

INSTRUCTION MANUAL

700153C

EN2130 SERIES CONTROLS

MICROPROCESSOR BASED
Weld Sequence Controls
With
Solid State Thyristor Contactors

Wiring Diagram 421367 "B" Cabinet

ENTRON

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ENTRON Controls, LLC.

MICROPROCESSOR BASED WELDING CONTROLS
WITH SOLID STATE THYRISTOR CONTACTORS

INSTALLATION AND OPERATION MANUAL FOR:
Model Series EN2130

! 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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FIGURES

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1.0 GENERAL DESCRIPTION

The EN2130 Control is a microprocessor based resistance welding control. This control is equipped with dual schedule, dual heat, with positive or negative half cycle feature.

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

All parameters are fully adjustable from 0 to 99.

CONTROL SEQUENCE

The EN2130 will perform the sequence described below after a pilot initiation switch closure.

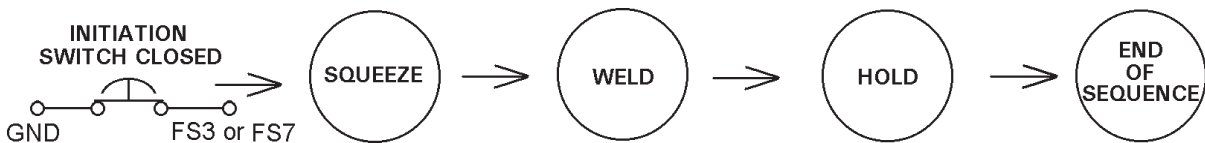


Figure 1-1. Control sequence

INITIATION ON FS1 (First stage of a two stage pilot switch)

Closure of a single pole, normally open switch between FS1 and GND will energize the valve output. The output will stay active until FS1 is released. This connection may be used as the first stage of a two stage initiation switch.

INITIATION ON FS3 (Second stage of a two stage pilot switch)

Closure of a single pole, normally open switch between FS3 and GND will initiate parameters stored in schedule 1.

INITIATION ON FS7 (Second stage of a two stage pilot switch)

Closure of a single pole, normally open switch between FS7 and GND will initiate parameters stored in 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.

SQUEEZE TIME – Interval that the valve output will be active prior to WELD time. SQUEEZE time allows the air cylinder time to build up the necessary welding force between the electrodes. SQUEEZE time is measured in cycles of alternating current (AC). One (1) cycle of SQUEEZE is 1/60 of one (1) second at 60 Hz.

WELD TIME – Interval that current is transferred to the welding transformer. WELD time is measured in cycles of alternating current (AC). One (1) cycle of WELD is 1/60 of one (1) second at 60 Hz.

1.1 STANDARD FEATURES (cont.)

HOLD TIME – Interval that the valve output will stay energized after WELD time. HOLD time is measured in terms of cycles of alternating current (AC). One (1) cycle of HOLD is 1/60 of one (1) second at 60 Hz.

CYCLE TIMING – 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.

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 leads to these terminals.

PRESSURE SWITCH FIRING – Terminal strip connection which allows the control to be initiated from a pressure switch closure. Remove the jumper from TS1-PS1 and TS1-GND and connect pressure switch leads to these terminals. A pressure switch is not furnished with control.

