines are connected in parallel inside the controller.

FS1 which is the first stage is separated into four select lines: FS1-1, FS1-2, FS1-3 and FS1-4.

FS1-1 will select the weld schedule number read on the Weld Schedule Selector dial.

FS1-2 when the activated will flip the front panel settings to the page which is the second largest number from the one viewed on the Weld Schedule Selector dial.

FS1-3 when activated will flip the front panel settings to the page which is the third largest number from the one viewed on the Weld Schedule Selector dial.

FS1-4 when activated will flip the front panel settings to the page which is the fourth largest number from the on viewed on the Weld Schedule Selector dial.

Provided as an option, is a controller with a program enabling FS1-1 through FS1-4 to operate in a binary mode, thus allowing Weld Schedule selection with up to 15 foot pedals.

SLOPE

To best understand the implementation of Slope Control an example will be used utilizing the Weld impulse column.

In a conventional use, the impulse variable is used as a multiplier for a series of repetitive pulses of cool - heat - heat decay which reverse heat electrical polarity with each impulse, if cool is other than zero.

In order to create a multiple heat series of pulses of different heat % values, the cool - heat - heat decay column is extended into the next page (weld schedule) whenever the slope button is used. The electrical polarity will remain the same if cool time is set to zero.

Example:

Weld Schedule	Weld Impulse	Cool Cycle	Heat Cycles	Heat %	Heat Decay Cycles	Heat Decay %	Slope
10	01	03	2	50	2	52	ON
11	01	00	3	54	3	56	ON
12	01	00	1	58	2	60	ON
13	01	00	5	64	3	35	ON
14	01	00	2	50	2	52	ON
15	01	00	3	54	3	56	ON
16	01	00	1	58	2	60	ON
17	01	00	5	64	3	35	OFF

The example above shows the generation of a low frequency heat wave form of one cycle. It should be noted that the last column in the example had the Slope lamp turned off. Upon the completion of the Weld column in schedule 17 the program jumps back to the next sequential event in weld schedule 10 such as Post Heat impulse or Quench or Temper impulse or Hold.

It should be obvious, that in the above example, weld schedules, pages 10 through 17 are committed to the main program stored in page 10 and cannot be used for other programs.

Likewise, multiple foot switch operation is not to be used in page areas with Slope.

TIP TRAVEL and PRECOMPRESSION TIME BY-PASS

For application where the operating speed needs to be higher than conventional use, and electrode travel time is optimized solely by the Squeeze timer, the tip travel and precompression timer can be by-passed by turning SW1- 5 switch to ON.

PROGRAM SECURITY INTERLOCK

To prevent unauthorized personnel from altering the weld program by accident when in contact with the front panel, when machine is in use, program changes are enabled only when the welding head is retracted in the UP position, and the Weld ON/OFF button is off.

RS 232 PROGRAM STORAGE AND EDITING ON PC COMPUTERS

All 150 weld schedules can be programmed in the computer memory.
This option is supplied with a floppy disc labeled 301BPC. The disc contains the program required to be loaded on the PC computer.
The purpose of the 301BPC program is to create and update weld schedule programs. These programs can be stored on a disc, uploaded from the 301B controller, and downloaded to the 301B controller. New schedules can be created and old schedules can be modified.

OPERATING THE PROGRAM

STARTUP

To start the program type “301BPC” and the name of the weld program you want to use. The name can be from one to eight alphanumeric characters with no period or extension permitted. A path is, however, permissible.
This name can be of an existing weld program you want to create. You will asked to verify the entered name. If no weld program name is entered during startup, you will be asked for a name after the program has started.

CONFIGURING THE SYSTEM

COM PORT CONNECTION - lets you tell the computer to which RS232 port, if any, the 301B controller is connected. The connection of the 301B is not required for the program to run. If the 301B is connected, you will be asked for the baud rate - 300 baud to 9600 baud. The 301B controller is factory preset by a jumper on the controller processor board to 9600 baud.

PRINTER CONNECTION - lets you set up the command to print a listing of the weld program on the printer or to save the listing on the disk.

MAIN MENU

GENERAL INFORMATION

1. Current weld schedule program name is displayed on the menu.
2. “Schedules in working memory” shows the number of schedules actually in memory currently. Until you read in schedules, schedules will equal “0”.
3. “Schedules in disk file” shows the number of schedules that the select weld program has on disk.
4. You can select the functions you want, using the function keys or using the number keys followed by a carriage return.
5. You can change the currently selected weld program by using function 9.
6. Using working memory and the 301B as buffers, you can combine weld schedules from different weld programs (see functions 3 & 4).
7. If a wrong character is entered, the delete key will remove it.

DESCRIPTION OF FUNCTIONS

FUNCTION #1 - "HELP" - gives you a brief explanation of each of the functions.

FUNCTION #2 - Clears working memory by setting all schedules to null schedules. To be used when you change selected weld schedule programs.

