INSTRUCTION MANUAL

700154C

EN2150 SERIES CONTROLS

MICROPROCESSOR BASED
Weld Sequence Controls
With
Solid State Thyristor Contactors

Wiring Diagram 421368 “B” Cabinet

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ENTRON Controls, LLC.

MICROPROCESSOR BASED WELDING CONTROLS
WITH SOLID STATE THYRISTOR CONTACTORS

INSTALLATION AND OPERATION MANUAL FOR:
Model Series EN2150

! CAUTION !
READ THIS MANUAL COMPLETELY BEFORE ATTEMPTING TO INSTALL OR OPERATE THIS CONTROL

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ENTRON Controls, LLC.
Greer, South Carolina 29650

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1.0 GENERAL DESCRIPTION

The EN2150 Control is a microprocessor-based resistance welding control. This control is equipped with dual schedule, dual heat, with positive, negative or alternating half cycle feature.

Initiation of two different weld schedules (WELD and PERCENT CURRENT) are available on separate initiation inputs.

The EN2150 includes an End of Sequence output which provides a signal after a sequence has been completed.

CONTROL SEQUENCE

The EN2150 will perform the sequence described below after a pilot initiation switch closure.

Initiation on FS3

Closure of a single pole, normally open switch between FS3 and GND will always initiate schedule 1 parameters shown on the control display. The control will deliver the programmed number of WELD cycles to the welding transformer at the programmed PERCENT CURRENT for schedule 1.

Initiation on FS7

Closure of a single pole, normally open switch between FS7 and GND will initiate schedule 2. The control will deliver the programmed number of WELD cycles to the welding transformer at the programmed PERCENT CURRENT for schedule 2.

1.1 STANDARD FEATURES

DIGITAL PHASE SHIFT CURRENT CONTROL – Varies the current from 0% to 99% of available; adjustable in 1% steps by means of Front Panel push buttons and direct reading LED displays.

WELD TIME – Measured in terms of cycles of alternating current (AC). One (1) cycle of WELD is 1/60 of one (1) second at 60 Hz.

Cycle timing is achieved by counting each cycle of the line current directly. This method of timing allows this control to be used on either 60 or 50 Hz operation without special adjustments. See Section 2.1 and Section 2.3.4 for further information.

NOTICE
NO ADJUSTMENT is required for power factor or timing to change from 60 to 50 hz operation.

1.1 STANDARD FEATURES (cont.)

87° DELAY OF FIRST HALF CYCLE FIRING of each weld sequence. The purpose of the 87° DELAY is to prevent the build-up of a DC component in the welding transformer which may be damaging.

TEMPERATURE LIMIT SWITCH – Terminal strip connection which allows the control to disable the Contactor firing in the event that the Contactor has reached the temperature limit of the thermal switch monitoring the Contactor temperature. Remove the jumper from TS1-TLS1/AUX1 and TS1-GND and connect a normally closed Temperature Limit Switch.

MANUAL ADJUST KNOB (Optional) – Located on the control Display Panel, can adjust the weld PERCENT CURRENT while the control is idle and during a weld. The new value of PERCENT CURRENT is automatically stored in memory in the schedule being executed during the adjustment. The MANUAL ADJUST knob is not functional with a PROGRAM LOCKOUT key switch option installed.

OPERATING CONDITIONS – Temperature Range: 0°C to 70°C (32°F to 158°F).