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

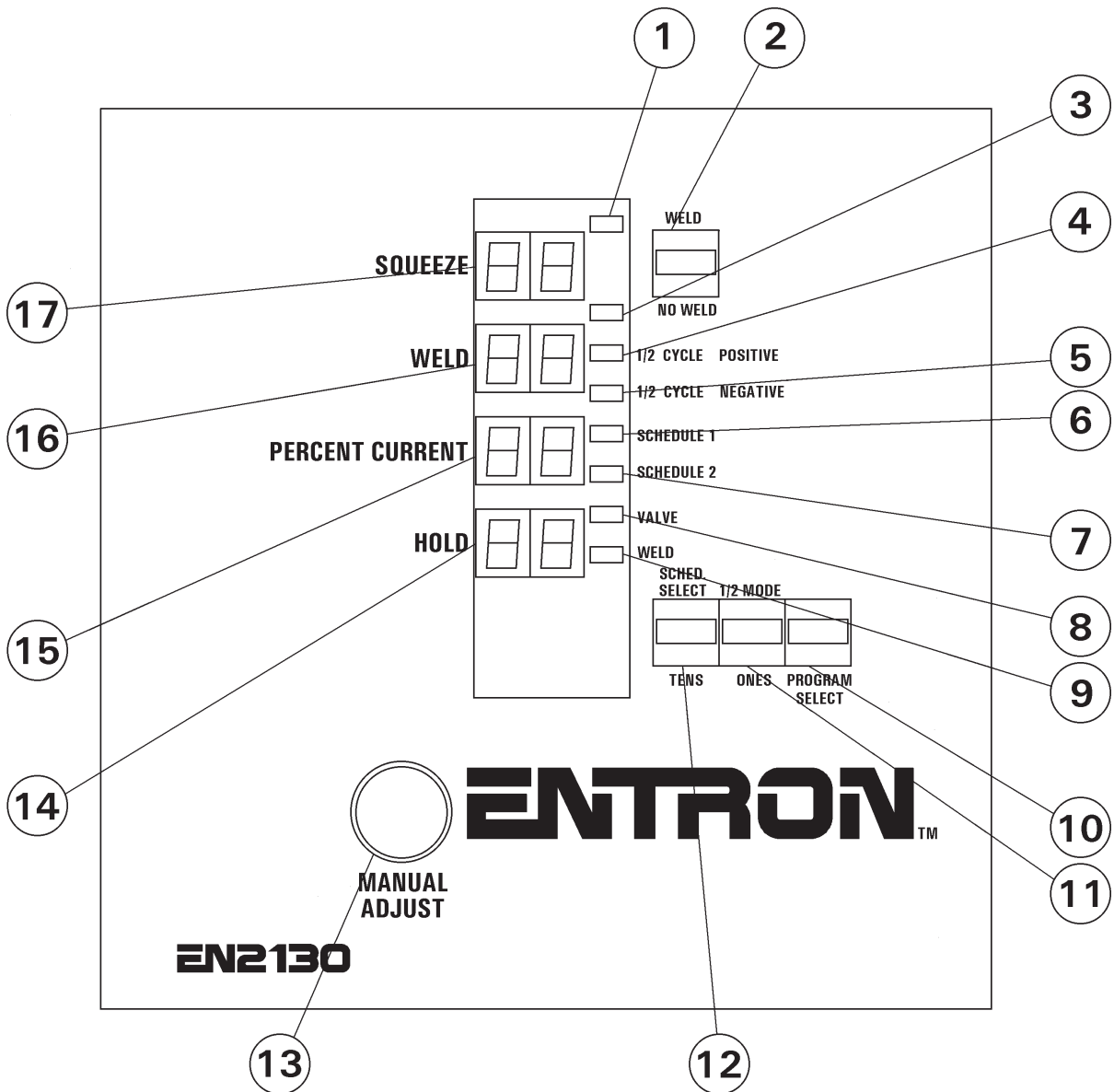


Figure 2-1. Control Panel layout

- | | |
|--------------------------------------|---------------------------------------|
| 1 – WELD mode indicator LED | 9 – WELD indicator LED |
| 2 – WELD/NO WELD push button | 10 – PROGRAM/SELECT push button |
| 3 – NO WELD mode indicator LED | 11 – ONES/1/2 MODE push button |
| 4 – 1/2 CYCLE POSITIVE indicator LED | 12 – TENS/SCHEDULE SELECT push button |
| 5 – 1/2 CYCLE NEGATIVE indicator LED | 13 – MANUAL ADJUST knob (Optional) |
| 6 – SCHEDULE 1 indicator LED | 14 – HOLD cycle count display |
| 7 – SCHEDULE 2 indicator LED | 15 – PERCENT CURRENT display |
| 8 – VALVE indicator LED | 16 – WELD cycle count display |
| | 17 – SQUEEZE cycle count 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 (11) – This is a **dual function** push button. In PROGRAM mode, this push button will increment the data stored in the welding parameter chosen 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** or **NEGATIVE ½ CYCLE** firing. Press and hold this push button until the display blanks, then release, to choose either **POSITIVE** or **NEGATIVE ½ CYCLE**.

TENS/SCHEDULE SELECT PUSH BUTTON (12) – In PROGRAM mode, this push button will increment the data stored in the welding parameter chosen by **ten**. When the digit reaches the maximum, it resets to zero. In OPERATE mode, press and hold, then release, this push button to select SCHEDULE 1 or 2.