FUNCTION #3 - Reads a weld schedule from the 301B into working memory. Schedules are read in blocks of 10. You select the starting schedule number in the 301B, the starting address in working memory to place the schedules, and the number of blocks to read.

FUNCTION #4 - Loads 10 weld programs at a time into the 301B but NOTE that the 301B thumb wheel switches must be set at the starting schedule number you wish to load. (i.e.; to load weld schedules 0 - 9 into the 301B from the PC, set T/W switches to 00, to load schedules 40 - 49 set T/W switches to 40.)

FUNCTION #5 - Reads all of the weld schedules from the selected memory.

FUNCTION #6 - Writes weld program that is in working memory onto the disk. The write starts with weld schedule number 1 and lets you select how many are to be written.

FUNCTION #7 - Allows you to create and edit weld schedules in working memory. See special instruction below.

FUNCTION #8 - Not implemented for the 301B controller.

FUNCTION #9 - File maintenance lets you:
print out the file listings to printer or disk (depending on the printer selection made during the configuration) and change the selected weld program.
Note - programs does not clear the prior weld program from working memory.

SPECIAL INSTRUCTIONS FOR FUNCTION #7

1. The EDIT screen is modeled after the 301B front panel.

2. Highlighted block is the selected field and will take entries from the keyboard. After an entry and carriage return, next block will be highlighted.

3. Movement on the screen is by using the arrow keys.

4. Page up and down will take you to the next or preceding schedule.

5. FORGE DELAY has 9 choices of which the last six require number of cycles. The choices are HIGH - LOW - VAR - PREHEAT - WELD - POST HEAT - QUENCH - TEMPER - HOLD.

6. Turning slope to “ON” position (when highlighted type “ON”), enables next weld schedule to be a continuation of that weld schedule. The screen has limited room for display of continuous slope lines. Editing of continuous weld schedules can only be done in the actual weld schedule.

7. If ”????????” appears on display of weld schedule, highlight that part and enter one of the following commands -SPOT, SEAM, or ROLL SPOT.
8. Several special functions are shown at the bottom of the screen:
   a. Function 3 brings in another weld schedule from memory.
   b. Function 4 brings in a schedule from the disk. You will first be asked if you want the last weld program used. A “N” response lets you select a new weld program.
   c. Function 6 lets you jump to a new weld schedule.
   d. Function 7 enter a remark. Any number of characters may be entered. However field will be truncated to 34 characters.
   e. Function 8 clears the current weld schedule from working storage. Only the currently displayed schedule is cleared.
   f. Function 10 returns you to the main menu.

NOTE - An emergency exit from routines and computer lockup is the ESC key. Use sparingly. Repeated use may corrupt stack and cause program to crash. Data will not usually be damaged by use of the ESC key.

PERIPHERAL DIAGNOSTICS

The controller has a set of LED's connected to the input lines, connecting to all the micro switches of the outside world. The micro switches when "ON" are grounding the input signal line and also turning on the LED's in the display column located on the processor Board.

The following inputs can be seen marked from top to bottom on the upper left hand section on the processor board.

FS1-3
FS1-2
MS1-2
MS3
FSA
FS2
Water/Air SW
MS1
MS2
FS1-4
FS1-1

All solenoids are turned on by solid state relays located on the lower left area of the peripheral board. They are turned on and off by optically isolated DC signals controlled by the computer. Each DC signal for each solenoid activation has a corresponding LED located in a column on the processor board.
The following outputs can be seen marked from top to bottom on the upper left hand section on the processor board:

Water Valve Solenoid
Weld Pressure Valve Solenoid
Forge Pressure Valve Solenoid
Head Up/On Valve Solenoid
Tip Arc Relay
Clutch/Brake Valve Solenoid
Motor Reverse Relay
Motor On Relay
Scan Output Signal
Key in Valve Solenoid

ALTERNATE POLARITY AND DC CONTACTOR FIRING

1.0 In frequency converter type welding machines it is a must to alternate the switching polarity of the ignitrons or SCR contactors, in order not to saturate the welding transformer.

1.1 In some applications it is required to weld the material with the same polarity. This can be done for short weld schedules, as long as the number of weld cycles does not exceed the maximum allowed not to saturate the welding transformer, and the time between welds is long.

1.3 This can be accomplished easily with the Interlock controller Model 301B simply by setting COOL TIME to zero. This will automatically prevent alternating and a UNIPOLARITY FIRING can be maintained.

1.4 The FC / DC switch located on the peripheral board must be set to FC for alternate polarity operation, and DC for operating welding transformers with rectified secondary output.

FIRST SPOT IN SEAM AND ROLL SPOT

The FIRST SPOT feature is based on the selection of two consecutively numbered weld schedules. The smaller weld schedule number will be executed only once. The next larger weld schedule number “UP” will be executed continuously, for the duration of the foot switch closure. TIP TRAVEL, PRECOMPRESSION and timers will be bypassed in the weld schedule no.”01"

SEAM set up example:

TIP TRAVEL TIME internally preset to 20 cycles.
PRECOMPRESSION TIME internally preset to 4 cycles.

