INSTRUCTION MANUAL

700163C

EN1380 SERIES CONTROLS

MICROPROCESSOR BASED
Weld Sequence Controls
With
Solid State Thyristor Contactors

Wiring Diagram	421382	S Cabinet
	421415	E Cabinet
	421418 Series	T/D/LS/LF Cabinet

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ENTRON Controls, LLC.

MICROPROCESSOR BASED WELDING CONTROL
WITH SOLID STATE THYRISTOR CONTACTORS

INSTALLATION AND OPERATION MANUAL FOR:
Model Series EN1380

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

ENTRON Controls, LLC.
Greer, South Carolina 29650

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1.0 GENERAL DESCRIPTION

The EN1380 Control is a microprocessor-based resistance welding control. It has been designed specifically for Flash Welding or Butt Welding with Upset and Annealing sequences. One outstanding (optional) feature of the EN1380 Control is its ability to allow the operator concurrent adjustment during an initiated sequence (during ANNEAL TIME). The EN1380 can store weld sequence parameters in each of 50 unique schedules. Weld schedule parameters are held in non-volatile memory for storage. Pilot initiation connections are dedicated for independent sequencing of WELD and ANNEAL sequences. Despite the seemingly complicated possible welding schedules, the EN1380 Control is simple to program and operate.

The initiations can operate in two different initiation modes – BEAT and NON-BEAT – depending on the pilot used to initiate and the SELECT MODE in EXTENDED FUNCTION **S.E.** In BEAT mode, the control will pass weld current to the transformer as long as the initiation is closed. BEAT initiation is used for Flash Welding.

In NON-BEAT initiation mode, the control will execute a timed sequence on a momentary closure of the pilot initiation. NON-BEAT is typically used for Annealing. The EN1380 will perform a BEAT operation if initiated on TS1-FS3 and a NON-BEAT operation if initiated on TS1-FS7. The control can also perform BEAT operation on TS1-FS7 if there is **00** programmed in ANNEAL TIME.

Regardless of which initiation is used, after a weld has been started, the control cannot be re-initiated until the previous sequence is completed or the sequence has been terminated (interrupted) by providing a momentary switch open between TS1-ES1 and TS1-GND.

The following illustrations will show the sequence of events that the control will execute depending on which initiation terminal is used.

INITIATION ON FS3

A switch closure between TS1-FS3 and TS1-GND will begin a flash weld at the programmed PERCENT CURRENT. Current will continue to flow while the switch between TS1-FS3 and TS1-GND is closed. Opening this switch begins an upset weld for a programmed number of UPSET cycles at the programmed UPSET % CURRENT.

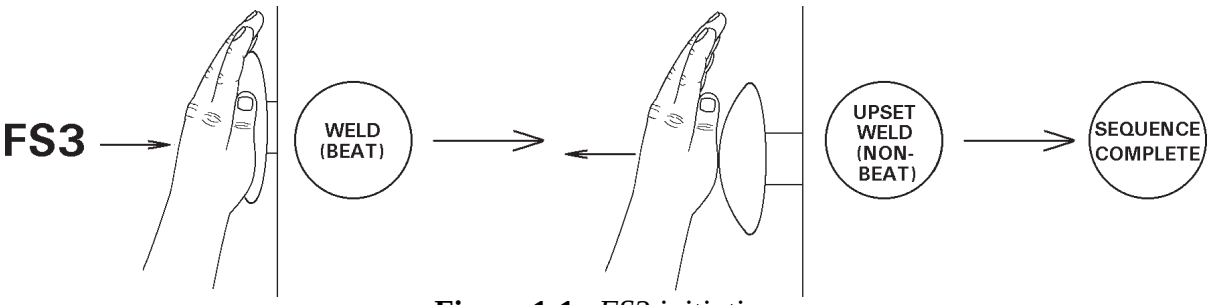


Figure 1-1. *FS3 initiation*

1.0 GENERAL DESCRIPTION (cont.)

INITIATION ON FS7

A momentary switch closure between TS1-FS7 and TS1-GND will begin ANNEAL 1 (timed in seconds) immediately followed by ANNEAL 2 sequence, typically a series of impulses.

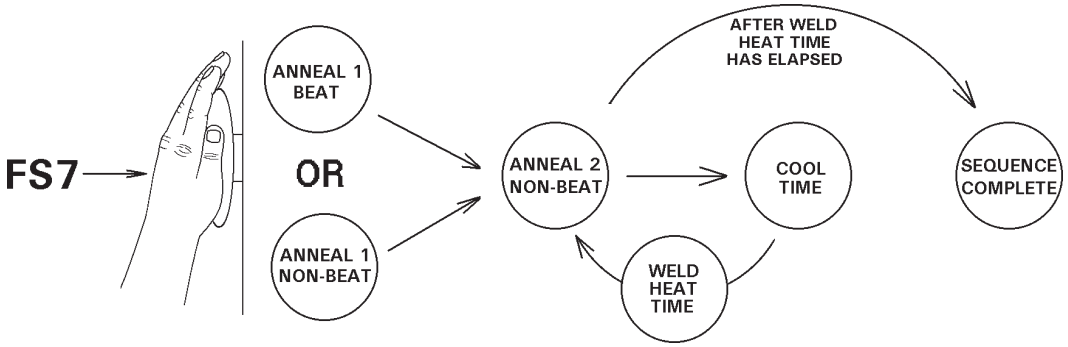


Figure 1-2. *FS7 initiation*

1.1 STANDARD FEATURES

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

FUNCTION TIMING (50/60 Hz) of sequence parameters will differ depending on the initiation used and the parameter being discussed. For instance, all WELD times, with the exception of ANNEAL 2, are defined in cycles, each being 1/60 second (or 1/50 second if line frequency is 50 Hz). The ANNEAL 2 timing is programmed in units of one (1) second (1/60 x 60). In the case of 50 Hz line frequency, timing is longer than one (1) second by approximately 20%.

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 5.2 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 CYCLE FIRING – The purpose of the 87° DELAY firing of each weld sequence is to prevent the build-up of a DC component in the welding transformer.

EMERGENCY STOP – When the Emergency Stop Switch is open, the control stops any and all processes (all valves and contactor). While in the Emergency Stop condition, the control will flash ERROR CODE **E.S.** on the DATA display until the condition has been cleared.

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

2.0 CONTROL PANEL LAYOUT

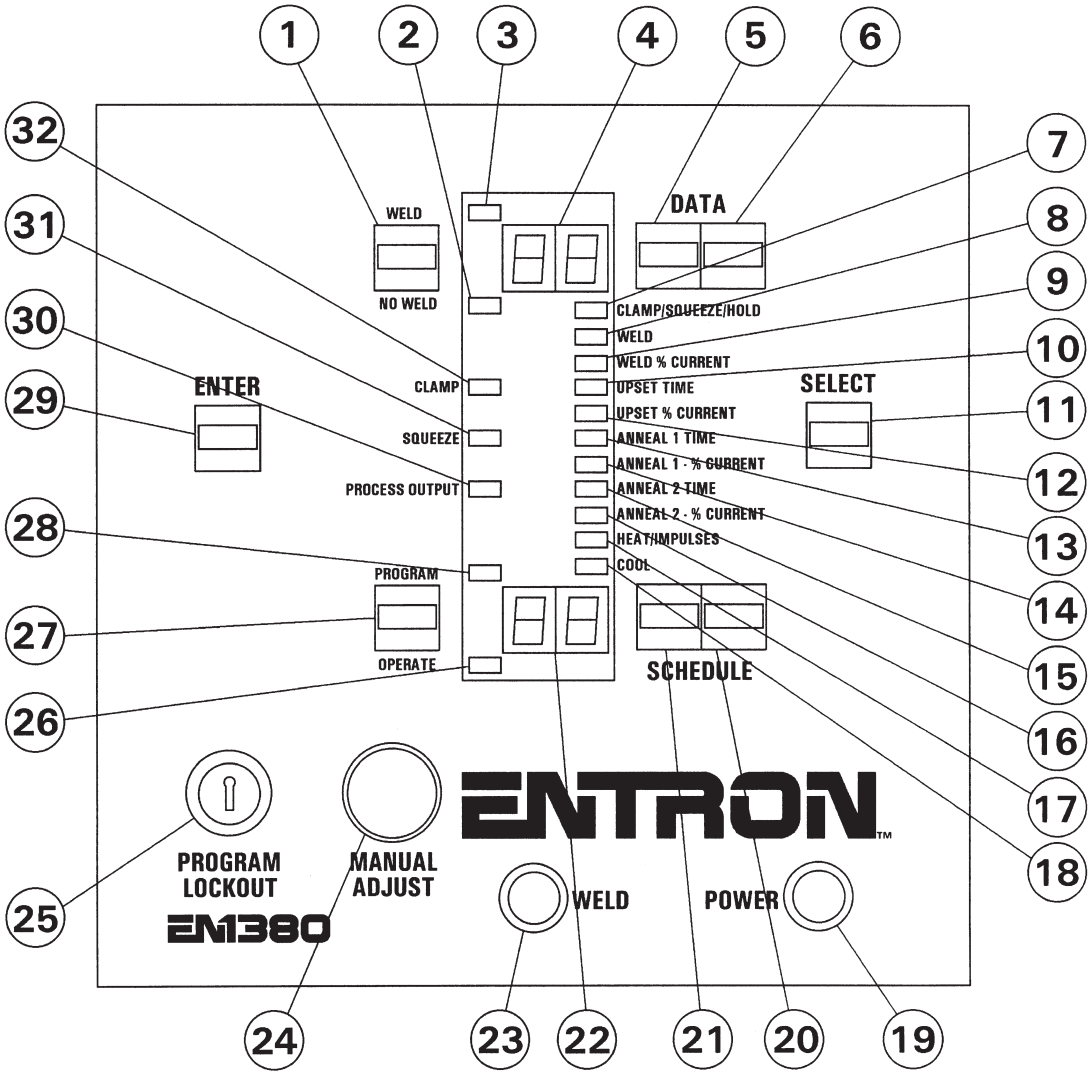


Figure 2-1. *Control Panel layout*

1 - WELD/NO WELD push button
2 - NO WELD mode indicator LED
3 - WELD mode indicator LED
4 - DATA display
5 - DATA 10s push button
6 - DATA 1s push button
7 - CLAMP/SQUEEZE/HOLD indicator LED
8 - WELD indicator LED*
9 - WELD % CURRENT indicator LED*
10 - UPSET TIME indicator LED*
11 - SELECT push button
12 - UPSET % CURRENT indicator LED*
13 - ANNEAL 1 TIME indicator LED**
14 - ANNEAL 1 % CURRENT indicator LED**
15 - ANNEAL 2 TIME indicator LED**
16 - ANNEAL 2 % CURRENT indicator LED**
17 - HEAT/IMPULSES indicator LED
18 - COOL indicator LED
19 - POWER light (red)
20 - SCHEDULE 1s push button
21 - SCHEDULE 10s push button
22 - SCHEDULE display
23 - WELD light (white)
24 - MANUAL ADJUST knob**
25 - PROGRAM LOCKOUT key switch
26 - OPERATE mode indicator LED
27 - PROGRAM/OPERATE push button
28 - PROGRAM mode indicator LED
29 - ENTER push button
30 - PROCESS OUTPUT indicator LED
31 - SQUEEZE indicator LED
32 - CLAMP indicator LED

* Denotes those functions associated with initiation on FS3
** Denotes those functions associated with initiation on FS7

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

WELD/NO WELD PUSH BUTTON (1) – 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 (3)**/NO WELD** (2) **INDICATOR LEDs** – These LEDs indicate the active status of the control. The LEDs toggle whenever the WELD/NO WELD push button is pressed.