PROGRAM/SELECT PUSH BUTTON (10) – Pressing this push button will put the control in PROGRAM mode and allow selection of 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 percent current) 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 in OPERATE mode via the (optional) MANUAL ADJUST knob (13)**.

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.

VALVE INDICATOR LED (8) – When the control is in OPERATE mode, this LED is lit when indicating the valve output is energized.

½ CYCLE POSITIVE INDICATOR LED (4) – Indicates that the control will allow only one 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 one 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 **zero**. Otherwise current will be delivered to the weld transformer for the programmed time.

WELD INDICATOR LED (9) – When the control is in OPERATE mode, this LED is lit indicating the contactor (SCR) is active.

SQUEEZE DISPLAY (17) – When the control is in OPERATE mode, this display indicates the number of cycles the valve output will be energized before WELD time begins. In PROGRAM mode (see PROGRAM/SELECT push button), all other displays will blank indicating the number of SQUEEZE cycles may be changed. The number of SQUEEZE cycles possible for either schedule is 0 to 99.

WELD 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 the selected schedule 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 either schedule is 0 to 99.

PERCENT CURRENT 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 the selected schedule is initiated. In PROGRAM mode (see PROGRAM/SELECT push button), all other displays will blank indicating the PERCENT CURRENT in the selected schedule may be changed. The PERCENT CURRENT may range from 0% to 99%.

HOLD DISPLAY (14) – When the control is in OPERATE mode, this display indicates the number of cycles the valve output will stay energized after WELD time has elapsed. In PROGRAM mode (see PROGRAM/SELECT push button), all other displays will blank indicating the number of HOLD cycles may be changed. The number of HOLD cycles possible for either schedule is 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 that 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, selections for the EXTENDED FUNCTIONS are provided by a DIP switch located on the back of the Display Board (See Figure 2-2).

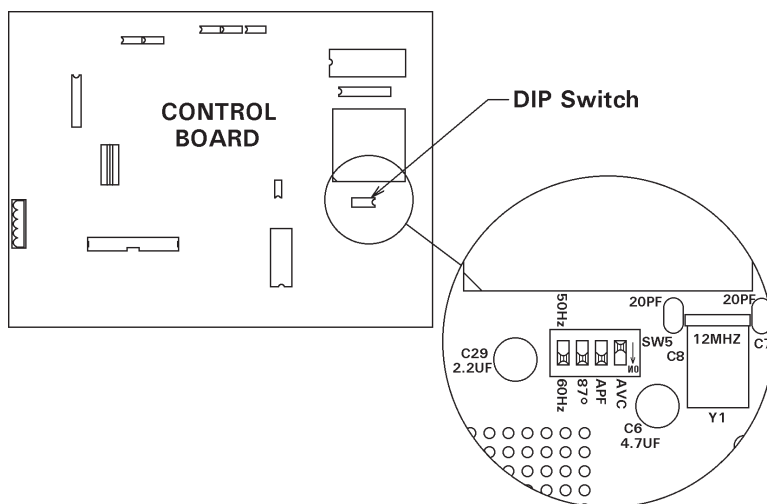


Figure 2-2. *EXTENDED FUNCTIONS DIP switch*

The EXTENDED FUNCTIONS listed below are available and described in the following 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 EN2130 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, EN2130 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 EN2130 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

SQUEEZE COUNT	0 to 99 cycles (1 cycle = 1/60 second)
HOLD COUNT	0 to 99 cycles (1 cycle = 1/60 second)
WELD/HEAT	0 to 99 cycles (programmed 00 = 1/2 cycle)
PERCENT CURRENT	0 to 99% (adjustable in 1% RMS steps)

4.0 INITIATION PILOT INPUTS

Stage One – Connect a normally open, single pole, pilot switch between TS1-FS1 and TS1-GND. Closure of this switch will energize the valve output.

Stage Two or Single Stage Initiation – Connect a normally 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

NOTICE

No jumper is required across TS1-FS1 to TS1-GND for single stage initiation.