2.0 CONTROL PANEL LAYOUT

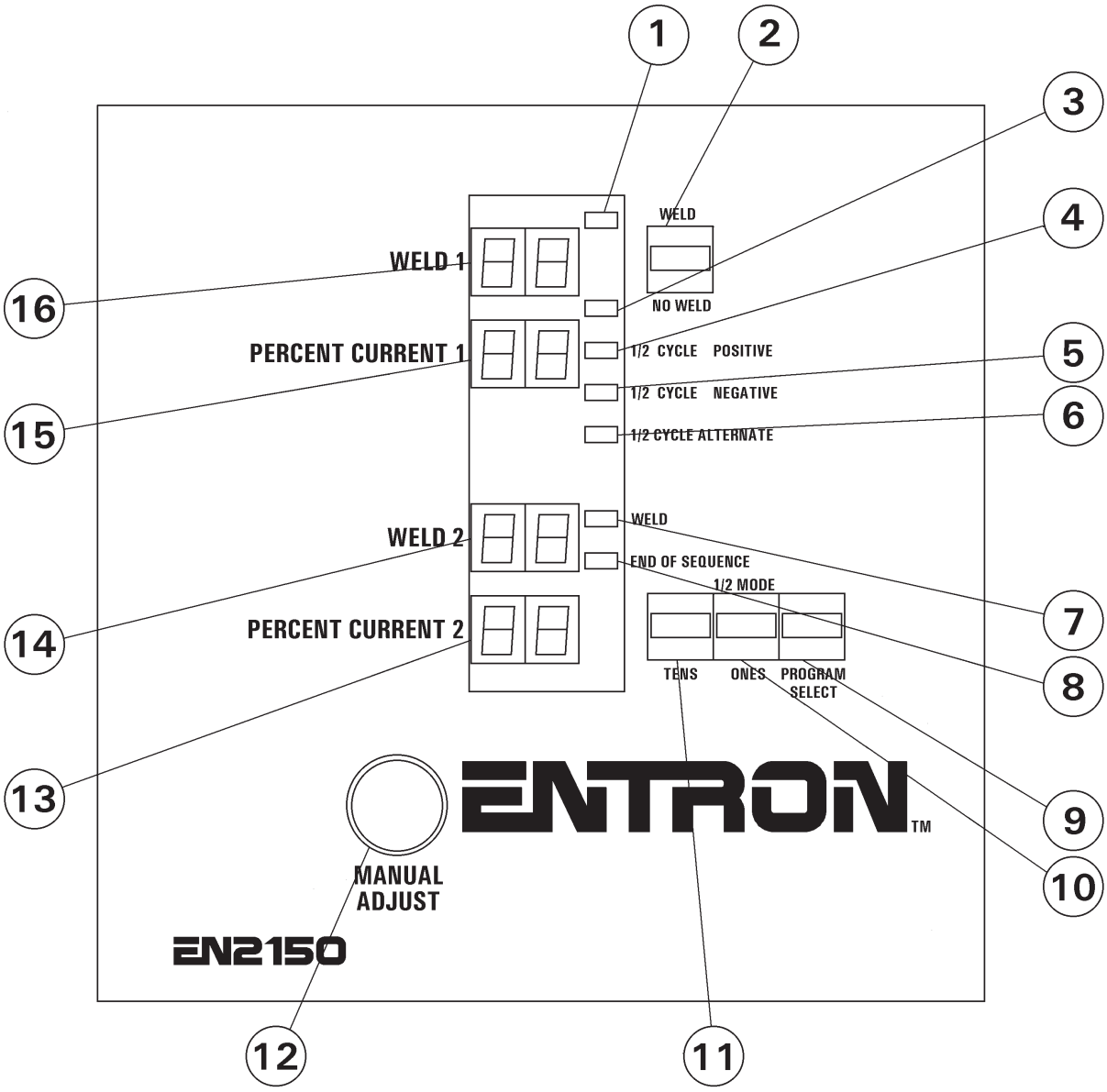


Figure 2-1. *Control Panel layout*

1 – WELD mode indicator LED
2 – WELD/NO WELD push button
3 – NO WELD mode indicator LED
4 – ½ CYCLE POSITIVE indicator LED
5 – ½ CYCLE NEGATIVE indicator LED
6 – ½ CYCLE ALTERNATE indicator LED
7 – WELD indicator LED
8 – END OF SEQUENCE indicator LED
9 – PROGRAM/SELECT push button
10 – ONES/½ MODE push button
11 – TENS push button
12 – MANUAL ADJUST knob (Optional)
13 – PERCENT CURRENT 2 display
14 – WELD 2 display
15 – PERCENT CURRENT 1 display
16 – WELD 1 display

2.1 CONTROL FUNCTIONS – See Figure 2-1 *Control Panel layout*

WELD/NO WELD PUSH BUTTON (2) – This push button is active at all times. It puts the control in the WELD mode (enables the contactor to fire) or NO WELD mode (disables firing). This function is accessible while in OPERATE mode or while welding with few exceptions (generally during error conditions).

WELD (1)/NO WELD (3) INDICATOR LEDs – These LEDs indicate the active status of the control. The LEDs toggle whenever the WELD/NO WELD push button is pressed.

ONES/½ MODE PUSH BUTTON (10) – This is a **dual function** push button. In PROGRAM mode, this push button will increment the data stored in the chosen welding parameter by **one**. When the digit reaches the maximum, it resets to zero. In OPERATE mode, this push button will allow a choice of either **POSITIVE, NEGATIVE** or **ALTERNATE ½ CYCLE** firing. Press and hold the button until the display blanks to choose either **POSITIVE, NEGATIVE** or **ALTERNATE ½ CYCLE**.

TENS PUSH BUTTON (11) – In PROGRAM mode, this push button will increment the data stored in the chosen welding parameter by **ten**. When the digit reaches the maximum, it resets to zero.

PROGRAM/SELECT PUSH BUTTON (9) – Pressing this push button will put the control in PROGRAM mode and select the parameters to be changed. As this push button is depressed, the individual displays will light where data can be stored or changed, all other individual displays will blank. After a display is lit, press the ONES and TENS push buttons until the desired value is displayed. Pressing the PROGRAM/SELECT push button again will highlight the next programmable parameter. Pressing the PROGRAM/SELECT push button until all displays are lit will restore the control to OPERATE mode.

PROGRAM mode is the mode in which the individual schedules can be entered or modified. Welding parameters (times and intensity) can only be changed in PROGRAM mode. If the control is fitted with a MANUAL ADJUST knob, the **PERCENT CURRENT parameter** can be adjusted in PROGRAM mode **or via the MANUAL ADJUST knob (12).**

OPERATE mode is the normal operating mode for the control. This is the only mode in which the control can initiate a weld. When the control is in OPERATE mode, the control is in a Ready (to initiate) state.

END OF SEQUENCE INDICATOR LED (8) – When the control is in OPERATE mode, this LED is lit when indicating the initiation sequence has ended. The END OF SEQUENCE function will cause the control to toggle an End of Sequence output for 0.5 seconds at the end of an initiated sequence.

½ CYCLE POSITIVE INDICATOR LED (4) – Indicates that the control will allow only the POSITIVE half of the AC power to enter the welding transformer.

NOTICE
½ CYCLE only occurs when the WELD time is set to a value of ***00***. Otherwise current will be delivered to the weld transformer for the programmed time.

2.1 CONTROL FUNCTIONS (cont.) – See Figure 2-1 *Control Panel layout*

½ CYCLE NEGATIVE INDICATOR LED (5) – Indicates that the control will allow only NEGATIVE half of the AC power to enter the welding transformer.

NOTICE
½ CYCLE only occurs when the WELD time is set to a value of **00**. Otherwise current will be delivered to the weld transformer for the programmed time.

½ CYCLE ALTERNATE INDICATOR LED (6) – Indicates that the control will allow ALTERNATING positive and negative half of the AC power to enter the welding transformer. POSITIVE and NEGATIVE ½ CYCLES will alternate upon each initiation.

NOTICE
½ CYCLE only occurs when the WELD time is set to a value of **00**. Otherwise current will be delivered to the weld transformer for the programmed time.

WELD INDICATOR LED (7) – When the control is in OPERATE mode, this LED is lit indicating the Contactor (SCR) is activated.