DATA PUSH BUTTONS (5) & (6) – The right button increments or decrements the DATA display (4) by one, and the left button increments or decrements by ten. When either digit reaches the maximum, it resets to zero. Pressing either DATA push button for more than one second will decrement rather than increment the data viewed on the numeric display. These push buttons are only active in PROGRAM mode.

NOTICE
Press and release of either push button will increment the data (7, 8, 9, 0, etc.). Press and hold of either push button will decrement the data (2, 1, 0, etc.).

FUNCTION INDICATOR LEDs (7-10 & 12-18) – The indicator LED adjacent to each programmable function will light when the chosen function is displayed in the DATA display. When in PROGRAM mode, the indicator LED will light to highlight the active function being edited.

SELECT PUSH BUTTON (11) – Use the SELECT push button in PROGRAM mode to choose any programmable function. When selecting a function, the indicator LED will light to indicate the selected function. Data pertaining to the selected function will appear in the DATA display. Tapping the SELECT push button will select the function below the one currently being displayed. Pressing the SELECT push button for more than one second will cause function indicator LEDs to change direction and select the previously displayed function.

EXTENDED FUNCTIONS – Section of memory dedicated as a second layer of parameters that apply to all the schedules, and can modify the way the control operates. This section of memory can be found by pressing the SELECT push button and paging through the functions until ***EF*** appears in the DATA display.

POWER LIGHT (19) – The red POWER lamp indicates when power is applied to the control.

SCHEDULE DISPLAY (22) – The SCHEDULE display shows the number of the active schedule. The EN1380 can store up to 50 schedules numbered from 00 to 49.

SCHEDULE PUSH BUTTONS (20) & (21) – The right button increments or decrements the SCHEDULE display by one, and the left button increments or decrements by ten. When either digit reaches the maximum, it resets to zero. Press and release of either SCHEDULE push button will increment the SCHEDULE display to the next integer. Press and hold of either SCHEDULE push button will decrement the SCHEDULE display to the previous integer selecting a lower schedule. SCHEDULE push buttons are active in both PROGRAM and OPERATE modes.

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

WELD LIGHT (23) – The white WELD lamp is connected directly across the welding transformer primary and will light when voltage is present at the welding transformer. The brilliance of the WELD lamp is an indication of the programmed PERCENT CURRENT and therefore provides a visual indication of the percent of RMS voltage supplied to the welding transformer.

PROGRAM/OPERATE PUSH BUTTON (27) – This push button will put the control in PROGRAM or OPERATE mode. The PROGRAM (28) and OPERATE (26) indicator LEDs indicate which mode the control is in:

PROGRAM mode is the mode in which the individual schedules can be entered or modified. Welding parameters (times, valves, etc.) can only be changed in PROGRAM mode. The WELD (heat) parameter can be adjusted in PROGRAM mode or via the MANUAL ADJUST knob (24).

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.

PROGRAM LOCKOUT KEY SWITCH (25) (Optional) – Allows the operator to lock the control in OPERATE mode only. A key is necessary to place the control in PROGRAM mode.

To put the control in PROGRAM mode using the PROGRAM LOCKOUT key switch:

1. Rotate the key 45 degrees clockwise.
2. Hold the key in this position and press the PROGRAM/OPERATE push button.
3. Release the PROGRAM/OPERATE push button.
4. Release the key. The OPERATE LED will now turn off and the PROGRAM LED will turn on, indicating programmability of all functions.

To put the control back in OPERATE mode:

Press the PROGRAM/OPERATE push button again. The control will return to OPERATE mode without rotating the key.

ENTER PUSH BUTTON (29) – The ENTER push button is used to **store** the data shown **from** the DATA display **into** the non-volatile **memory** which retains data with the power off.

NOTICE
If ENTER is **not** pressed before other data is viewed (by pressing the SELECT push button) or before returning to OPERATE mode, the new data will not be stored and the previous data will be retained.

CLAMP/SQUEEZE/HOLD INDICATOR LED (7) – When the control is in OPERATE mode, during an initiated sequence, this LED is lit when indicating CLAMP or SQUEEZE or HOLD time is elapsing and the associated valve outputs are active. In PROGRAM mode, the same LED is lit when a value for these timed parameters is being entered or changed in the selected schedule. (Timing in cycles 1/60 second @ 60 Hz.)

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

WELD INDICATOR LED (8)* – When the control is in OPERATE mode, during an initiated sequence, this LED is lit when indicating WELD time is elapsing and the contactor is activated. In PROGRAM mode, the same LED is lit when indicating a value is being entered or changed in the selected schedule. (Timing in cycles 1/60 second @ 60 Hz.)

WELD % CURRENT INDICATOR LED (9)* – When the control is in PROGRAM mode, this LED is lit indicating a value representing the percentage of available current is being entered or changed in the selected schedule. This PERCENT CURRENT will be present during WELD time.

UPSET TIME INDICATOR LED (10)* – When the control is in OPERATE mode, during an initiated sequence, this LED is lit indicating the UPSET TIME interval is elapsing. UPSET TIME immediately follows the BEAT WELD time highlighted by the WELD LED. In PROGRAM mode, the same LED is lit indicating a value may be entered or changed in the selected schedule. (Timing in cycles 1/60 second @ 60 Hz.)

UPSET % CURRENT INDICATOR LED (12)* – When the control is in PROGRAM mode, this LED indicates that the percentage of available current can be entered or changed in the selected schedule. This PERCENT CURRENT will be present during UPSET TIME.

ANNEAL 1 TIME INDICATOR LED (13)** – When the control is in OPERATE mode, this LED is lit indicating ANNEAL (WELD) TIME is elapsing and the contactor is activated. In PROGRAM mode, the same LED is lit indicating a value may be entered or changed in the selected schedule. (Timing in seconds at 60 Hz or 60 cycle increments.)

ANNEAL 1 % CURRENT INDICATOR LED (14)** – When the control is in PROGRAM mode, this LED indicates that the percentage of available current can be entered or changed in the selected schedule. This PERCENT CURRENT will be present during ANNEAL 1 (WELD) TIME. Adjustment is also possible in OPERATE mode with the MANUAL ADJUST knob.

ANNEAL 2 TIME INDICATOR LED (15)** – When the control is in OPERATE mode, this LED indicates ANNEAL (WELD) TIME is elapsing and the contactor is activated. In PROGRAM mode, the same LED is lit indicating a value may be entered or changed in the selected schedule. (Timing in seconds at 60 Hz or 60 cycle increments.)

ANNEAL 2 % CURRENT INDICATOR LED (16)** – When the control is in PROGRAM mode, this LED indicates that the percentage of available current can be entered or changed in the selected schedule. This PERCENT CURRENT will be present during ANNEAL 2 (WELD) TIME. Adjustment is also possible in OPERATE mode with the MANUAL ADJUST knob.

HEAT/IMPULSES INDICATOR LED (17) – When the control is in OPERATE mode, this LED indicates an impulse sequence is elapsing. In PROGRAM mode, the same LED indicates that a number of HEAT cycles can be entered or changed in the selected schedule. (Timing in cycles at 60 Hz or 60 cycle increments.) Active during ANNEAL in FLASH WELD mode (see Section 3.2). Active during WELD in BUTT WELD mode (see Section 3.3).

* Denotes those functions associated with initiation on FS3
** Denotes those functions associated with initiation on FS7

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

COOL INDICATOR LED (18) – When the control is in OPERATE mode, this LED indicates that an impulse sequence is elapsing. In PROGRAM mode, the same LED indicates that a value of COOL cycles can be entered or changed in the selected schedule. (Timing in seconds at 60 Hz or 60 cycle increments.) Active during ANNEAL in FLASH WELD mode (see Section 3.2). Active during WELD in BUTT WELD mode (see Section 3.3).

MANUAL ADJUST KNOB (24)** (Optional) – Allows the manual increase or decrease of the PERCENT CURRENT. Adjustment in OPERATE mode can only be made in ANNEAL 1 and ANNEAL 2, or during a WELD time. This knob is not functional with a PROGRAM LOCKOUT key switch option installed.

CLAMP INDICATOR LED (32) – This LED is lit when Valve 1 output is active during an initiated sequence for the programmed CLAMP/SQUEEZE/HOLD time.

SQUEEZE INDICATOR LED (31) – This LED is lit when Valve 2 output is active during an initiated sequence for the programmed CLAMP/SQUEEZE/HOLD time.

PROCESS OUTPUT INDICATOR LED (30) – This LED is lit when Valve 3 (Process Output) output is active for 0.5 seconds at the end of a completed sequence.

2.2 OTHER CONTROL FEATURES – See Figure 5-2. *Terminal Strip/Firing Board*

CONTACTOR TEMPERATURE LIMIT SWITCH – This feature is used to inhibit welding if the temperature of the contactor is above the rated operating temperature (149°F). If the Temperature Limit Switch is open (over temperature), the control cannot be initiated until the Temperature Limit Switch cools (resets/closes). If the Temperature Limit Switch becomes open during a weld, the firing pulses to the contactor will continue until the end of WELD time. A new sequence cannot be initiated until the Temperature Limit Switch cools and resets (closes).

In either of the above cases, the DATA display will show ERROR CODE **01** until the Temperature Limit Switch recovers its normally closed state; then, the control will return to normal operation.

NOTICE
If the Temperature Limit Switch is not used, place a jumper between PCB2-TLS1/AUX1 and TS1-GND. Temperature Limit Switches are standard on ALL supplied contactors.

EMERGENCY STOP SWITCH – When the Emergency Stop Switch is open, the control **stops any and all processes (all valves and contactor).** While in the Emergency Stop condition, the control will flash **E.S.** on the DATA display until the condition has been cleared. If the execution of a schedule was interrupted by means of the Emergency Stop Switch, the control cannot be re-initiated automatically (after the Emergency Stop condition is removed). Upon release of the switch, it must be re-initiated by closing the Pilot Switch.

NOTICE
If an Emergency Stop Switch is not used, place a jumper (factory installed) between TS1-ES1 and TS1-GND. Emergency Stop Switch is not supplied with the control.

** Denotes those functions associated with initiation on FS7

2.2 OTHER CONTROL FEATURES (cont.)

INTERLOCKING DOOR SOLENOID (IDS) – The control may include an IDS to prevent entry to the control when power is applied. An IDS is included (unless otherwise specified) in "S" and "E" Style Cabinets. "T/D", "L" and other NEMA 12 Style Cabinets **do not** include Interlocking Door Solenoids.

! WARNING !
The IDS is protected by fuse F1 (6/10A). If the fuse is blown or missing, the IDS will not operate and will not prevent entry to cabinet.

3.0 WELD PARAMETERS (Count, Time and Percent Functions)

The EN1380 can be programmed to perform a variety of welds (Flash, Butt, Annealing, etc.). The SELECT MODE (**S.E.**) setting in EXTENDED FUNCTIONS affects the control's timing and initiation response depending on MODE selection.