WELD SCHEDULE “00”	WELD SCHEDULE “01”
SQUEEZE TIME = 20	SQUEEZE TIME = 20
IMPULSES = 01	IMPULSES = 01
COOL TIME = 03	COOL TIME = 03
HEAT TIME = 12	HEAT TIME = 12
HEAT% = 48	HEAT % = 52
HEAT DECAY TIME = 01	HEAT DECAY TIME = 01
HEAT DECAY % = 15	HEAT DECAY % = 18
HOLD TIME = 20	HOLD TIME = 20
OFF TIME = 00	OFF TIME = 00
LVC = ON	LVC = ON
MOTOR SPEED = 0.25"/WELD	MOTOR SPEED = 0.25"/WELD
WELD COUNTER = 275	WELD COUNTER = 275
NEXT W.S.> = ON	NEXT W.S.> = OFF
FORGE DELAY = LOW	FORGE DELAY = LOW
PREHEAT SLOPE = OFF	PREHEAT SLOPE = OFF
WELD SLOPE = OFF	WELD SLOPE = OFF
POSTHEAT = OFF	POST HEAT = OFF
SPOT = OFF	SPOT = OFF
SEAM = ON	SEAM = ON

Note that all parameters are the same, exclusive of:

a. HEAT %
b. HEAT DECAY %
c. NEXT W.S.>

The controller will use the “MOTOR SPEED” & “WELD COUNTER” parameters from the FIRST SPOT schedule, regardless of values placed in the next weld schedule up. It is recommended however that these values, including FORGE DELAY ; LVC; and SPOT - SEAM - ROL SPOT switches be kept identical in both weld schedules. The SLOPE switches may not be used with FIRST SPOT operating mode. Set them to OFF in seam and roll spot operation.

ROLL SPOT set up example:

TIP TRAVEL TIME internally preset to 20 cycles.
PRECOMPRESSION TIME internally preset to 4 cycles.

WELD SCHEDULE "02"	WELD SCHEDULE "03"
SQUEEZE TIME = 20	SQUEEZE TIME = 03
PR IMPULSES = 01	PR IMPULSES = 01
PR COOL TIME = 01	PR COOL TIME = 01
PR HEAT TIME = 12	PR HEAT TIME = 12
PR PRHEAT% = 48	PR HEAT % = 52
PR HEAT DECAY TIME = 02	PR HEAT DECAY TIME = 02
PR HEAT DECAY % = 51	PR HEAT DECAY % = 55
W IMPULSES = 01	W IMPULSES = 01
W COOL TIME = 00	W COOL TIME = 00
W HEAT TIME = 02	W HEAT TIME = 02
W HEAT% = 56	W HEAT % = 60
W HEAT DECAY TIME = 02	W HEAT DECAY TIME = 01
W HEAT DECAY % = 15	W HEAT DECAY % = 19
HOLD TIME = 20	HOLD TIME = 20
OFF TIME = 00	OFF TIME = 00
LVC = ON	LVC = ON
MOTOR SPEED = 0.25"/WELD	MOTOR SPEED = 0.25"/WELD
WELD COUNTER = 275	WELD COUNTER = 275
NEXT W.S.> = ON	NEXT W.S.> = OFF
FORGE DELAY = VAR / W	FORGE DELAY = VAR / W
FORGE DELAY CYCLES = 16.0	FORGE DELAY CYCLES = 16.0
PREHEAT SLOPE = OFF	PREHEAT SLOPE = OFF
WELD SLOPE = OFF	WELD SLOPE = OFF
POSTHEAT = OFF	POST HEAT = OFF
SPOT = ON	SPOT = ON
SEAM = ON	SEAM = ON

The example above, represents a three step upslope with forge delay set in the peak current. SQUEEZE TIME has been almost eliminated in the second spot and beyond. Note that all parameters are the same, exclusive of:

a. SQUEEZE TIME
b. HEAT %
b. HEAT DECAY %
d. NEXT W.S.>

The controller will use the "MOTOR SPEED" & "WELD COUNTER" parameters from the FIRST SPOT schedule, regardless of values placed in the next weld schedule up. It is recommended however that these values, including FORGE DELAY ; LVC; and SPOT - SEAM - ROL SPOT switches be kept identical in both weld schedules. The SLOPE switches may not be used with FIRST SPOT operating mode. Set them to OFF.

Schematics

Re: Schematics

Unfortunately, the schematics to go with this document are too large (2→6.5 Megs each) to be posted on the T. J. Snow web-site at this time. If you would like to view them, and have a fast Internet connection, arrangements can be made to send them to you electronically.
Please email welders@tjsnow.com for details.

It is also possible for us to print them here and mail them to you via regular mail. It should be noted that the complete manual is also available by request directly from Intertron. They can be contacted via their web-site at http://www.intertron-ind.com .

--Thank you

RWMA

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