ENTRON

APPLICATION NOTE 700114C

EN1000 HALF-CYCLE OPTION

ENTRON Model: **1/2**

The ENTRON Model "1/2", Half-Cycle Option, allows the user to program either **unipolar** or **antipolar** operation as well as the polarity of the half-cycle in the unipolar mode (see Figure 1). Unipolar operation produces half-cycle welds of the same polarity. The polarity of the half-cycle welds, positive (+) or negative (-), is set by programming the appropriate VALVE codes as shown in Table 1. In antipolar half-cycle welding, the polarity of the half-cycle welds alternates between positive and negative with each successive initiation.

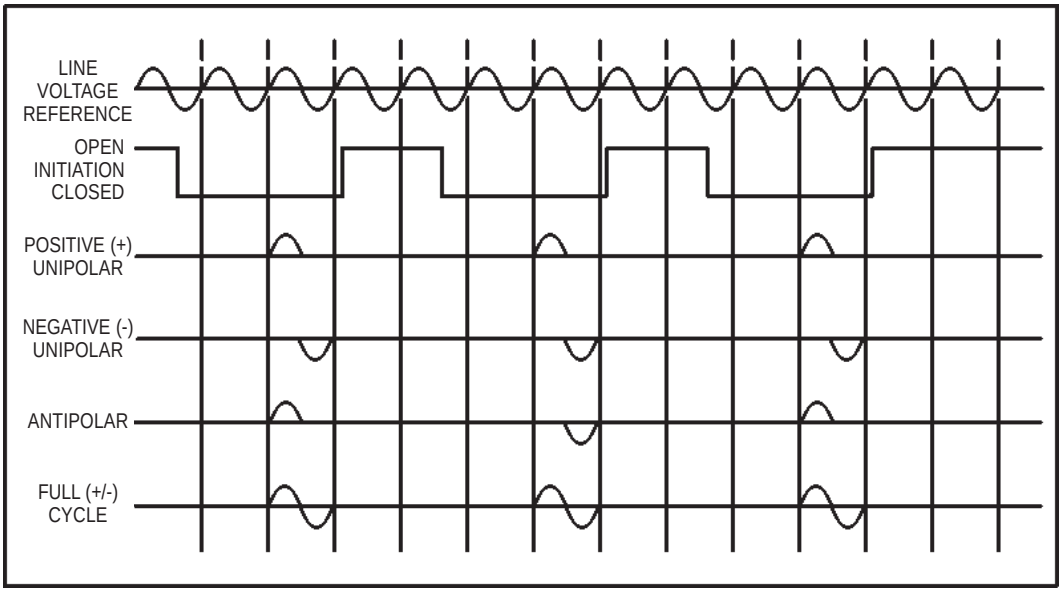

Figure 1.

Unipolar operation may be required when welding certain types of metals, particularly dissimilar metals. This mode of operation can saturate some welding transformers if the duty cycle is such that the transformers BH curve is exceeded. Antipolar operation is recommended for general purpose half-cycle welding. Rapid sequencing is possible since the transformer will operate in its intended mode of operation. Further information on individual transformers can be obtained from the transformer manufacturer.

This option is accomplished by selectively interrupting the gate pulses to one of the two Silicon Controlled Rectifiers (SCRs) at a time. This interruption is provided by two normally open relays, one connected in series with each of the two gate leads. One relay is actuated by V2 and switches the gate lead of SCR #1. The other relay is actuated by V3 and switches the gate lead of SCR #2.

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NOTICE

With the Half-Cycle option installed, the user only has one independently programmable 110 VAC valve output (V1).

When programming positive unipolar welds, both V2 and the desired solenoid valve V1 must be on simultaneously. This is because the relays are normally open and require a voltage input to switch the gate pulses. Similarly, in programming negative unipolar welds, V3 and the desired solenoid output valve V1 must be on simultaneously. If full-cycle welds are required, both V2 and V3 as well as the desired solenoid valve V1 must be on simultaneously.

When the Half-Cycle option is used, the control is supplied with a 410319-004 which can provide unipolar and antipolar weld sequences. Table 1 outlines the available VALVE codes for positive and negative half-cycle welding as well as those for full-cycle (+/-) welding.

NOTICE

For additional information on VALVE codes, refer to Valve Modes Section in Instruction Manual 700120.

By programming various VALVE codes as shown in Table 1, the user can select positive half-cycle, negative half-cycle, or full-cycle welds. By using the CHAINED or SUCCESSIVE modes of operation, the user can achieve antipolar operation or any combination of positive, negative, or full-cycle welds.

It is necessary to allow for a minimum of two cycles of SQUEEZE time when programming for half-cycle welding. The actual SQUEEZE time is based on the mechanics of the welder and the time required to build up sufficient welding pressure. The minimum two cycles of SQUEEZE allows the relay contacts to close well in advance of gate pulses being applied to the SCR through the relay contacts. This becomes very important in antipolar operation. One relay is closed for the positive half-cycle, then opens as the other relay closes for the negative half-cycle. Without two cycles of SQUEEZE time, the first relay does not open before the second closes. See Figure 2.