The control will change its timing (seconds vs. cycles) and count (impulses vs. weld cycles) units depending on the programmed SELECT MODE **S.E.**

3.1 WELD PARAMETERS FOR FLASH WELD MODE – S.E.=01

FLASH WELD SEQUENCES are initiated using FS3

CLAMP/SQUEEZE/HOLD ..... 00 to 99 cycles
WELD (BEAT mode) ..... 01 (for BEAT operation)
WELD (TIMED mode) ..... 02 to 99 cycles (for NON-BEAT operation)
WELD PERCENT ..... 00% to 99%
UPSET TIME ..... 00 to 99 cycles
UPSET PERCENT ..... 00% to 99%

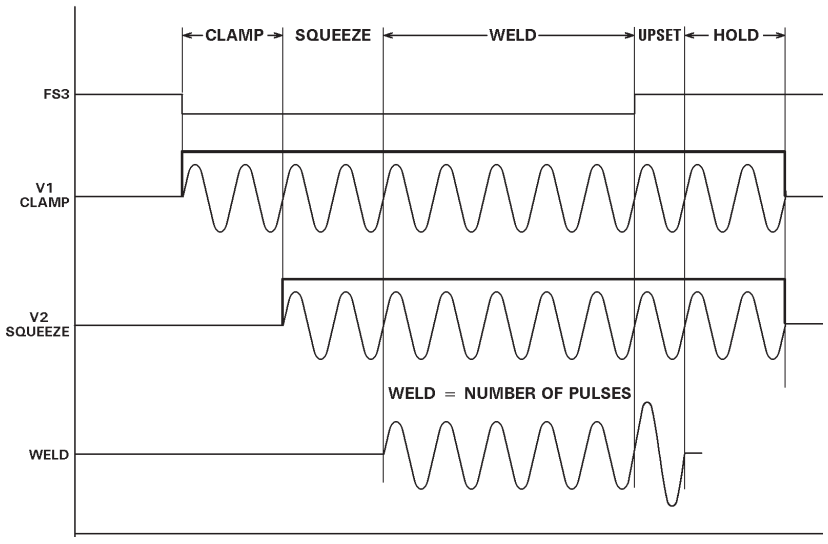


Figure 3-1. *FLASH WELD (BEAT) initiated on FS3 –* **S.E.=01**

3.1 WELD PARAMETERS FOR FLASH WELD MODE – S.E.=01 (cont.)

CLAMP/SQUEEZE/HOLD TIME – This value determines the time intervals during which the appropriate valve outputs will activate during the CLAMP, SQUEEZE and HOLD segments of the WELD sequence.

NOTICE
Both valve outputs – CLAMP (Valve 1) and SQUEEZE/HOLD (Valve 2) – will be active for the time programmed in this parameter unless interrupted during SQUEEZE by release of the pilot initiation. CLAMP and SQUEEZE time occur at the beginning of an initiated sequence. HOLD occurs immediately after a WELD or ANNEAL. In a complete FLASH WELD sequence, the appropriate valve outputs will be active continuously from CLAMP until the end of HOLD.

WELD TIME – The time during which the SCRs are conducting and there is voltage present across the primary of the welding transformer. In BEAT mode (WELD time=01), the WELD time (weld current on) depends on how long the FS3 pilot is held closed. In NON-BEAT mode (WELD times are 02-99 cycles), the WELD time (in cycles) can be initiated and completed through UPSET by means of a momentary FS3 initiation closure.

WELD PERCENT CURRENT – The portion of each half cycle of the line voltage (as a percent of voltage available) during which the SCRs are active (voltage present across the welding transformer primary) during WELD. WELD % CURRENT is programmed in steps of 1% from 0% to 99%.

UPSET TIME – The interval immediately following WELD time during which the SCRs remain active. UPSET TIME will begin immediately following WELD.

UPSET PERCENT CURRENT – The portion of each half cycle of the line voltage (as a percent of voltage available) during which the SCRs are active (voltage present across the welding transformer primary) during UPSET. UPSET % CURRENT is programmed in steps of 1% from 0% to 99%.

3.2 ANNEAL PARAMETERS FOR FLASH WELD MODE – S.E.=01

ANNEAL SEQUENCES are initiated using FS7

As part of an ANNEAL sequence, CLAMP and HOLD are applicable as follows:

CLAMP/HOLD ..... 00 to 99 cycles (see Section 3.1)
ANNEAL 1 (BEAT mode) ..... 00 cycles
ANNEAL 1 (NON-BEAT mode) ..... 01 to 99 seconds
ANNEAL 1 PERCENT ..... 00% to 99%
ANNEAL 2 ..... 00 to 99 seconds
ANNEAL 2 PERCENT ..... 00% to 99%
HEAT ..... 00 to 99 weld cycles
COOL ..... 00 to 99 cycles

3.2 ANNEAL PARAMETERS FOR FLASH WELD MODE – S.E.=01 (cont.)

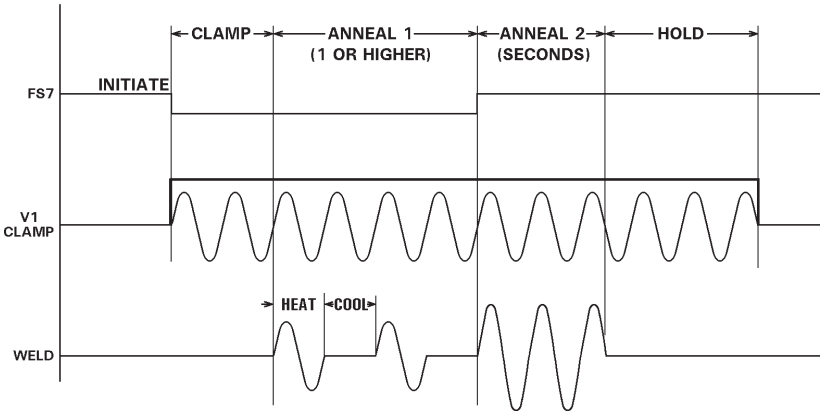


Figure 3-2. *ANNEAL sequence (BEAT) initiated on FS7 –* **S.E.=01**

CLAMP/HOLD TIME – This value determines the time intervals during which the appropriate valve outputs will activate during the CLAMP and HOLD segments of the ANNEAL sequence.

NOTICE
CLAMP (Valve 1 output) and HOLD will be active for the time programmed in this parameter unless interrupted during SQUEEZE by release of the pilot initiation. CLAMP occurs at the beginning of an initiated sequence. HOLD occurs immediately after the completed ANNEAL sequence. In a complete ANNEAL sequence, the Valve 1 output will be active continuously from CLAMP until the end of HOLD.

ANNEAL 1 TIME – Similar to WELD, the time during which the SCRs are conducting and there is voltage present across the primary of the welding transformer.

NOTICE
In NON-BEAT mode, the time is programmed in seconds.

In BEAT mode (ANNEAL 1 TIME=**00**), the ANNEAL 1 TIME (weld current on) depends on how long the FS7 pilot is held closed (to end of complete line cycle).

In NON-BEAT mode (ANNEAL 1 TIME=01-99 seconds), the ANNEAL 1 TIME (weld current on) can be initiated and completed through the ANNEAL 2 sequence by means of a momentary FS7 initiation closure.

ANNEAL 1 PERCENT – The portion of each half cycle of the line voltage (as a percent of voltage available) during which the SCRs are active (voltage present across the welding transformer primary) during ANNEAL 1 TIME. ANNEAL 1 % CURRENT is programmed in steps of 1% from 0% to 99%.

ANNEAL 2 TIME – The time in seconds during which the programmed HEAT and COOL portions of ANNEAL 2 are active. ANNEAL 2 TIME (00-99 seconds) may be continuous or intermittent and begins immediately following ANNEAL 1.

3.2 ANNEAL PARAMETERS FOR FLASH WELD MODE – S.E.=01 (cont.)

ANNEAL 2 PERCENT – The portion of each half cycle of the line voltage (as a percent of voltage available) during which the SCRs are active (voltage present across the welding transformer primary) during ANNEAL 2 TIME. ANNEAL 2 % CURRENT is programmed in steps of 1% from 0% to 99%.

HEAT COUNT – Similar to WELD, the time during which the SCRs are conducting and there is voltage present across the primary of the welding transformer. HEAT count only affects the ANNEAL 2 portion of the ANNEAL 1–ANNEAL 2 sequence.

COOL COUNT – The time during the ANNEAL 2 sequence during which the SCRs are turned off. COOL count is adjustable from 1 to 99 cycles and begins after the first HEAT pulse has been executed. COOL occurs as part of a HEAT-COOL sequence and only during ANNEAL 2.

3.3 WELD PARAMETERS FOR BUTT WELD MODE – S.E.=02

BUTT WELD SEQUENCES are initiated using FS3

CLAMP/SQUEEZE/HOLD ..... 00 to 99 cycles
WELD ..... 01 to 99 cycles
WELD PERCENT ..... 00% to 99%
UPSET TIME ..... 00 to 99 cycles
UPSET PERCENT ..... 00% to 99%
HEAT ..... 00 to 99 weld cycles
COOL ..... 00 to 99 cycles

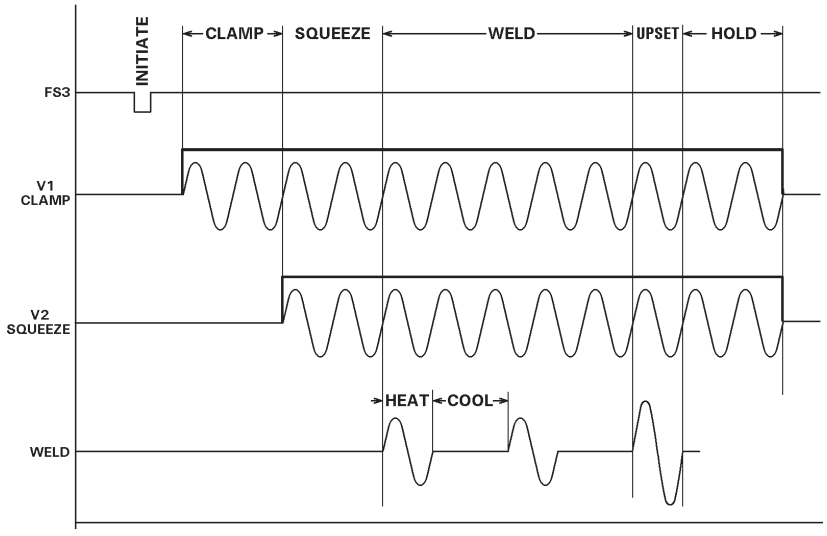


Figure 3-3. *BUTT WELD (NON-BEAT) initiated on FS3 –* **S.E.=02**

3.3 WELD PARAMETERS FOR BUTT WELD MODE – S.E.=02 (cont.)

CLAMP/SQUEEZE/HOLD TIME – This value determines the time intervals during which the appropriate valve outputs will activate during the CLAMP, SQUEEZE and HOLD segments of the WELD sequence.

