ENTRON

APPLICATION NOTE 700130D
EN1000 FLASH & BUTT WELDING APPLICATIONS

FLASH WELDING

Flash welding operations differ from other resistance welding operations in that an untimed or externally controlled flashing period occurs first, followed by a timed upset period. Different currents may be required during these two periods of time.

The EN1000 Controls can be programmed to provide this flash welding sequence. A special operating mode is selected which allows the control to operate in the SEAM mode for the flashing period, and then switch to the SPOT mode for the upset period.

PROGRAMMING FOR FLASH WELDING

NOTICE
Two normally open contacts must be provided. The first one is connected between FS3 and GND. Closure of this contact will start the flashing period. The second contact is connected between FS7 and GND. Closure of this contact will start the upset period in schedule 10.

1. Using the PROGRAM/OPERATE push button, select PROGRAM mode.
2. Select EXTENDED FUNCTION *S.E.*, Data Code *03*, and press ENTER.
3. In schedule 00, enter *01* for WELD/HEAT and enter the PERCENT CURRENT required for the flashing period. Other parameters may also be entered if needed, such as SQUEEZE time, VALVE OUTPUTS, INTERMITTENT CURRENT, and UPSLOPE.
4. In schedule 10, enter the time (WELD/HEAT) and the PERCENT CURRENT required for the upset period. If more than 99 cycles upset time is required, two or more schedules may be chained together. Other parameters may also be entered if needed, such as multiple IMPULSES (HEAT/COOL), DOWNSLOPE, and VALVE OUTPUTS. PROCESS OUTPUTS, such as END OF SEQUENCE (Data Code *06*), may also be entered via the EXTENDED FUNCTIONS. See Instruction Manual 700120.
5. If an annealing function is required after the upset period, this can be accomplished by chaining additional schedules to schedule 10.
6. Using the PROGRAM/OPERATE push button, select OPERATE mode.

FLASH WELDING (cont.)

After the control is programmed as described above, the operation is as follows:
1. Close the contact between FS3 and GND to start the flashing period. This contact must be maintained closed.
2. When the process is ready to switch to the upset period, close the contact between FS7 and GND. This closure may be momentary or maintained. After this closure, the FS3 contact may be opened. If FS3 is still closed at the end of the upset period, ERROR *08* will be displayed, but does not affect the operation.

The EN1000 Controls programmed and operated as described may also be used as a replacement for the older ENA150 and ENA300 Series Annealing Controls.

BUTT WELDING

The EN1000 Series Control can be used to program a butt welding sequence. This Application Note assumes that the weld control is used to do the clamping, squeezing, and welding. Since the weld control includes three Valve Outputs, Valve 1 may be used to clamp the parts to be welded. Valve 2 may be used to actuate the cylinder that brings the parts together and Valve 3 could be reserved for future use in EXTENDED FUNCTIONS. The example below is composed of two schedules. The first schedule does the clamping only. The second brings the parts together and begins the weld sequence immediately after the SQUEEZE time has elapsed.

Some materials require annealing process after welding. Depending on the material, after welding, some high carbon or stainless materials become brittle after the weld and will easily break if the material is not annealed. The column "Anneal Sequence 2" reflects, in this case, that part of the sequence. If the second schedule in Weld Sequence 1 includes CYCLE mode *03*, the weld control will automatically select schedule 02 at the end of the weld sequence. At that point the weld control will flash *03* on the SCHEDULE display, indicating that it is ready to initiate the anneal sequence. Upon re-initiation, the control will execute schedule 02.

| | WELD SEQUENCE 1 | | ANNEAL SEQUENCE 2 |
	SCHEDULE 00	SCHEDULE 01	SCHEDULE 02 (OPTIONAL IF ANNEALING)
SQUEEZE	50	50	50
WELD/HEAT	00	15	05
PERCENT	00	78	40
HOLD	00	05	05
OFF	00	00	00
IMPULSES	01	01	15
COOL	00	00	04
VALVE MODE	01	03	02
	(Valve 1)	(Valves 1 & 2)	(Valve 2 - Clamping only)
CYCLE MODE	02	00	00
		(Optional if 03 Annealing)	
SLOPE MODE	00	00	00
SLOPE COUNT	00	00	00

BUTT WELDING (cont.)

Some butt welding applications require that the machine (Cam drive or Limit switch) stop the sequence based on an amount of displacement during the sequence, rather than being time dependent, as shown above. In addition, an anneal process is frequently monitored and fully controlled by the operator and visually evaluated to judge appropriate annealing and stop at will. In both these cases, the control may be programmed to stop the sequence during the WELD time (BEAT operation) by simply opening the Initiation Pilot switch. To program the control to BEAT DURING SQUEEZE AND WELD, follow these instructions:

1. Use the SELECT push button and find **EF**.
2. Use the SCHEDULE push buttons and find **b.E.**.
3. Program a value of **02** for **b.E.** (BEAT DURING SQUEEZE AND WELD).
4. Press ENTER.

!   CAUTION   !
When using BEAT during SQUEEZE and WELD, the control will abort any sequence during the programmed SQUEEZE times and/or WELD times.

BUTT WELDING/FLASH BUTT WELDING

The butt welding control sequence is similar to the spot weld sequence with the addition of a second clamping valve. Two pieces of metal are clamped by the electrodes, brought together during a SQUEEZE time and then are upset welded together (see Figure 1). A post heat or anneal function may be added between the WELD and HOLD for some applications. This may also be done by a separate initiation of the control and re-clamping the part for the annealing. For flash butt welding, essentially all welding is controlled by the machine which is mechanically sequenced (see Figure 2). A post heat or anneal function may be added after welding is complete. This function is most often initiated by a separate initiation switch after parts are re-clamped for annealing sequence.
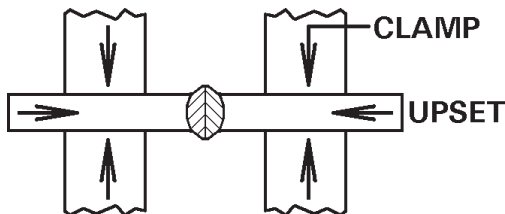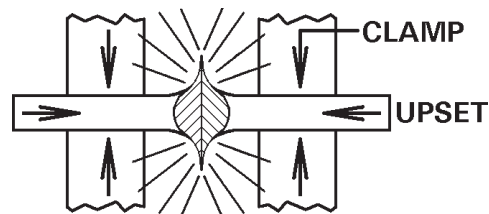
Figure 1. *Butt Welding*   **Figure 2.** *Flash Butt Welding*

"T" WELDERS

The weld sequence for a "T" welder can be either spot or pulsation, as may be required. Successful operation of a "T" welder depends more on the proper clamp placement on the "T" section of the parts to be welded. The clamp must be placed as close to the cross piece as possible to reduce heat loss to the weld area, by overheating the "T" section (see Figure 3).
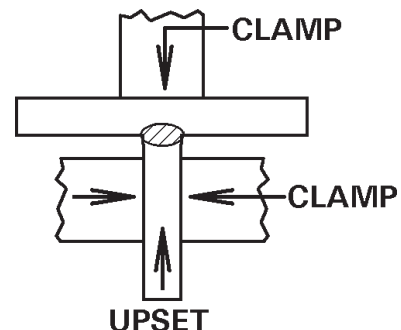
A butt weld type sequence, including the clamp functions, is most often used for "T" welders.

Figure 3. *"T" Welding*