WELD 1 DISPLAY (16) – When the control is in OPERATE mode, this display indicates the number of WELD cycles to be delivered to the welding transformer when schedule 1 is initiated. In PROGRAM mode (see PROGRAM/SELECT push button), all other displays will blank indicating the number of WELD cycles may be changed. The number of WELD cycles possible for schedule 1 is 0 to 99.

PERCENT CURRENT 1 DISPLAY (15) – When the control is in OPERATE mode, this display indicates the percentage of available CURRENT to be delivered to the welding transformer when schedule 1 is initiated. In PROGRAM mode (see PROGRAM/SELECT push button), all other displays will blank indicating the PERCENT CURRENT in schedule 1 may be changed. The PERCENT CURRENT may range from 0% to 99%.

WELD 2 DISPLAY (14) – When the control is in OPERATE mode, this display indicates the number of WELD cycles to be delivered to the welding transformer when schedule 2 is initiated. In PROGRAM mode (see PROGRAM/SELECT push button), all other displays will blank indicating the number of WELD cycles may be changed. The number of WELD cycles possible for schedule 2 is 0 to 99.

PERCENT CURRENT 2 DISPLAY (13) – When the control is in OPERATE mode, this display indicates the percentage of available CURRENT to be delivered to the welding transformer when schedule 2 is initiated. In PROGRAM mode (see PROGRAM/SELECT push button), all other displays will blank indicating the PERCENT CURRENT in schedule 2 may be changed. The PERCENT CURRENT may range from 0% to 99%.

MANUAL ADJUST KNOB (12) – Allows the increase or decrease of PERCENT CURRENT in both PROGRAM and OPERATE modes. This knob is not functional with PROGRAM LOCKOUT key switch option.

2.2 CLEAR ALL

It is sometimes desirable to clear all previous schedules from the memory and return the programmed control parameters to factory defaults.

To execute the CLEAR ALL function, hold the PROGRAM/SELECT push button upon power-up and the control will erase all programmed parameters in both schedules.

NOTICE
WHEN THE CLEAR ALL FUNCTION IS EXECUTED, THE CONTROL MUST BE REPROGRAMMED.

2.3 EXTENDED FUNCTIONS

EXTENDED FUNCTIONS are a set of adjustable parameters which affect a section of memory that determines **how the control is intended to operate based on the user's system configuration.**

The default (factory) settings of the EXTENDED FUNCTIONS are set for the more common uses and may need to be changed to meet the user's needs. To change control operating parameters, selection of the EXTENDED FUNCTIONS are provided by a DIP switch located on the back of the Display Board (See Figure 2-2).

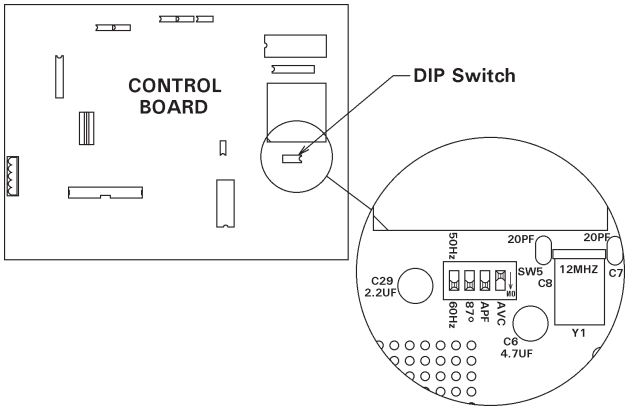


Figure 2-2. *EXTENDED FUNCTIONS DIP switch*

The available EXTENDED FUNCTIONS are listed below and described in the indicated sections:

DESIGNATION	DESCRIPTION	SECTION
AVC	Automatic Voltage Compensation	2.3.1
87°	87° Delay	2.3.2
APF	Automatic Power Factor	2.3.3
50Hz/60Hz	Operating Frequency	2.3.4

2.3.1 AVC

The EN2150 Controls are shipped with the AUTOMATIC VOLTAGE COMPENSATION feature disabled. Under conditions of poor line voltage regulation, its use will provide consistently good quality welds in spite of varying line voltage. To enable the AVC, slide the AVC switch to the "ON" position (see Figure 2-2). Once the switch is in the "ON" position, press and hold the PROGRAM/SELECT push button until the display goes blank. This process records the nominal line voltage in the control's non-volatile memory.

NOTICE	
NOTE 1:	The AVC must be enabled at a time when the line voltage is nominal, not abnormally high or low.
NOTE 2:	Also, when using AVC, select a PERCENT CURRENT not higher than 85% to allow the AVC circuit operating space.

2.3.2 87° DELAY

The purpose of the 87° DELAY is to prevent the build-up of a DC component in the welding transformer which may be damaging to wound core (hypersil) transformers and some stacked core transformers. If this delay is not needed, it may be disabled (or re-enabled) by sliding the corresponding DIP switch in the back of the Front Panel Display to the desired position (see Figure 2-2).

ON = 87° DELAY enabled
OFF = 87° DELAY disabled

2.3.3 AUTOMATIC POWER FACTOR

The EN2130 incorporates AUTOMATIC POWER FACTOR equalization in its programming. Calibration of the AUTOMATIC POWER FACTOR circuit is not required. This feature makes it unnecessary to make manual adjustments when installing the control, to match its circuitry to the power factor of the welding machine. It assures that maximum welding current, for any welding transformer tap switch setting, will occur when the selected PERCENT CURRENT is 99%. As shipped from the factory, EN2150 Controls are in the AUTOMATIC POWER FACTOR mode (see Figure 2-2).

If desired, for some applications, the AUTOMATIC mode can be disabled and a FIXED POWER FACTOR of 40 can be manually set into the control by moving APF switch to "OFF" position.

2.3.4 50HZ/60HZ OPERATION

The EN2150 Controls will operate on either 50 Hz or 60 Hz AC power systems. As shipped from the factory, they are set for 60 Hz operation.