NOTICE
Both valve outputs – CLAMP (Valve 1) and SQUEEZE/HOLD (Valve 2) – will be active for the time programmed in this parameter unless interrupted during SQUEEZE by release of the pilot initiation. Upon initiation, CLAMP time followed by SQUEEZE time occurs. HOLD occurs immediately after a WELD or ANNEAL. In a complete BUTT WELD sequence, the Valve 1 output will be active continuously from CLAMP until the end of HOLD.

WELD TIME – The number of pulses for which the programmed HEAT and COOL portions of BUTT WELD sequence are active. WELD portion of sequence may be continuous or intermittent.

WELD PERCENT CURRENT – The portion of each half cycle of the line voltage (as a percent of voltage available) during which the SCRs are active (voltage present across the welding transformer primary) during WELD. WELD % CURRENT is programmed in steps of 1% from 0% to 99%.

UPSET TIME – The interval immediately following WELD time during which the SCRs remain active. UPSET TIME will begin immediately following WELD.

UPSET PERCENT CURRENT – The portion of each half cycle of the line voltage (as a percent of voltage available) during which the SCRs are active (voltage present across the welding transformer primary) during UPSET. UPSET % CURRENT is programmed in steps of 1% from 0% to 99%.

HEAT COUNT – The time during which the SCRs are conducting and there is voltage present across the primary of the welding transformer. HEAT count only affects the WELD portion of the BUTT WELD sequence.

COOL COUNT – The time during the BUTT WELD sequence during which the SCRs are turned off. COOL occurs in intervals of 1 to 99 cycles and begins after the first HEAT pulse has been executed. COOL occurs as part of a HEAT-COOL sequence and only during WELD during a BUTT WELD sequence.

3.4 ANNEAL PARAMETERS FOR BUTT WELD MODE – S.E.=02

ANNEAL SEQUENCES are initiated using FS7

ANNEAL 1 can be switched between BEAT and NON-BEAT depending on programmed value.

- CLAMP/HOLD ..... 00 to 99 cycles (see Section 3.3)
- ANNEAL 1 (BEAT mode) ..... 00 cycles
- ANNEAL 1 (NON-BEAT mode) ..... 01 to 99 seconds
- ANNEAL 1 PERCENT ..... 00% to 99%
- ANNEAL 2 ..... 00 to 99 seconds
- ANNEAL 2 PERCENT ..... 00% to 99%

3.4 ANNEAL PARAMETERS FOR BUTT WELD MODE – S.E.=02 (cont.)

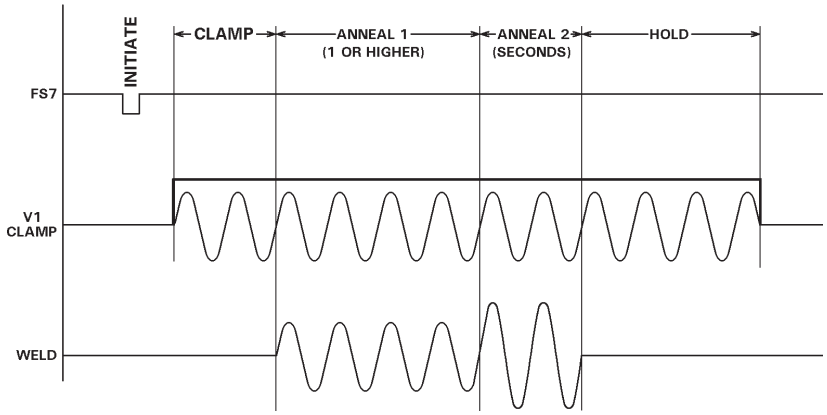


Figure 3-4. *ANNEAL sequence (NON-BEAT) initiated on FS7 –* **S.E.=02**

CLAMP/HOLD TIME – This value determines the time intervals during which the appropriate valve outputs will activate during the CLAMP and HOLD segments of the ANNEAL sequence.

NOTICE
CLAMP (Valve 1 output) and HOLD will be active for the time programmed in this parameter. Upon initiation, CLAMP time occurs. HOLD occurs immediately after the complete ANNEAL sequence. In a complete ANNEAL sequence, the Valve 1 output will be active continuously from CLAMP until the end of HOLD.

ANNEAL 1 TIME – Similar to WELD, the time during which the SCRs are conducting and there is voltage present across the primary of the welding transformer.

NOTICE
In NON-BEAT mode, the time is programmed in seconds.

In BEAT mode (ANNEAL 1 TIME=**00**), the ANNEAL 1 TIME (weld current on) depends on how long the FS7 pilot is held closed. The current will end at the next cycle after the initiation is released.

In NON-BEAT mode (ANNEAL 1 TIME=01-99 seconds), the ANNEAL 1 TIME (weld current on) can be initiated and completed through the ANNEAL 2 sequence by means of a momentary FS7 initiation closure.

ANNEAL 1 PERCENT – Programmable in steps of 1% from 0% to 99%.

ANNEAL 2 TIME – The time in seconds during which the programmed HEAT and COOL portions of ANNEAL 2 are active. ANNEAL 2 TIME (00-99 seconds) begins immediately following ANNEAL 1.

ANNEAL 2 PERCENT – Programmable in steps of 1% from 0% to 99%.

4.0 INITIATIONS

4.1 SINGLE STAGE PILOT INITIATION ON FS3

4.1.1 FLASH WELD MODE (S.E.=01) – BEAT MODE (WELD=01)

Once control is initiated (using TS1-FS3 and TS1-GND), the switch must remain closed for weld current to flow. Upon release of the switch, the control will automatically proceed to UPSET TIME using the programmed UPSET % CURRENT. After UPSET TIME has elapsed, the control is again in the Ready state.

4.1.2 FLASH WELD MODE (S.E.=01) – NON-BEAT MODE (WELD=02-99)

Once control is initiated (using TS1-FS3 and TS1-GND), the switch must remain closed until the beginning of WELD. The control will automatically proceed to UPSET TIME using the programmed UPSET % CURRENT. After UPSET TIME has elapsed, the control is again in the Ready state. The initiation pilot switch must be released before re-initiation.

4.1.3 BUTT WELD MODE (S.E.=02) – NON-BEAT MODE

In this mode, the control can be initiated by means of a momentary closure of TS1-FS3 to TS1-GND. After WELD, the control will automatically proceed to UPSET TIME using the programmed UPSET % CURRENT. After UPSET TIME has elapsed, the control is again in the Ready state. The initiation pilot switch must be released before re-initiation. The following settings determine the PULSED BUTT WELD timing characteristics:

If HEAT=01
Then WELD=Number of WELD cycles

– OR –

If HEAT=02 or greater
Then WELD=Number of Impulses
and HEAT=Number of WELD cycles per pulse
and COOL=Number of COOL cycles between pulses

4.2 SINGLE STAGE INITIATION ON FS7

4.2.1 ANNEAL 1–ANNEAL 2 SEQUENCE (S.E.=01) – BEAT MODE (ANNEAL 1=00)

Once the control is initiated (using TS1-FS7 to TS1-GND), the switch must remain closed for weld current to flow. Upon release of the switch, the control will automatically proceed to ANNEAL 2 TIME using the programmed ANNEAL 2 % CURRENT.

4.2.2 ANNEAL 1–ANNEAL 2 SEQUENCE (S.E.=01) – NON-BEAT MODE (ANNEAL 1=01-99)

In NON-BEAT mode, a momentary closure (using TS1-FS7 to TS1-GND) will allow for a timed execution of the complete ANNEAL 1–ANNEAL 2 sequence. The control will automatically proceed to ANNEAL 2 TIME using the programmed ANNEAL 2 % CURRENT.

4.2.3 PULSED ANNEAL 2 WHEN S.E.=01

ANNEAL 2 in this mode can use HEAT and COOL. The ANNEAL parameter only determines how long in seconds the HEAT and COOL cycles alternate.

NOTICE
When S.E.=02, the ANNEAL 2 sequence cannot be pulsed.

4.3 NON-VOLATILE MEMORY ERROR

The EN1380 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 disturbance on the control, upon power-up, 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 number of the schedule where the error was found. 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 disturbance into the control (see Figure 4-1).

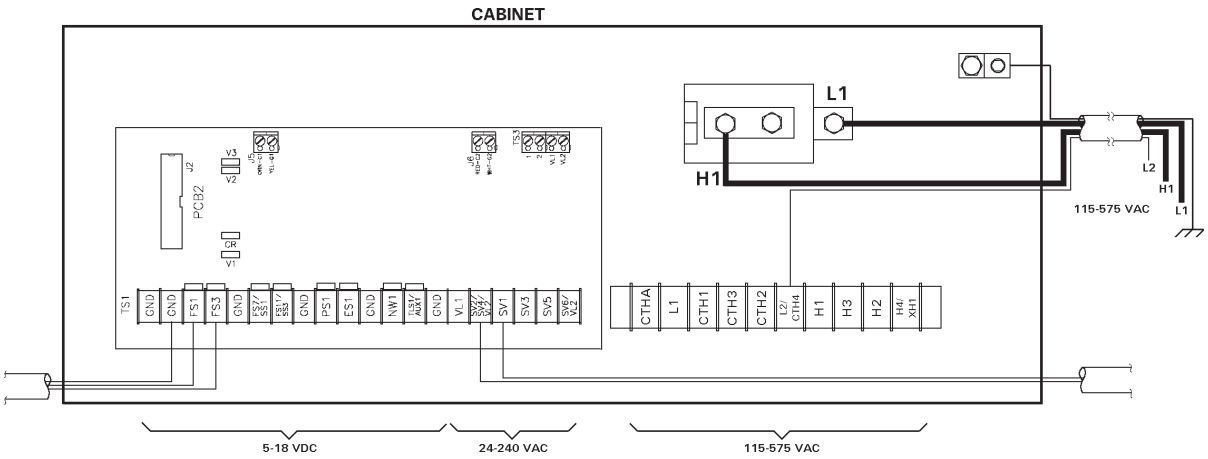


Figure 4-1. *Recommended wiring and routing*

If ERROR CODE **14** occurs, the following procedure should be performed to clear ERROR:

1. Press the SELECT push button to stop the flashing.
2. Place the control in PROGRAM mode.
3. The operator can use SELECT to find the function containing the invalid data.
4. Use the DATA push buttons to correct the data.
5. Press ENTER.
6. Return the control to OPERATE mode.

If more than one location has been affected, it may be necessary to use the CLEAR ALL command in the EXTENDED FUNCTIONS to erase all the memory locations and restore the default settings (factory settings).