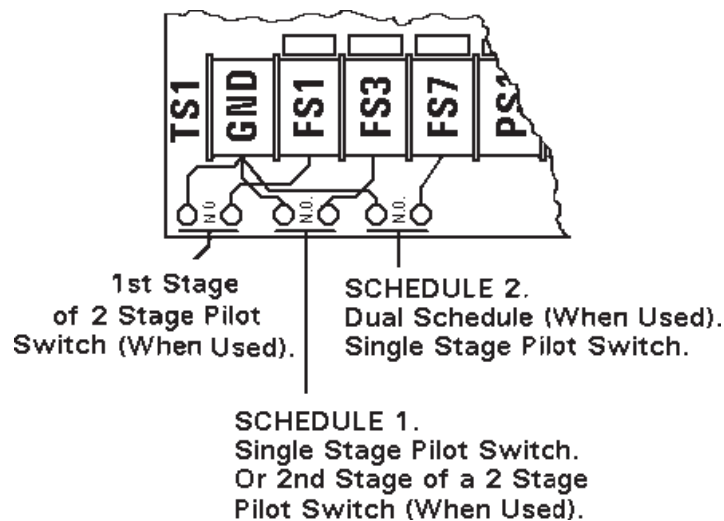


Figure 4-1. *Initiation inputs*

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 (421367) 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 schedule 1 as follows:
 - SQUEEZE count 20 cycles
 - WELD count 02 to 03 cycles
 - PERCENT CURRENT 50 to 60%
 - HOLD count 5 cycles
8. Set the welding transformer tap to 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. Close the initiation pilot switch (TS1-FS3 and TS1-GND) to initiate schedule 1. Welding head or arms will close. The control will sequence but will not weld. The head or arms will retract after the sequence has finished and the initiation released. On foot-operated machines only, a switch on the mechanical linkage of the machine will initiate the sequence.
10. Reprogram 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 (both 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 EN2130 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 HOLD parameter, all parameter displays will light. The control is now in OPERATE mode.

7.0 VALVE POWER CONNECTION

The EN2130 is not equipped with a valve transformer to provide the necessary voltage for powering the welding machine solenoid valve.

An external valve power input is available between terminals TS1-VL1 and TS1-SV2/VL2. This power will be transferred to the valve output, terminals TS1-SV1 and TS1-SV2/VL2 for the programmed SQUEEZE and HOLD times.

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.

Input voltage range from 24 to 240 VAC (see Wiring Diagram 421367).

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.

VALVE 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 421367 for "B" Cabinet.