If operation at 50 Hz is required, move the corresponding DIP switch to the 50 Hz position (see Figure 2-2).

3.0 WELD PARAMETERS

WELD/HEAT ..... 0 to 99 cycles (programmed 00 = 0 cycles)
WELD COUNT (1 and 2)..... The time duration that current will flow through the welding transformer
PERCENT CURRENT (1 and 2) ..... 0 to 99% (adjustable in 1% RMS steps)

4.0 INITIATION PILOT INPUTS

SINGLE STAGE INITIATION

Connect a normally open, open single pole, pilot switch between TS1-FS3 or TS1-FS7 and TS1-GND. Closure of this switch will execute a welding schedule as follows:

FS3 – Initiates schedule 1
FS7 – Initiates schedule 2

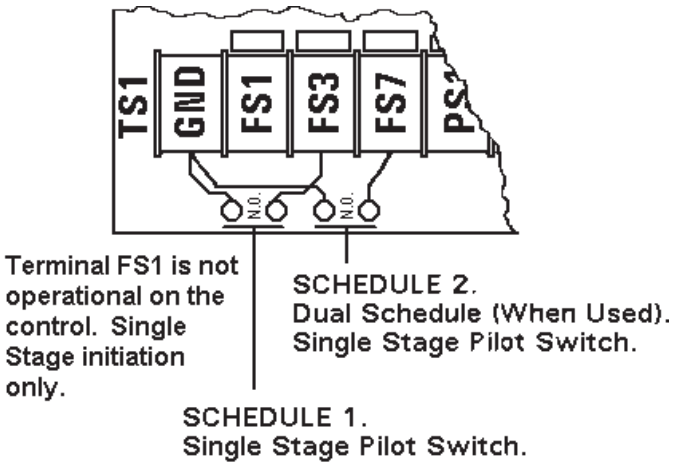


Figure 4-1. *Initiation inputs*

5.0 GENERAL OPERATING INSTRUCTIONS

1. For your convenience, many electrical and mechanical connections have been performed at the factory. Refer to the Wiring Diagram (421368) shipped with your control for other connections.
2. Be sure all electrical connections are properly made and that all fittings are securely tightened. Loose electrical connections can cause faulty or erratic operation of the control or welding machine.
3. If the machine is air operated, turn on the air supply to the machine. Set air pressure in accordance with the machine manufacturer's recommendations.
4. If the Contactor in your control is water cooled, turn water on. Be sure water is flowing freely in drain. Check flow gauge, on closed systems, for water flow.
5. Be sure that the welding machine head is fully retracted. Turn on main power. The SCHEDULE parameter displays should light at this time.
6. Use WELD/NO WELD push button (and/or external WELD/NO WELD switch) to put control in the NO WELD mode.
7. Program a simple SPOT schedule into the control as follows:
   WELD 1 count ..... 02 to 03 cycles
   PERCENT CURRENT 1 ..... 50 to 60%
   Initiation Pilot (TS1-FS3 and TS1-GND) ..... Schedule 1
8. Set the welding transformer tap to LOW or a low tap switch setting.

! CAUTION !

KEEP HANDS, ARMS, OTHER PORTIONS OF THE BODY, CLOTHING AND TOOLS AWAY FROM THE MOVING PARTS OF THE MACHINE!

9. Initiate the cylinder to close the welding electrodes. Welding head or arms will close. Be sure the electrodes have closed together and then depress the initiation pilot switch. The control will sequence but will not weld. De-energize the cyclinder solenoid. The head or arms will retract. On foot-operated machines only, a switch on the mechanical linkage of the machine will initiate the sequence.
10. Program the schedule for the part to be welded as recommended by the machine manufacturer or to RWMA standards for the work to be performed. Place the work in the machine and use the WELD/NO WELD push button on Control Panel and any external WELD/NO WELD switches to put control in the WELD mode. The machine is now ready to weld.
11. If no standards have been set, it is recommended to use a short WELD count for initial setup and welding. WELD count can be increased, welding transformer tap can be increased, and the PERCENT CURRENT can then be adjusted for the best weld. The most efficient use of the control and welding machine will generally be made at the lowest welding transformer tap, the highest PERCENT CURRENT setting and the shortest WELD count.

6.0 INTRODUCTION TO PROGRAMMING

The EN2150 is capable of storing and accessing two unique welding schedules. Programming allows the operator to enter or change parameters of weld schedules and store those parameters in non-volatile memory. Basically, programming only requires selecting the parameter to be programmed (or modified) and then entering the desired values (data).

6.1 GENERAL PROGRAMMING

1. Select the schedule that you wish to enter or modify by pressing the PROGRAM/SELECT push button until the desired parameter is highlighted.
2. Use ONES & TENS push buttons to select the desired value for the chosen parameter (chosen display will be lit).
3. Press the PROGRAM/SELECT push button to select the next parameter to be entered or modified. The lighted parameter display indicates which function has been selected to be entered or modified. When the PROGRAM/SELECT push button is pressed again, the display will advance to the next parameter.

NOTICE
When PROGRAM/SELECT is advanced one past the PERCENT CURRENT 2 parameter, all parameter displays will light.

7.0 END OF SEQUENCE POWER CONNECTION

End of Sequence power is not supplied with the EN2150, so external power must be provided to enable End of Sequence output operation.

An End of Sequence power input is available between terminals TS1-VL1 and TS1-SV2/VL2. This power will be transferred to the End of Sequence output (TS1-SV1 and TS1-SV2/VL2) for 0.5 seconds after a sequence has been completed.

NOTICE
The maximum current that can be switched by the firing board is 1 AMP. If more current is desired, the valve circuit should be wired to a relay having a suitable contact rating to switch the desired valve.

7.1 FUSING

CONTROL FUSE This fuse, a BBS 6/10 AMP, is used to protect the control circuits. The fuse holder is located within the cabinet.

END OF SEQUENCE FUSE This fuse, a 2AG 1 AMP, is used to protect the valve circuits. The fuse is located on Terminal Strip PCB2 A/N 410333-003.