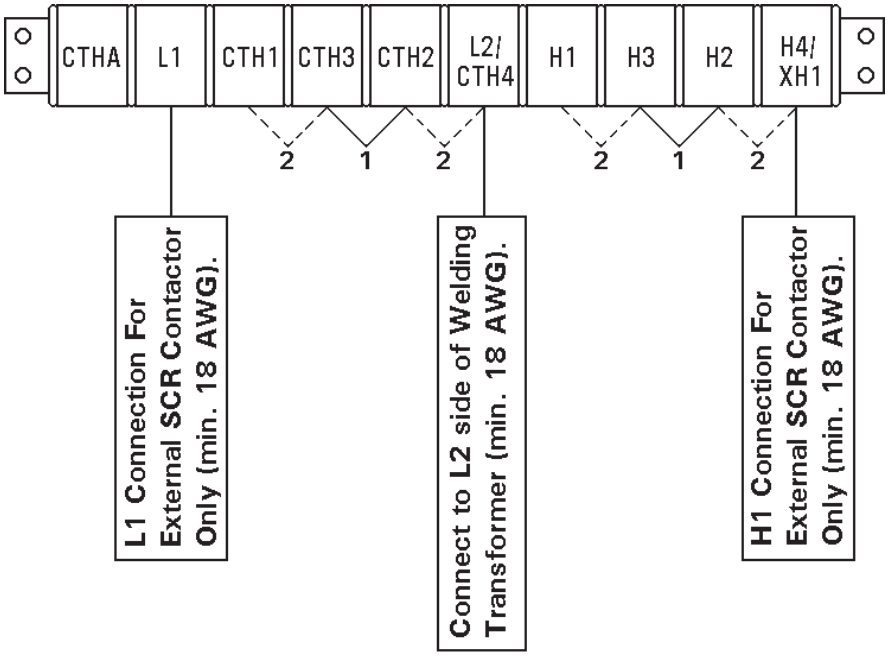
NOTICE

If ERROR **14** persists, you may need to isolate high voltage wires (valve outputs, etc.) from low voltage wires (initiation inputs). Re-routing each type of wire to a separate grounded conduit may restore the control to normal operation.

NOTICE

If ERROR **14** is NOT flashing or appears immediately after pressing ENTER during programming, the Main Control Board may need repair.

5.0 VOLTAGE PROGRAMMING



For 480 VAC Operation – Use Jumpers #1
For 240 VAC Operation – Use Jumpers #2
For 208 VAC Operation – Use Jumpers #2
For 380 VAC Operation – Consult Factory

For 575 VAC Operation – **FACTORY WIRED ONLY**

NO CALIBRATION OR CHANGE REQUIRED
FOR OPERATION ON EITHER 50 OR 60 Hz.

Figure 5-1. *Voltage operation jumpers settings*

NOTICE

For complete wiring instructions, refer to Wiring Diagram originally shipped with control.

! CAUTION !

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

5.1 TERMINAL STRIP DIAGRAM

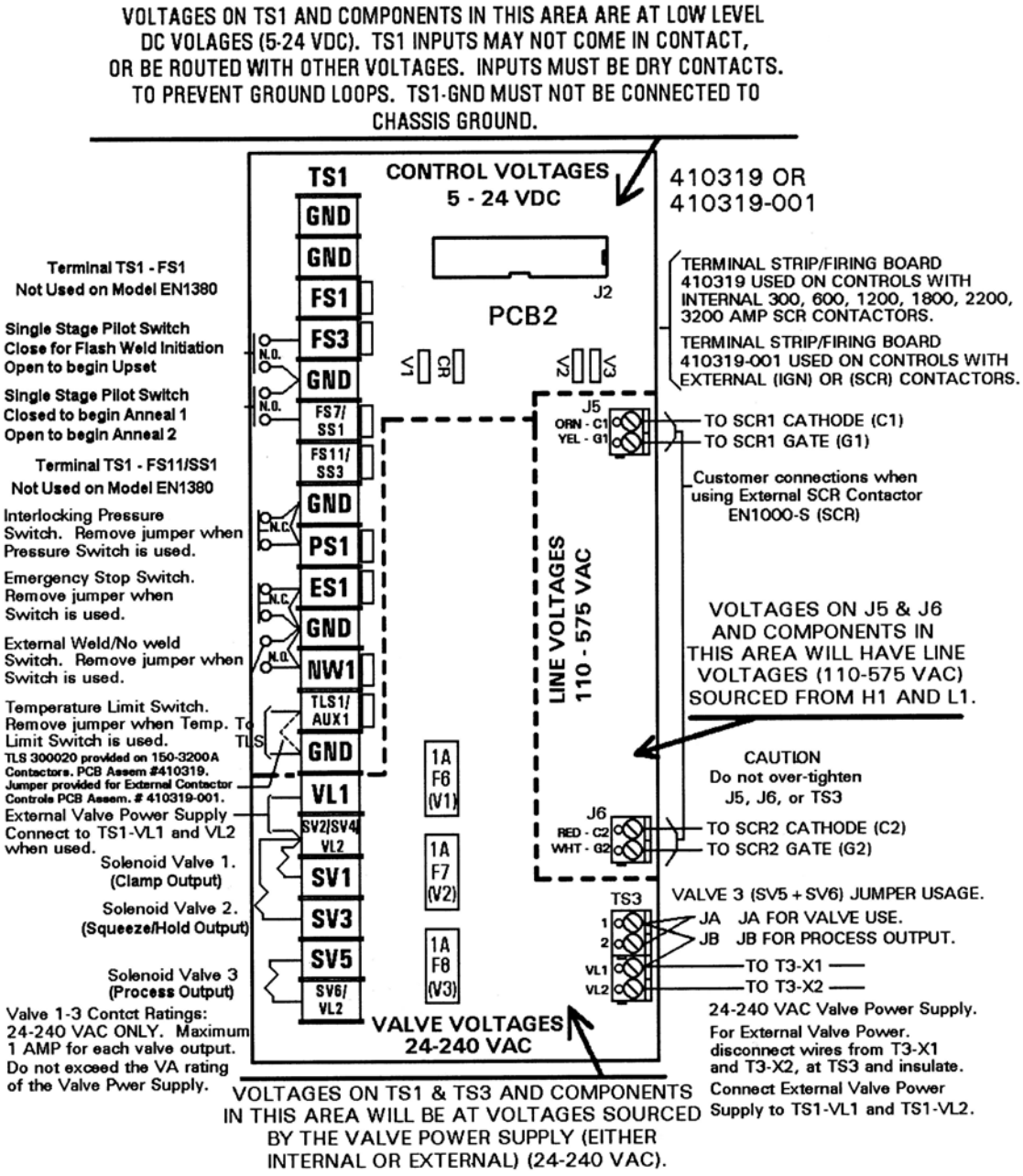


Figure 5-2. *Terminal Strip/Firing Board*

5.2 TERMINAL STRIP CONNECTIONS

TS1-GND Used as the **common connection point** for most all of the other Terminal Strip connections. There are six GND terminals provided on TS1. **Do not connect to earth or power ground.**

TS1-FS1 Not used. No connection is necessary to this terminal.

TS1-FS3 Used to connect **one side of a Single Stage Pilot.** Connect a Single Stage Pilot between TS1-FS3 and TS1-GND terminals. Use a single pole, normally open, momentary type switch.

When initiated via TS1-FS3, the switch **must** remain closed for flash weld current to flow. Upon release of the switch, the control will automatically proceed to UPSET TIME for the programmed UPSET % CURRENT.

TS1-FS7 Used to connect **one side of a Single Stage Pilot** for ANNEAL 1 or ANNEAL 2 initiation. Connect a Single Stage Pilot between TS1-FS7 and TS1-GND terminals. Use a single pole, normally open, momentary type switch.

When initiated via TS1-FS7, ANNEAL 1 TIME will elapse unless there is a value of **00** programmed in ANNEAL 1 TIME, in which case, the control will anneal as long as the switch remains closed (BEAT initiation); immediately followed by the ANNEAL 2 TIME. The control will perform a series of impulses for a time equivalent to the programmed ANNEAL 2 TIME (if programmed).

TS1-FS11 Not used. No connection is necessary to this terminal.

TS1-PS1 Used to connect **one side of a Pressure Switch.** When used, remove jumper between TS1-PS1 and TS1-GND terminals and install a single pole, normally open Pressure Switch.

TS1-ES1 Used to connect **one side of an Emergency Stop Switch.** When used, remove jumper between TS1-ES1 and TS1-GND terminals and install a single pole, normally closed Emergency Stop Switch. It is possible to install several Emergency Stop Switches in series. Activation of any one switch will put the control into the Emergency Stop condition.

TS1-NW1 Used to connect **one side of an External Weld/No Weld Switch.** When used, remove jumper between TS1-NW1 and TS1-GND terminals and install a single pole, normally open switch. The switch must be in the closed position to weld.

NOTICE
Connect a chassis ground to the lug provided on the right wall of the control cabinet and to an external earth ground. **A good earth ground is necessary for proper control operation.**

TS1-TLS1 Used to connect **one side of a Temperature Limit Switch.** When used, remove jumper and install a normally closed Temperature Limit Switch between TLS1/AUX1 and TS1-GND terminals.

5.2 TERMINAL STRIP CONNECTIONS (cont.)

TS1-VL1 External Valve power input. The terminal is one side of an external power. External power is supplied between TS1-**VL1** and TS1-SV2/SV4/**VL2**.

TS1-SV2/SV4/VL2 One side of Valve 1 Solenoid output power. External input power neutral.

TS1-SV1 Clamp Valve output. This output is active during any schedule for which CLAMP/SQUEEZE/HOLD has been programmed.

TS1-SV3 Squeeze/Hold Valve output. This output is active during any schedule for which CLAMP/SQUEEZE/HOLD has been programmed.

TS1-SV5 Switched side of the Process Output power output.

TS1-SV6/VL2 Other side of the Process Output power output.

5.3 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.

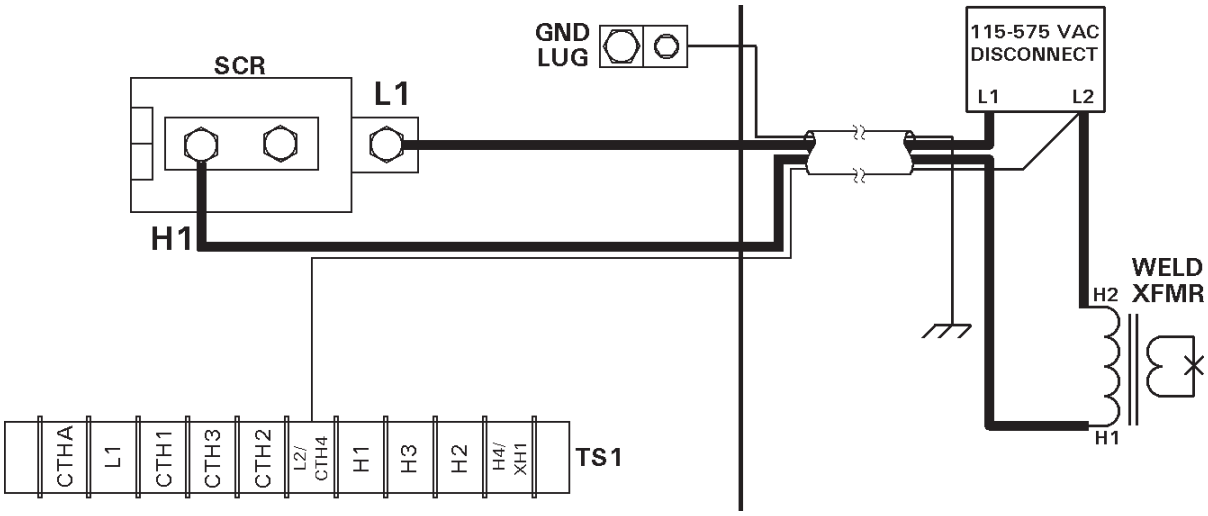


Figure 5-3. *Welding contactor connections*

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

Connect an 18 AWG wire from L2 incoming power (H2 of the welding transformer primary) to TS1-L2/CTH4 terminal.