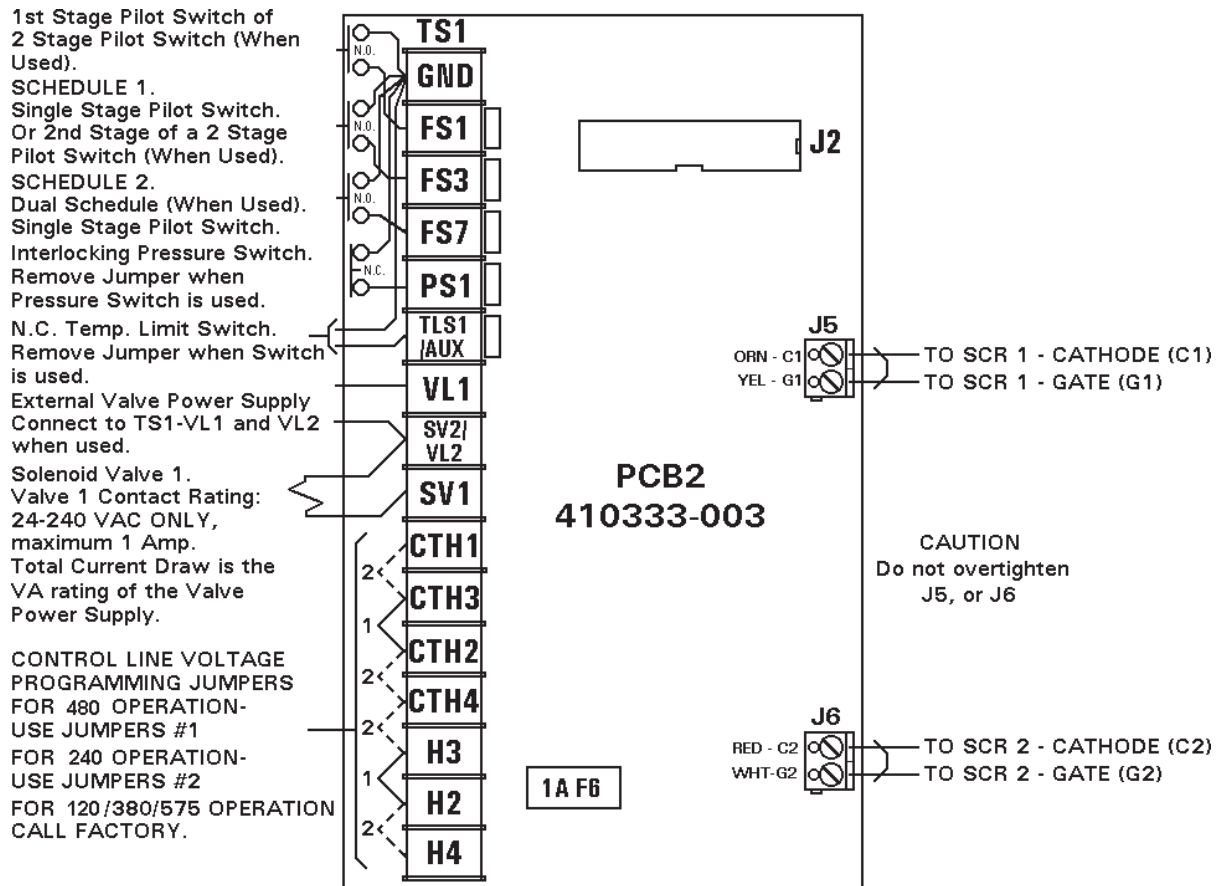


Figure 8-1. Terminal Strip/Firing Board



9.0 VOLTAGE PROGRAMMING

It is possible to operate the EN2130 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.

! CAUTION !

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

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.

FOR 480 OPERATION
USE JUMPERS #1

FOR 240 OPERATION
USE JUMPERS #2

FOR 120/380/575 OPERATION
CALL FACTORY

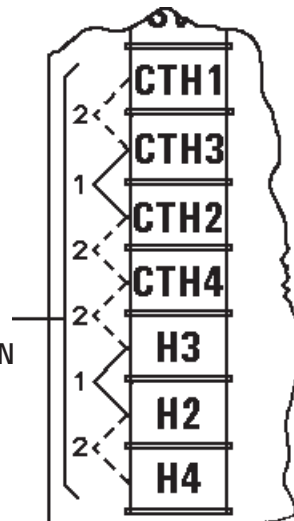


Figure 9-1. Voltage Operation jumpers settings

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 EN2130 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.

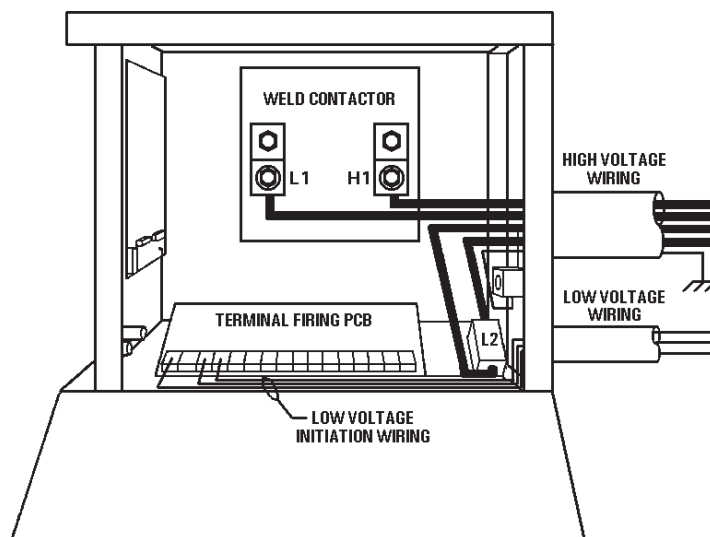
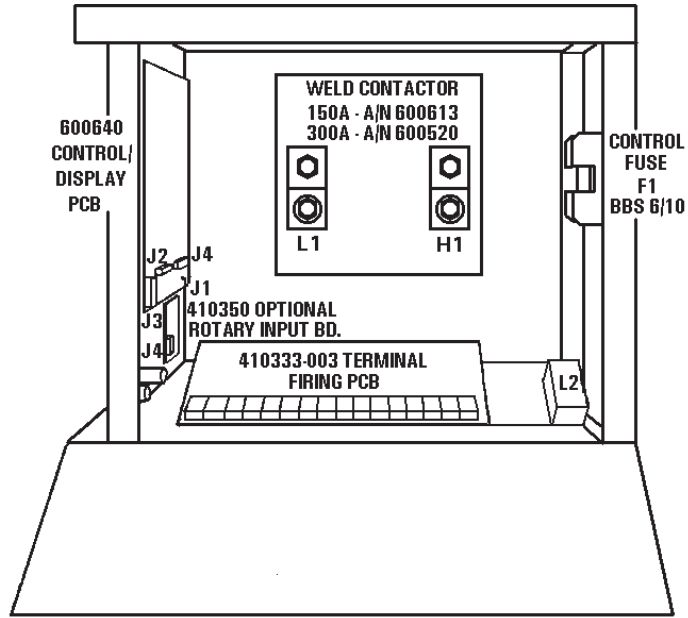