! CAUTION !
INSTALL PROPERLY SIZED FUSES IN SERVICE DISCONNECT SWITCH. CHECK WELDING MACHINE MANUFACTURER'S RECOMMENDATIONS.

! DANGER !
VOLTAGES PRESENT IN THIS CONTROL CAN CAUSE SEVERE OR FATAL INJURY. **DO NOT CHANGE FUSES WITH THE POWER ON.** USE ONLY THE FUSE TYPE SPECIFIED TO MAINTAIN SAFE OPERATION.

8.0 TERMINAL STRIP DIAGRAM

See Wiring Diagram 421368 for “B” Cabinet.

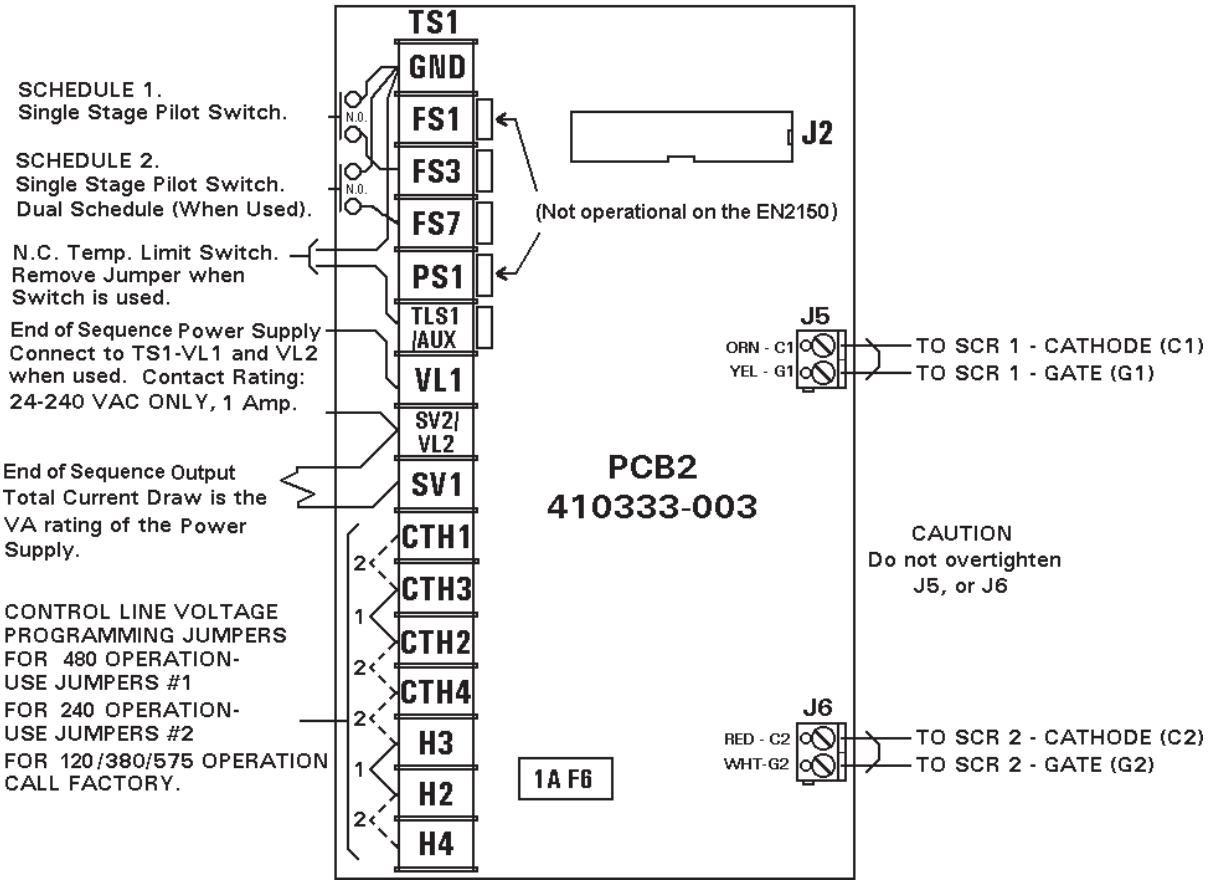
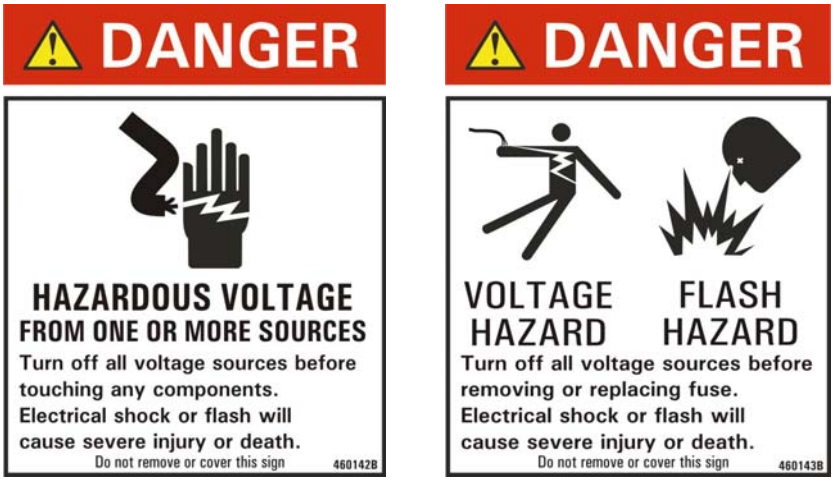


Figure 8-1. *Terminal Strip/Firing Board*



9.0 VOLTAGE PROGRAMMING

It is possible to operate the EN2150 Control at 120, 208, 240, 380, 480, and 575 VAC.

NOTICE
When a 120, 380 or 575 VAC main is desired, please consult the factory.