Refer to Wiring Diagram shipped with the control for other connections.

6.0 EXTENDED FUNCTIONS

To change settings of EXTENDED FUNCTIONS, put the control in PROGRAM mode. Use the SELECT push button to step once past COOL. All function indicator LEDs will turn off and the DATA display will read **EF**. This indicates that the control is in the EXTENDED FUNCTION mode. EXTENDED FUNCTIONS can now be viewed or altered.

To view all of the EXTENDED FUNCTIONS, press the SCHEDULE push buttons and step through the available EXTENDED FUNCTIONS in either direction. When a desired function is shown in the SCHEDULE display, the DATA display will read the current value programmed for that function.

To exit the EXTENDED FUNCTIONS mode, press SELECT once to advance the function indicator LED one more time.

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

Designation	Description	Section
S.E.	Select Mode	6.1
C.C.	AVC	6.2
C.A.	Clear All	6.3
P.O.	Process Outputs	6.4
8.7.	87° Delay	6.5
P.P.	Manual Power Factor Programming	6.6
P.F.	Power Factor Measuring	6.7
S.d.	Squeeze Delay	6.8

6.1 SELECT MODE – S.E.

The EN1380 Flash/Butt Welding Controls are capable of operating in one of two modes:

- **S.E.=01 – FLASH WELD mode** – The control sequence associated with FS3 occurs as described in Section 3.1.
- **S.E.=02 – BUTT WELD mode** – The control sequence associated with FS3 occurs as described in Section 3.3.

6.2 AVC – C.C.

The EN1380 Controls are shipped with the AUTOMATIC VOLTAGE COMPENSATION feature disabled. Under conditions of poor line voltage regulation, AVC will allow for consistently good quality welds in spite of varying line voltage.

To enable AVC:

1. Put the control in PROGRAM mode.
2. Use SELECT to find **EF**.
3. Use the SCHEDULE push buttons to find **C.C.**

6.2 AVC – C.C. (cont.)

4. Enter a value for **C.C.** of **00**, **01**, **02**, **03**, **04**, or **05** using the DATA push buttons,
   ***where*:** **C.C.=00** AVC disabled
   C.C.=01 Nominal Line Voltage 120 VAC
   C.C.=02 Nominal Line Voltage 240 VAC
   C.C.=03 Nominal Line Voltage 380 VAC
   C.C.=04 Nominal Line Voltage 480 VAC
   C.C.=05 Nominal Line Voltage 575 VAC
5. Press the ENTER push button.

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

6.3 CLEAR ALL – C.A.

It is sometimes desirable to CLEAR ALL previous SCHEDULES and EXTENDED FUNCTIONS from the memory and return programmed control parameters to factory defaults.

To use the CLEAR ALL feature:

1. Put the control in PROGRAM mode.
2. Use SELECT to find **EF**.
3. Use the SCHEDULE push buttons to find **C.A.**
4. Enter a value for **C.A.** of **01** or **02** using the DATA push buttons,
   ***where*:** **C.A.=01** Clears SCHEDULE data
   C.A.=02 Clears EXTENDED FUNCTION data
5. Press the ENTER push button.

NOTICE
ERASED DATA *CANNOT* BE RESTORED – IT MUST BE RE-PROGRAMMED

6.4 PROCESS OUTPUTS – P.O.

The EN1380 provides a 120 VAC output on TS1-SV5 and TS1-SV6 that can be programmed to allow a 0.5 seconds pulse occurring immediately after a sequence has ended.

To use any PROCESS OUTPUT mode:

1. Put the control in PROGRAM mode.
2. Use SELECT to find **EF**.
3. Use the SCHEDULE push buttons to find **P.O.**
4. Use Table 6-1 as a guide for the desired PROCESS OUTPUT code.
5. Press the ENTER push button.

To enable the Process Output Valve, a jumper on TS3 on PCB2 (410319) must be moved connecting terminal #1 to VL1 as indicated by “JB” printed on the board (see Section 5.1).

6.4 PROCESS OUTPUTS – P.O. (cont.)

! CAUTION !
Process Output terminals SV5 and SV6 may be energized at any time. Caution must be exercised in what this output is connected to and the results of it being energized.

Table 6-1. *PROCESS OUTPUT codes and descriptions*

CODE	PROCESS OUTPUT description
00	PROCESS OUTPUT disabled (**default setting**)
01	ON during WELD
02	ON during UPSET
03	ON during HOLD
04	ON for 0.5 seconds after the end of a sequence

6.5 87° DELAY – 8.7.

The 87° DELAY helps to prevent the build-up of a DC component in the welding transformer. This DC component may be damaging. To program this function:

1. Put the control in PROGRAM mode.
2. Use SELECT to find **EF**.
3. Use the SCHEDULE push buttons to find **8.7.**
4. Use the DATA push buttons and make **8.7.**=**00** or **01**,
   ***where*:** **8.7.**=**00** 87° DELAY is disabled
   8.7.=**01** 87° DELAY is enabled (default factory setting)
5. Press ENTER.

6.6 MANUAL POWER FACTOR PROGRAMMING – P.P.

If required, the EN1380 Control can be placed in the MANUAL POWER FACTOR mode as follows:

1. Place the control in PROGRAM mode.
2. Use SELECT to find **EF**.
3. Use the SCHEDULE push buttons to find **P.P.**
4. Use the DATA push buttons to enter the machine's POWER FACTOR,
   ***where*:** **P.P.**=**00** The control is in AUTOMATIC POWER FACTOR mode
   P.P.=[***xx***] If ***xx*** is not **00**, the control is in MANUAL POWER FACTOR mode and the programmed POWER FACTOR is ***xx***
5. Press ENTER.

6.7 POWER FACTOR MEASURING – P.F.

While the SCHEDULE display reads **P.F.** and a sequence is executed, the DATA display will show the measured POWER FACTOR of the machine.

6.8 SQUEEZE DELAY – *S.d.*

This parameter will allow the EN1380 additional CLAMP time. A value stored in ***S.d.*** will delay the activation of the Squeeze (Valve 2) output for the number of cycles entered. The control display will dim slightly while SQUEEZE DELAY time is elapsing.

SQUEEZE DELAY will be added at **all** schedules in memory.

7.0 COOLING REQUIREMENTS FOR CONTACTORS

SOLID STATE MANUFACTURER'S COOLING RECOMMENDATIONS

600 AMP SCR Solid State Contactor
1200 AMP SCR Solid State Contactor
1800/2200 AMP SCR Solid State Contactor

1 GPM at 104°F (40°C) maximum inlet temperature.

Be sure power to an electronic Contactor is turned off when water is turned off.

With a voltage applied, most water will ionize and begin to conduct current between points of high differential voltages. This current is sufficient to heat the water past the boiling point, creating steam and possibly causing the rubber hose to burst. The water spraying over the high voltage circuit can cause considerable damage to the Contactor and, most likely, the control circuitry as well. Never use metallic or other conductive tubing to plumb a water-cooled resistance welding Contactor. Heater hose has a very high carbon content and should not be used for Contactor plumbing.

A low carbon, reinforced hose (such as the hose originally supplied with the unit), no less than 18" long, must be used to connect the Heatsinks to each other and to the bulkhead fitting on the inside wall of the cabinet (see plumbing instructions on Wiring Diagram).

The 600 and 1200 Ampere water-cooled Contactors are electrically isolated from the electrical circuit within the Contactor. Again, 18" of hose length is required for electrical isolation of the Contactor. It is still recommended to turn power off when the control is not in use.

WATER OFF – POWER OFF
POWER ON – WATER ON

For all water-cooled Contactors, be sure water is turned ON before placing welder in operation. An open drain is recommended for best operation. If a closed return system is used, be sure return line is properly sized so that back pressure will not reduce water flow below recommendations. A sight flow indicator is recommended.

8.0 INSTALLATION DIAGRAM – 11x11 FLAT PLATE RETROFIT

For more information on installation of the EN1380 FPX (SCR) retrofit package, refer to Wiring Diagram shipped with that model.