Figure 10-1. Recommended wiring and routing

11.0 INSTALLATION DIAGRAM – “B” CABINET



STYLE "B" CABINET

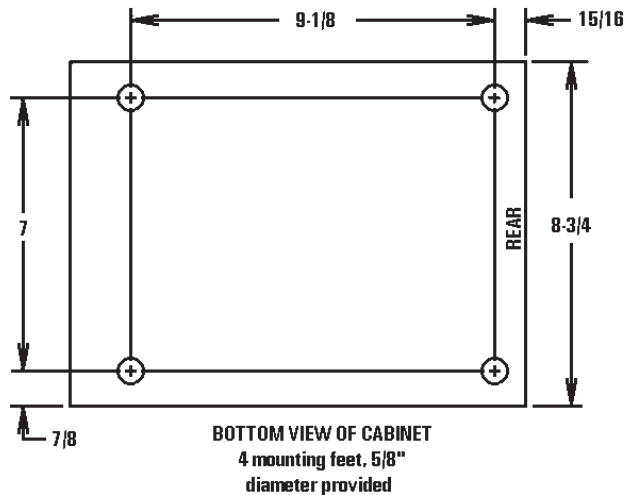
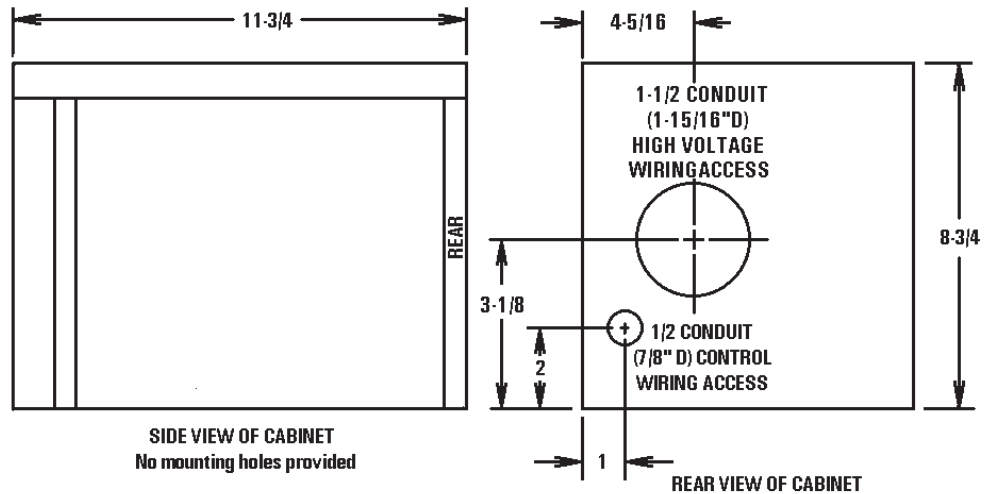


Figure 11-1. Style "B" Cabinet

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.	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 1. Initiation switch(es) defective. 2. Loose or broken wire(s) at initiation switch(es). 3. Defective Control/Display. 	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 1. HALF CYCLE is enabled. 2. Defective Terminal Strip/Firing PCB. 	<ol style="list-style-type: none"> 1. Disable HALF CYCLE. 2. Replace board. See Wiring Diagram for correct A/N.
Control sequences but will not weld.	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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 if 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.	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Work not square with electrodes. 2. Poor part fit-up. 3. Dirty material to be welded. 	<ol style="list-style-type: none"> 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.