In order to convert the control operating voltage from one line voltage to another, there are two changes required:

1. **Control Transformer:** Jumpers on TS1-L2/CTH4, CTH2, CTH3, and CTH1 must be configured to match the line voltage.

2. **Sense Transformer:** Jumpers on TS1-H4, TS1-H2, TS1-H3, and TS1-H1 must be configured to match the line voltage.

! WARNING !
THIS WELDING CONTROL IS A MULTI-VOLTAGE UNIT WHICH CAN BE CHANGED FROM ONE VOLTAGE TO ANOTHER BY RE-ARRANGING JUMPERS ON THE TERMINAL STRIP INSIDE THE UNIT. OPERATING THE CONTROL AT A VOLTAGE OTHER THAN THAT PRESCRIBED BY THE VOLTAGE CONFIGURATION JUMPERS MAY CAUSE SERIOUS DAMAGE.

! CAUTION !
THE WELDING CONTROL WAS SHIPPED CONFIGURED FOR A SPECIFIC VOLTAGE. A TAG ATTACHED TO THE CONTROL TERMINAL BLOCK SPECIFIES THIS VOLTAGE.

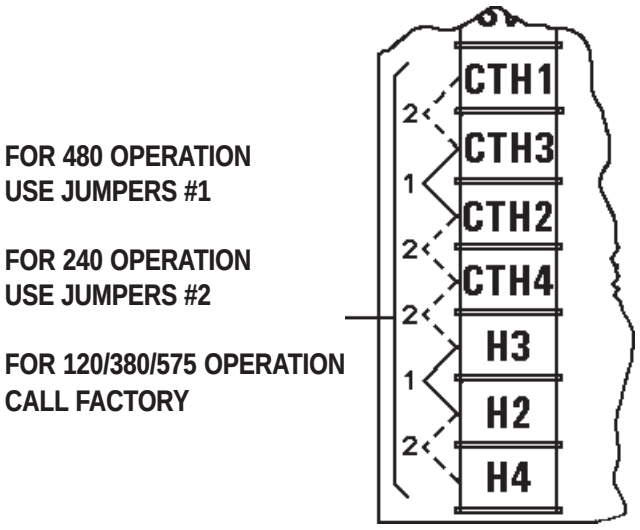


Figure 9-1. *Voltage Operation jumpers settings*

9.1 PRIMARY WIRING TO WELDING CONTACTOR

For your convenience, many electrical and mechanical connections have been performed at the factory. Check **ALL** electrical connections to insure integrity. Connections may loosen during shipping.

Connect the L1 lead from incoming power to the L1 connection located on the contactor assembly. Connect the H1 lead from the welding transformer to the H1 connection located on the contactor assembly.

Connect L2 and H2 to the terminal labeled L2 on the wiring terminal block.

10.0 NON-VOLATILE MEMORY ERROR

The EN2150 Series Controls make extensive use of non-volatile memory devices. These devices are sometimes susceptible to corruption due to electrical noise present in some systems.

To detect effects of electrical noise on the control, upon power up or return from Emergency Stop, the control executes a diagnostic test that reads all memory locations within the schedule storage areas. If the microcontroller finds invalid data, it displays ERROR code **14** alternated with the schedule number where the invalid data is stored. The invalid data may also be found in the EXTENDED FUNCTIONS' memory area; in this case, the alternate flash displays **EF**.

Physically isolating high voltage wires from low voltage wires will avoid the introduction of electrical noise into the control.

If ERROR CODE **14** occurs, the memory MUST be cleared of stored parameters, using the CLEAR ALL function (see Section 2.2).

NOTICE

If ERROR CODE **14** persists, you may need to physically isolate high voltage (120 VAC outputs, etc.) from low voltage (initiation inputs) wires. The isolation methods shown in Figure 10-1 will diminish coupling of adjacent signals. Re-routing each type of wires to a separate grounded conduit may restore the control to normal operation.

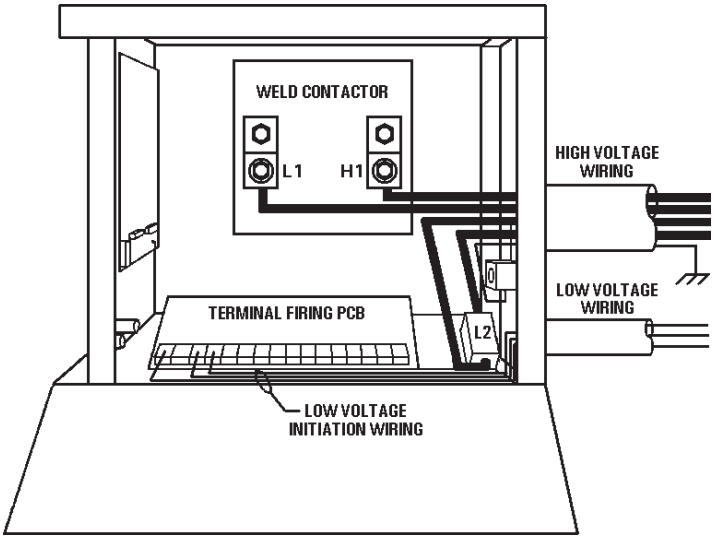
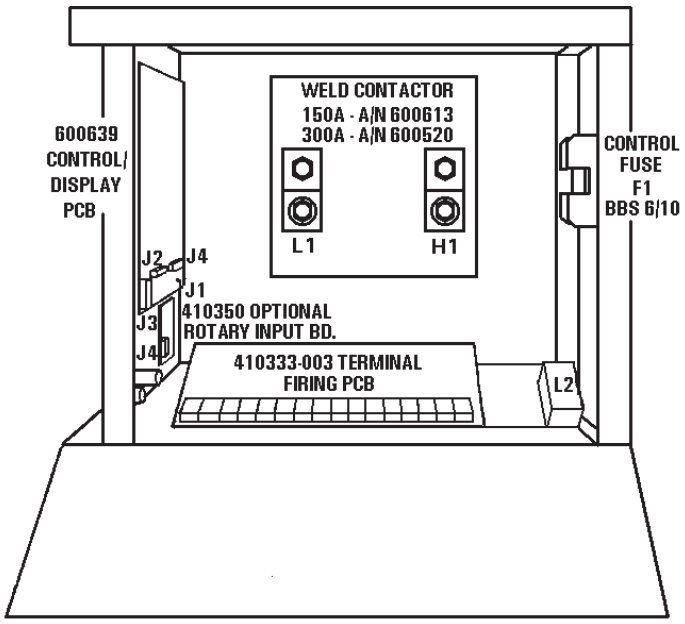