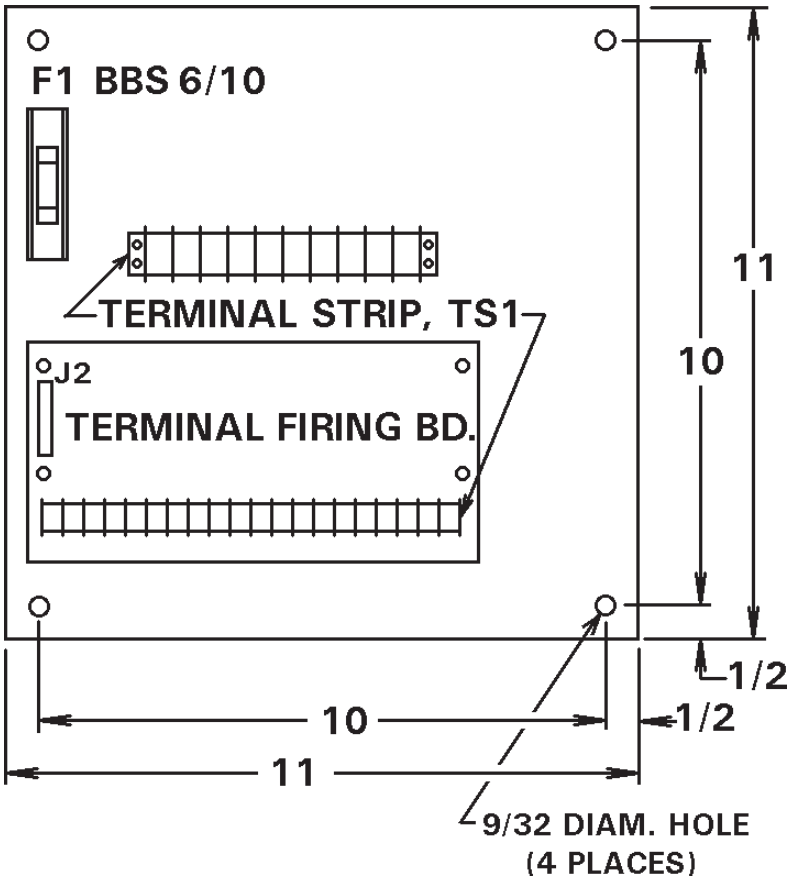


Figure 8-1. *11x11 Flat Plate Retrofit*

8.1 INSTALLATION DIAGRAMS – “S” CABINET

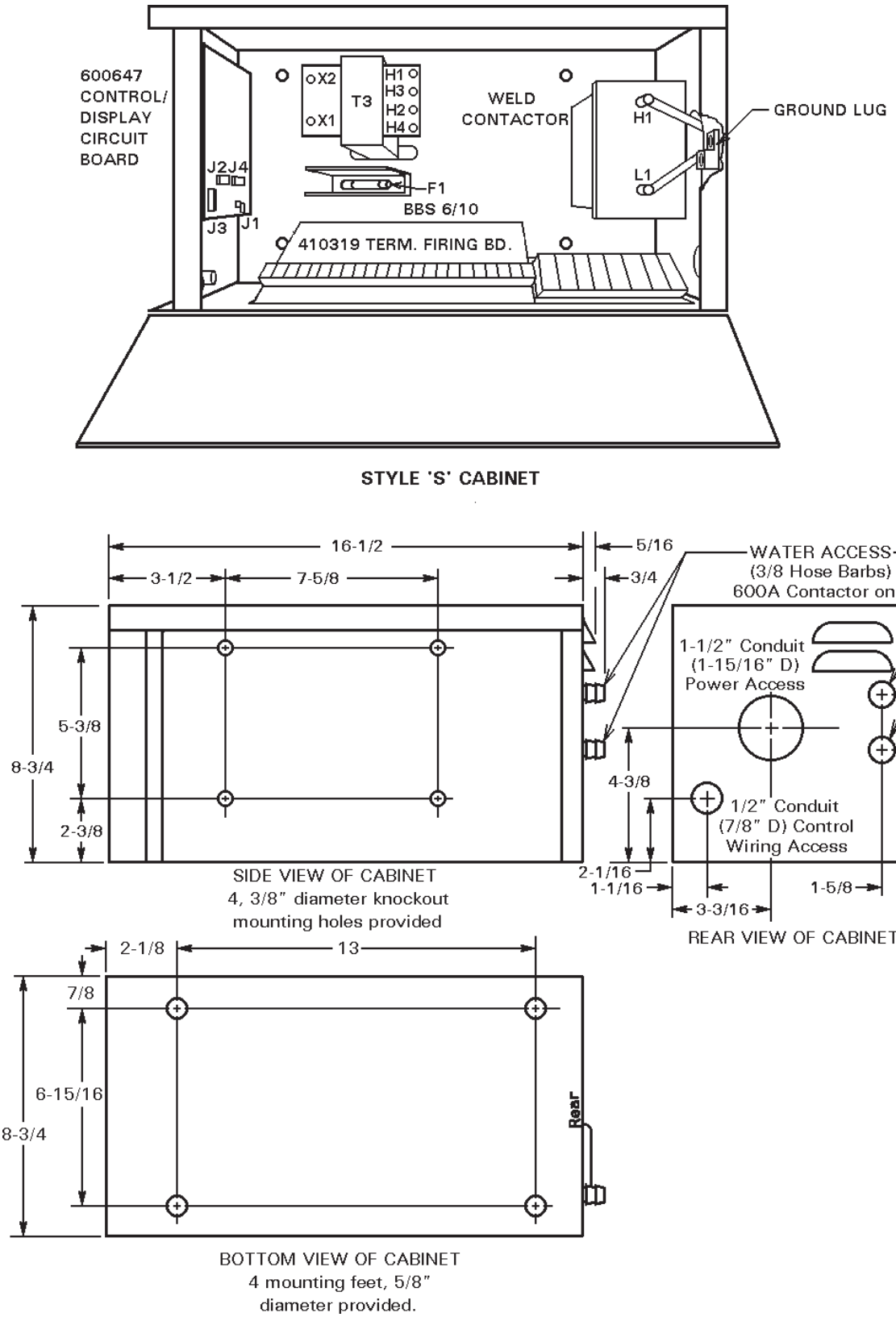


Figure 8-2. *Style “S” Cabinet*

8.2 INSTALLATION DIAGRAMS – “E” CABINET

See Section 8.4 for mounting information.

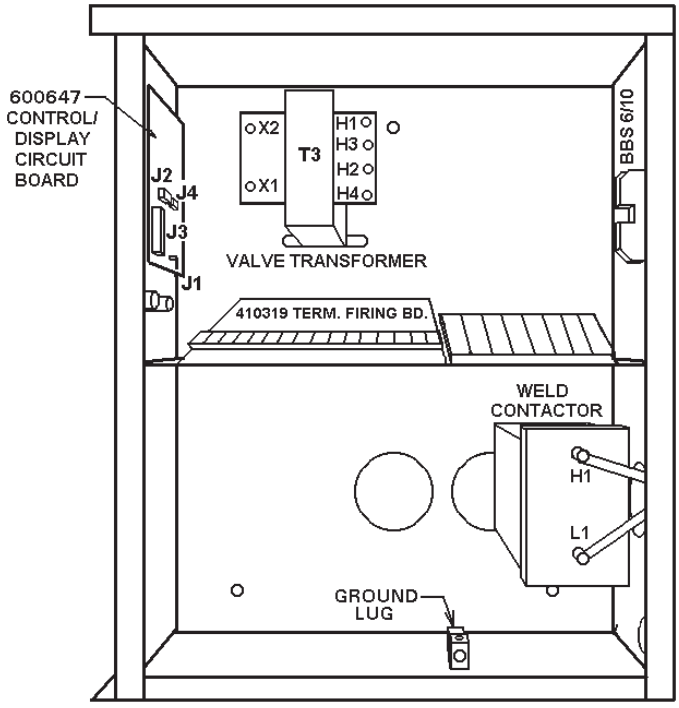


Figure 8-3. *“E” Cabinet – 300/600/1200A Contactor*

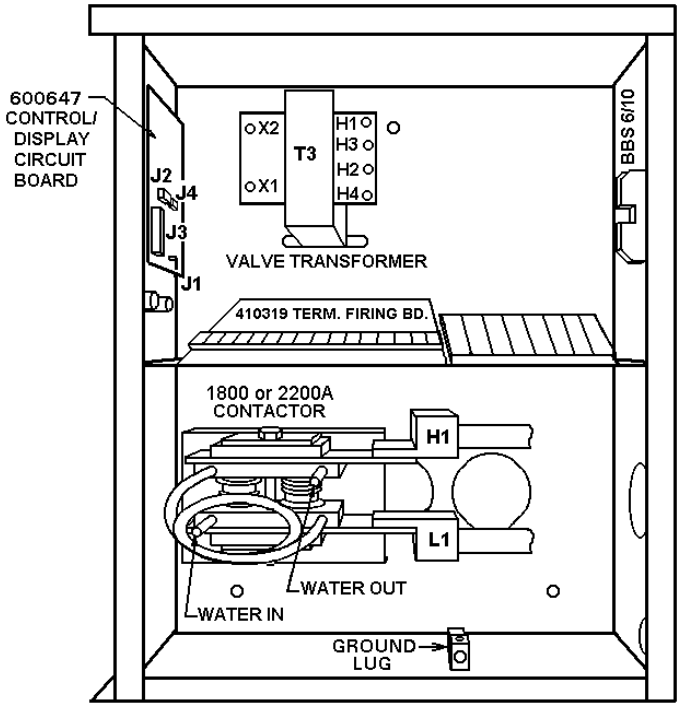


Figure 8-4. *“E” Cabinet – 1800/2200A Contactor*

8.3 INSTALLATION DIAGRAMS – "T/D" AND "L" CABINETS

See Section 8.4 for mounting information.