Figure 10-1. *Recommended wiring and routing*

11.0 INSTALLATION DIAGRAM – “B” CABINET



STYLE "B" CABINET

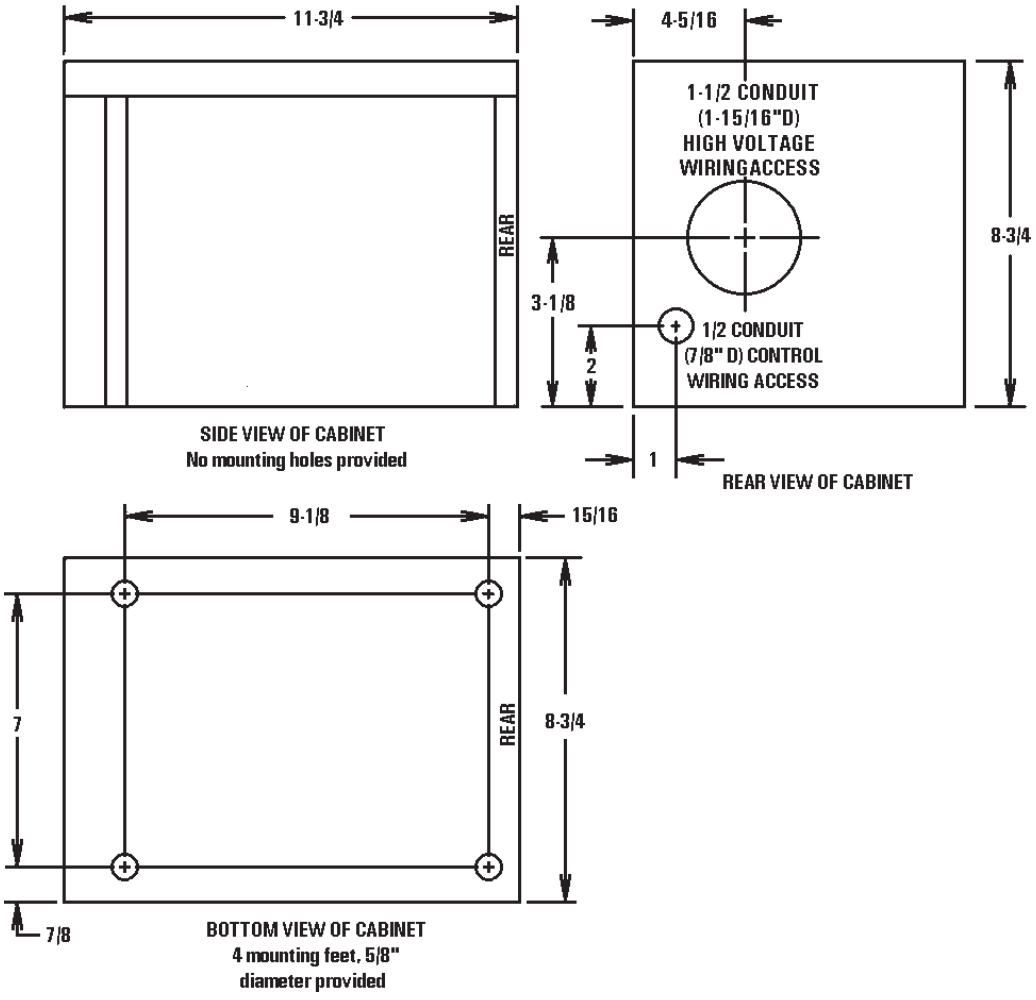


Figure 11-1. *Style “B” Cabinet*

12.0 ERROR CODES

Please refer to other manual pages and Wiring Diagrams for location of Terminal Strip connections, etc.

ERROR	POSSIBLE CAUSE	REMEDY
Data/Schedule Display E.r.=01	Error Code #01 Temperature Limit Switch open/ overheated.	Wait for Temperature Limit Switch to cool, or check for open circuit TLS1/AUX1. **See Section 1.1.**
Data/Schedule Display E.r.=04	Error Code #04 Attempt to weld while in PROGRAM mode.	Return to OPERATE mode. **See Section 2.1.**
Data/Schedule Display E.r.=05	Error Code #05 FS3 or FS7 closed to GND before power on.	All initiations must be open at power on. **See Section 1.0 and 4.0.**
Data/Schedule Display E.r.=08	Error Code #08 FS3 initiated while another seq. active.	Open TS1-FS3. **See Section 1.0 and 4.0.**
Data/Schedule Display E.r.=09	Error Code #09 FS7 initiated while another seq. active.	Open TS1-FS7. **See Section 1.0 and 4.0.**
Data/Schedule Display E.r.=11	Error Code #11 Control Board. Control Relay problem.	Replace Control Board.
Data/Schedule Display E.r.=12	Error Code #12 Control Board. Hardware error.	Replace Control Board.
Data/Schedule Display E.r.=13	Error Code #13 Full conduction detected.	Change to higher welding transformer tap.
Data/Schedule Display E.r.=14 FLASHING	Error Code #14 FLASHING EEROM error. Possible electrical noise causing invalid data storage.	Follow procedure in Section 2.2 and 10.0.
E.r.=14 NON-FLASHING	Error Code #14 NON-FLASHING EERAM Memory Failure.	Replace Control Board. **See Section 2.2 and 10.0.**
Data/Schedule Display E.r.=26	Error Code #26 Contactor short detected.	1. Check contactor for short. 2. Check Firing Module 410333-003.

12.1 TROUBLESHOOTING

Please refer to other manual pages and Wiring Diagrams for location of Terminal Strip connections, etc.

TROUBLE	POSSIBLE CAUSE	REMEDY
Display will not light.	1. Fuse F1, type BBS 6/10, control fuse blown. 2. Defective Control Board. 3. Main welder disconnect open. 4. L2 wire to Terminal Strip missing.	1. Check that control is wired for proper input line voltage (H1, H2, H3 and H4 and CTH1, CTH2, CTH3 and CTH4 jumpers on Terminal Strip). 2. Replace Control Board. 3. Check that fuse or circuit breaker is of sufficient size for KVA demand of welding transformer. 4. Add L2 wire.
Control will not initiate.	1. Initiation switch(es) defective. 2. Loose or broken wire(s) at initiation switch(es). 3. Defective Control/Display.	1. Replace switch(es). 2. Check for loose or broken wire(s) at initiation switch(es) and at Terminal Strip (FS3, FS7, etc.). 3. Replace board with another board stamped with same A/N.
HALF CYCLE during WELD time.	1. HALF CYCLE is enabled. 2. Defective Terminal Strip/Firing PCB.	1. Disable HALF CYCLE. 2. Replace board. See Wiring Diagram for correct A/N.
Control sequences but will not weld.	1. WELD/NO WELD push button on Front Panel of control. 2. Open Temperature Limit Switch. 3. Welding transformer tap switch in OFF position. 4. Welding transformer secondary open. 5. Defective Terminal Strip/Firing PCB. 6. Defective Control/Display PCB.	1. Check to see that control is in WELD. 2a) Contactor overheated, causing Limit Switch to open. 2b) Defective Limit Switch. Replace Limit Switch. 2c) Connect jumper across TLS1 & GND is TLS is not used. 3. Set to ON or at one of the tap positions. 4. Check for corroded or open connections. Be sure welding electrodes close on work. 5. Replace board. See Wiring Diagram for correct A/N. 6. Replace board with another board stamped with same A/N.

12.1 TROUBLESHOOTING (cont.)

TROUBLE	POSSIBLE CAUSE	REMEDY
Weld too cool or too small.	1. Line voltage drop. 2. Excessive force at electrodes. 3. Weld transformer set low. 4. WELD count too short. 5. PERCENT CURRENT too low. 6. Electrode face too small. 7. Excessive electrode wear.	1. KVA demand for welding transformer too high for input power line. 2. Check force setting. 3. Increase transformer tap setting. 4. Increase WELD count duration. 5. Increase value of PERCENT CURRENT. 6. Select correct electrode face diameter. 7. Properly dress electrodes.
"HOT" Welds	1. Low force. 2. Weld transformer set high. 3. WELD count set too high. 4. PERCENT CURRENT set too high. 5. Electrode face too small.	1. Check force at electrodes. 2. Reset tap to lower setting. 3. Reduce WELD count duration. 4. Decrease value of PERCENT CURRENT. 5. Dress or replace electrodes with proper size.
Inconsistent Welds	1. Work not square with electrodes. 2. Poor part fit-up. 3. Dirty material to be welded.	1. Check welding fixtures setup or electrode alignment. 2. Check parts for proper fit-up. 3. Work should be free from excessive dirt, paint and oxides.

13.0 ENTRON LIMITED WARRANTY AND FACTORY SERVICE

ENTRON Controls, LLC., warrants that all ENTRON control panels, **EXCEPT** Mid-frequency Inverter controls, silicon controlled rectifiers (SCRs), insulated gate bipolar transistors (IGBTs), SCR and IGBT assemblies, circuit breakers, and electro-mechanical contactors, are free of manufacturing defects for a period of **TWO YEARS** from the date of original purchase and, in the event of a manufacturing defect, ENTRON will repair or replace, at its discretion, the defective part without any cost for parts or labor.

All silicon controlled rectifiers, SCR and IGBT assemblies, circuit breakers, and electro-mechanical contactors in ENTRON control panels are covered by **a limited warranty from the original manufacturer**. If these parts fail because of a manufacturing defect, they will not be repaired or replaced by ENTRON, but will be returned by ENTRON to the original manufacturer in accordance with said manufacturer's warranty.

ENTRON Controls, LLC., warrants that all Mid-frequency Inverter controls are free of manufacturing defects for a period of **ONE YEAR** from the date of original purchase and, in the event of a manufacturing defect, ENTRON will repair or replace, at its discretion, the defective part without any cost for parts or labor.

To obtain repairs or replacement parts under this warranty, the defective part must be returned, prepaid, to ENTRON Controls, LLC., 1402 S. Batesville Road, Greer, SC 29650. Please send your repair to the attention of "Service" with a description of the problem you are experiencing, contact person, and phone number.

EXCLUSIONS: This warranty does not cover damage by accident or misuse, unauthorized repair or modification to any control assembly by the customer.

IMPORTANT NOTE: The warranty period is considered from the date of shipment and is tracked by a serial number code.

USE OF OUT OF WARRANTY REPAIR SERVICE:
To obtain service for any printed circuit board assembly or welding control after the warranty period, send the assembly or control, prepaid, to ENTRON Controls, LLC., and ENTRON will repair the printed circuit board assembly or control and return it to you without further warranty. Additional service charges may be invoiced at time of shipment.

Your ENTRON Controls, LLC., Original Equipment Manufacturers (OEMs), Dealers and Distributors are your first response contact to secure technical assistance on control or welding problems. Should they be unable to assist you, please contact your ENTRON sales representative or the factory directly. Contact the factory at 864-416-0190.