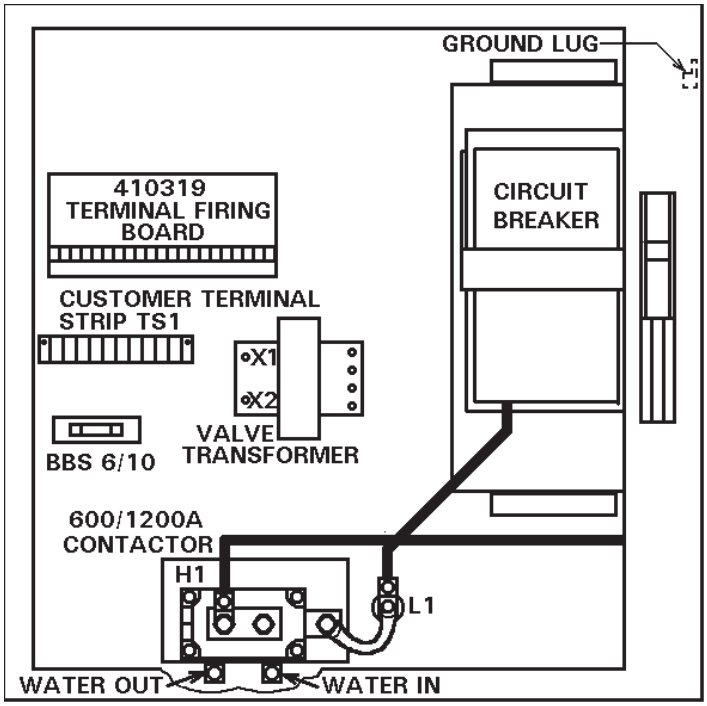


Figure 8-5. *"T/D" and "L" Cabinets – 600/1200A Contactor*

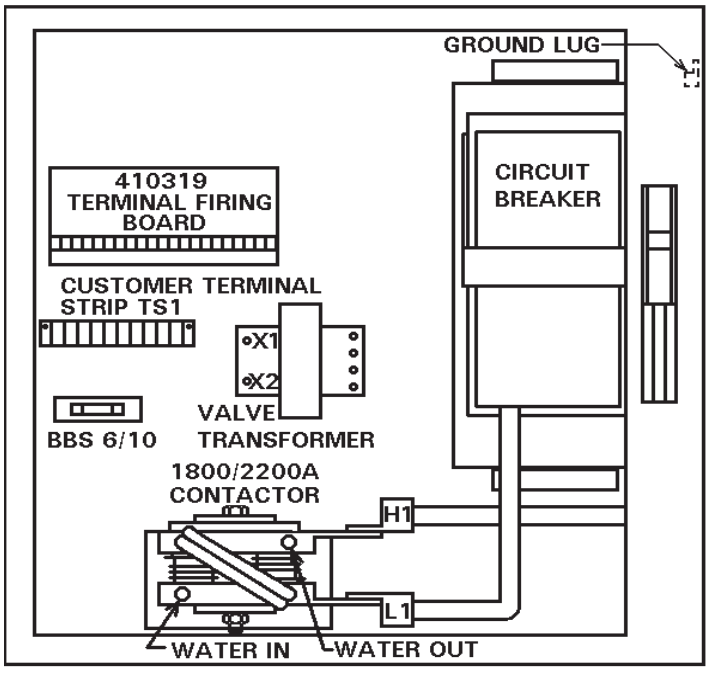


Figure 8-6. *"T/D" and "L" Cabinets – 1800/2200A Contactor*

8.4 MECHANICAL MOUNTING DIAGRAMS

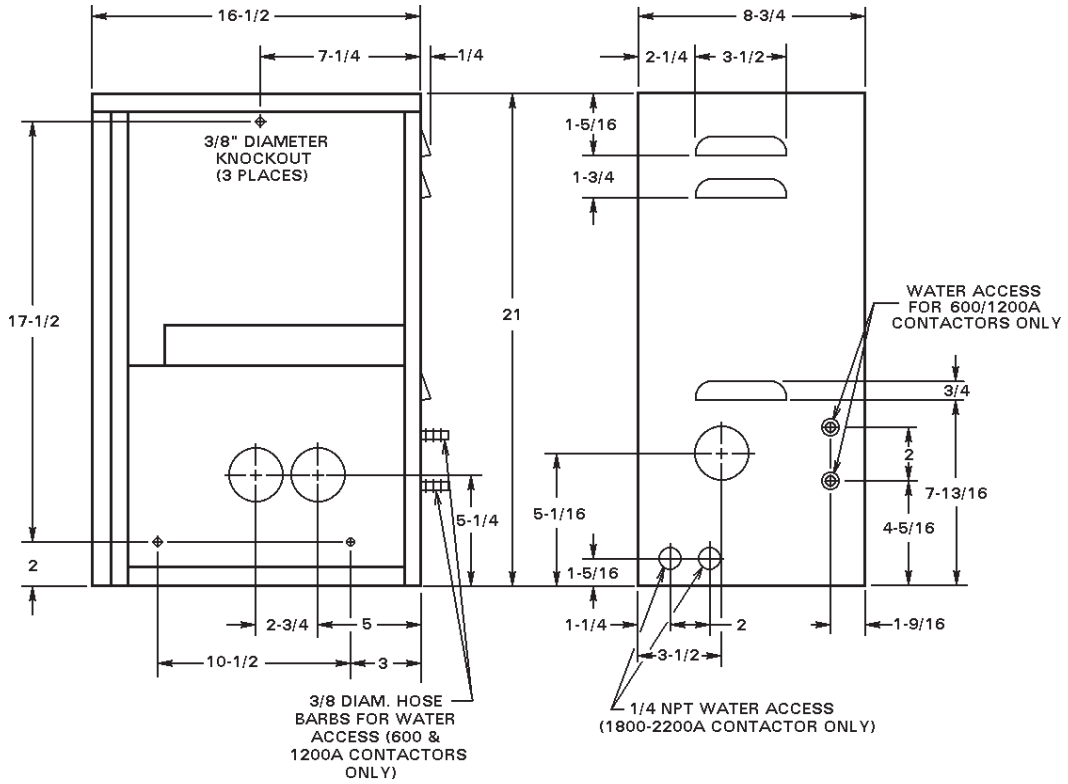


Figure 8-7. *"E" Cabinet mounting*

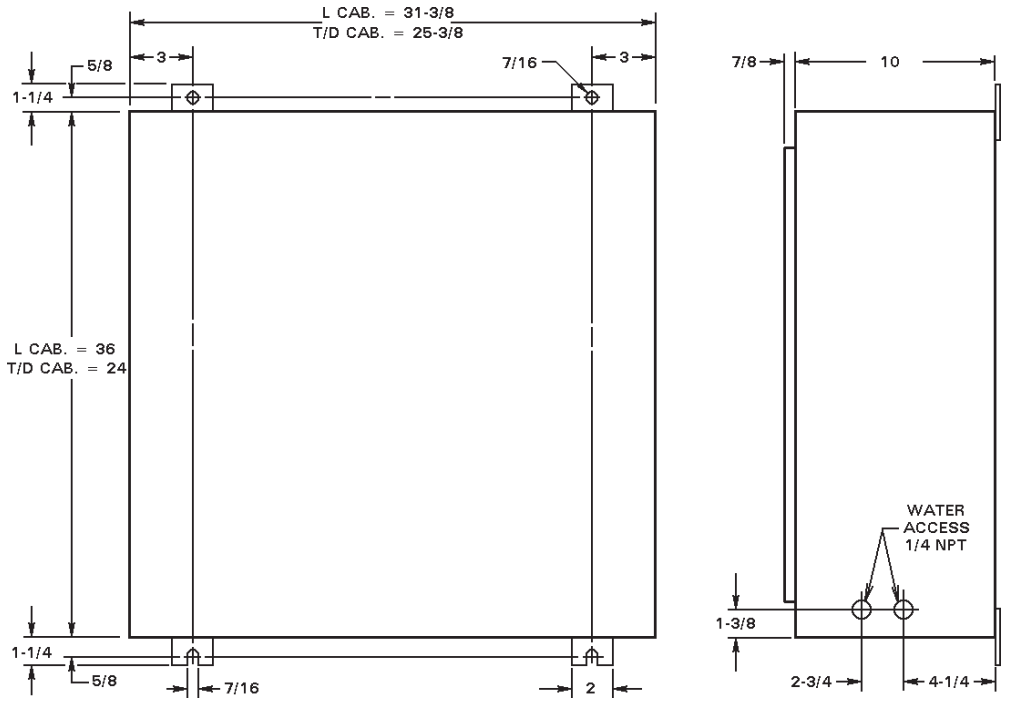


Figure 8-8. *"T/D" and "L" Cabinets mounting*

9.0 ERROR CODES

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

ERROR	POSSIBLE CAUSE	REMEDY
Data/Schedule Display E.r.=01	Error Code #01 Temperature Limit Switch open or overheated.	Wait for the Temperature Limit Switch to cool or check for open circuit. **See Section 2.2, 5.1, and 5.2**.
Data/Schedule Display E.r.=02	Error Code #02 FS1 and FS7 both closed.	Remove any connection to FS1. **See Section 4.0, 5.1, and 5.2.**
Data/Schedule Display E.r.=04	Error Code #04 Attempt to weld in PROGRAM mode.	Return to OPERATE mode. **See Section 2.1.**
Data/Schedule Display E.r.=05	Error Code #05 FS1,FS3,FS7 closed to GND before power on.	All initiations must be open at power on. **See Section 4.0, 5.1, and 5.2**.
Data/Schedule Display E.r.=07	Error Code #07 FS1 initiated while another seq. active.	Remove any connection to FS1. **See Section 4.0, 5.1, and 5.2.**
Data/Schedule Display E.r.=08	Error Code #08 FS3 initiated while another seq. active.	Open TS1-FS3. **See Section 4.0, 5.1, and 5.2**.
Data/Schedule Display E.r.=09	Error Code #09 FS7 initiated while another seq. active.	Open TS1-FS7. **See Section 4.0, 5.1, and 5.2.**
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 4.3 and 6.3**.
Data/Schedule Display E.r.=14 (Non-Flashing)	Error Code #14 Non-Flashing EEPROM memory failure.	Replace Control Board. **See Section 4.3 and 6.3**.
Data/Schedule Display E.r.=26	Error Code #26 SCR Contactor short detected.	1. Check Contactor for short. 2. Check Firing Module 410319.

For list of all Error Codes, refer to Appendix A (Application Note 700158).

9.1 TROUBLESHOOTING

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

TROUBLE	POSSIBLE CAUSE	REMEDY
POWER light will not light.	1. Fuse F1, type BBS 6/10, control fuse blown.	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. Defective POWER light.	2. Replace POWER light.
	3. Main welder disconnect open.	3. Check that fuse or circuit breaker is of sufficient size for KVA demand of welding transformer.
	4. L2 wire to Terminal Strip missing.	4. Add L2 wire.
Control will not initiate.	1. Initiation switch(es) defective.	1. Replace switch(es).
	2. Loose or broken wire(s) at initiation switch(es).	2. Check for loose or broken wire(s) at initiation switch(es) and at Terminal Strip (FS3, FS7, etc.).
	3. Defective Control/Display.	3. Replace board with another board stamped with same A/N.
HALF CYCLE during WELD time.	1. Defective thyristor.	1. Check thyristor for open. Replace.
	2. Defective Terminal Strip/Firing PCB.	2a) Check connections on PCB1-J3 and PCB2-J5 and J6. 2b) Replace Board. See Wiring Diagram for correct A/N.

9.1 TROUBLESHOOTING (cont.)

TROUBLE	POSSIBLE CAUSE	REMEDY
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. (WELD light may light.) 5. Defective Terminal Strip/Firing PCB. 6. Defective Control/Display PCB. 7. External Weld/No Weld on TS1-NW1. 8. No data in WELD or % CURRENT.	1. Check to see that control is in WELD. 2a) Contactor overheated, causing switch to open. 2b) Defective switch. Replace. 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. 7. Make sure jumper exists between TS1-NW1 and TS1-GND. 8. Put data in WELD or % CURRENT.
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 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 PERCENT CURRENT. 5. Dress or replace electrode 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.

10.0 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, 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 will 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.

APPENDIX A – ERROR CODES

APPLICATION NOTE 700158L
ERROR CODES*

ERROR CODE	Reason or Cause
01	Temperature limit exceeded (TLS open). / Incorrect **b.5.** or **P.0.** programmed.
02	FS1 & FS7 are both active.
03	FS1 & FS11 are both active.
04	Weld initiated while in PROGRAM mode.
05	FS1, FS3, FS7, or FS11 is active upon power up.
06	BACK-STEP is active too long. / Input switch closed. / Incorrect **b.5.** or **P.0.** programmed.
07	FS1 still active after weld.
08	FS3 still active after weld.
09	FS7 still active after weld.
10	FS11 still active after weld.
11	Control Relay still active after weld.
12	Hardware error is detected.
13	Full conduction is detected.
14	EEPROM error is detected (refer to Application Note 700127).
14 - **flashing**	Invalid data in EEPROM (refer to Application Note 700127).
15	Pressure Switch is open too long.
16	Emergency Stop is active.
17	Nominal AVC reading is too low.
18	Nominal AVC reading is too high.
19	AVC reading is too low.
20	AVC reading is too high.
21	+5 VDC is out of range.
22	+18 VDC is out of range.
23	Maximum firing angle exceeded during AVC correction.
24	Minimum firing angle exceeded during AVC correction.
25	Power factor measured as zero.
26	Sense input active while not welding. / Shorted SCRs. / Incorrect wiring or missing L2.
27	Retraction not active upon initiation.
28	Front Panel NO WELD switch is active for **P.0.**=**10** or for *EN1000/EN1001 Cascade only* **P.0.**=**33**.
29	Schedule out of range for **5.5.**=**03** when using S49 or S99 option.
30	Over current (*EN1200 and EN1201 only*).
31	IIC Error.
32 - **flashing**	Invalid data in EEPROM (refer to Application Note 700127).
33	MM2 is not found. Memory Module required.
34	Downloading data from MM2 Checksum Error.
35	Copy data to MM2 Checksum Error.
36	Pressure Sense input is too low or too high.
37	Calibration data out of range (*EN1001 only*).
38	DC bus voltage is too low (*EN1200 and EN1201 only*).
39	DC bus voltage is too high (*EN1200 and EN1201 only*).
40	Control with programmed ID not found on the RS485 network (*RT4 only*).
41	Message is not received from the control (*RT4 only*).
42	Communication Error (*RT4 only*).
43	Checksum Error in data bytes (*RT4 only*).
44	DC bus voltage is too high. Send signal to Circuit Breaker Shunt Trip (*EN1200 and EN1201 only*).
45	One or two of the three phases are missing (*EN1200 and EN1201 only*).
46	Setup failed. Control failed to adjust for signal level *(EN1001/EN1001 Cascade only).*
47	Over current from Primary Current Sensor (*EN1200 and EN1201 only*).
48	SCR's Firing Board is not ready for weld (*EN1200 and EN1201 only*).
90	Error Output from control to ENLINK, High.
91	Error Output from control to ENLINK, Low.
d.o.u.n.	VCC power supply voltage below safe operating range.
H. i. or L.o.	Flashing on DATA display if control is unable to correct and maintain constant current during weld. Generally shown after weld for **P.0.**=**12**, **13**, **14**, **22**, **23**, **24** or **25** (*EN1001 and EN1201 only*).
E.S. - **flashing**	Emergency Stop is active.

*These ERROR CODES affect controls in Series EN1000, EN1001, EN1000B, EN1003, EN1000/EN1001 Cascade, EN1200, EN1201, EN1280, TW1280, EN1380, EN1500 and EN1501.