Figures 1, 2, and 3 are based on the example schedules presented in this Application Note. The values used in the examples are minimum values based on absolute timing constraints. Any or all times (particularly SQUEEZE and HOLD) may be increased to suit the application and to configure the control to the machine in use. However, the primary consideration is that enough time be allowed (a minimum of 2 cycles) for the relay contacts to close prior to applying gate pulses to the SCRs through the relay contacts.

In the example schedules, SQUEEZE time is set to 02 cycles. This allows the control to sequence as rapidly as possible. In addition, HOLD time is typically programmed to 02 to allow the one relay time to open before the other relay is closed.

The schedule numbers used in the examples are for reference only. Any of the 50 available schedules can be used as long as consecutive schedules are used when operating in CHAINED or SUCCESSIVE modes.

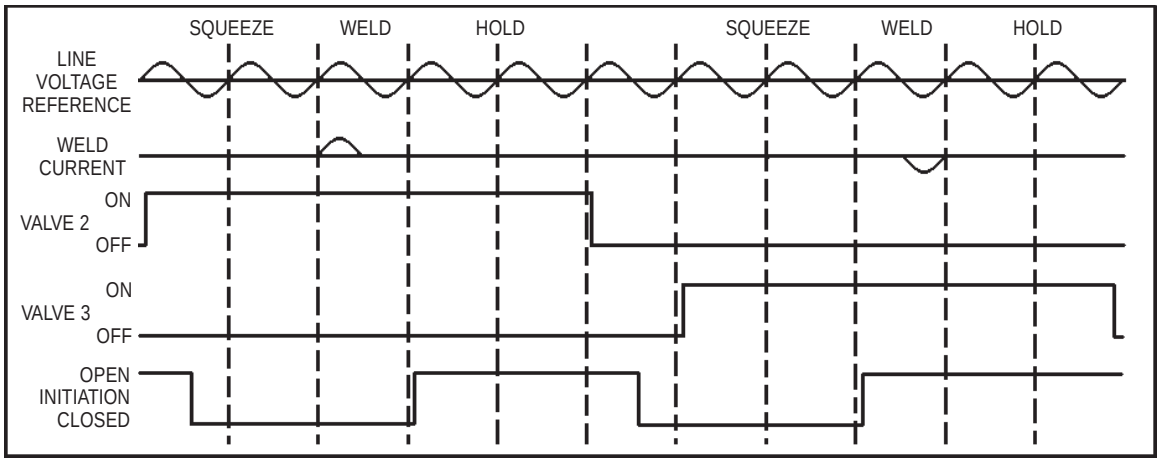

Figure 2.

Table 1. *VALVE codes*

Available VALVE codes for **positive (+) half-cycle** welding			
CODE	**V1**	**V2**	**V3**
02		X	
03	X	X	
Available VALVE codes for **negative (-) half-cycle** welding			
CODE	**V1**	**V2**	**V3**
04			X
05	X		X
Available VALVE codes for **full-cycle (+/-)** welding			
CODE	**V1**	**V2**	**V3**
06		X	X
07	X	X	X

Table 1 shows which VALVE codes should be used for positive, negative, and full-cycle weld sequences.

NOTICE

V1 is the solenoid valve output.
V2 is for use with positive half-cycle welding.
V3 is for use with negative half-cycle welding.

The following programming examples use the minimum allowable times for SQUEEZE and HOLD. The values should be programmed based on the mechanics of the machine, and cycle times required to make consistent welds.

Programming example #1: Positive unipolar half-cycle weld sequence

Each initiation results in a single positive half-cycle weld (see Figure 1).

SCHEDULE 00

SQUEEZE count ..... 02 cycles (or desired SQUEEZE time)
WELD count ..... 01 WELD cycle
PERCENT CURRENT ..... desired PERCENT CURRENT for positive half-cycle
HOLD count ..... 02 cycles (or desired HOLD time)
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count ..... 00 cycles
VALVE MODE ..... 03 (Valve 1 and 2 for positive half-cycle mode)
CYCLE MODE ..... 00 (SINGLE SPOT mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

Programming example #2: Negative unipolar half-cycle weld sequence

Each initiation results in a single negative half-cycle weld (see Figure 1).

SCHEDULE 00

SQUEEZE count ..... 02 cycles (or desired SQUEEZE time)
WELD count ..... 01 WELD cycle
PERCENT CURRENT ..... desired PERCENT CURRENT for negative half-cycle
HOLD count ..... 02 cycles (or desired HOLD time)
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count ..... 00 cycles
VALVE MODE ..... 05 (Valve 1 and 3 for negative half-cycle mode)
CYCLE MODE ..... 00 (SINGLE SPOT mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

Programming example #3: Antipolar half-cycle weld sequence

Each successive initiation results in a single half-cycle weld that alternates in polarity (see Figure 2). Antipolar half-cycle welding is accomplished by programming two SUCCESSIVE schedules. The first contains a single positive half-cycle weld and the second contains a single negative half-cycle weld. Each initiation toggles between schedule 00 and schedule 01.

SCHEDULE 00

SQUEEZE count..... 02 cycles (or desired SQUEEZE time)
WELD count..... 01 WELD cycle
PERCENT CURRENT..... desired PERCENT CURRENT for positive half-cycle
HOLD count ..... 02 cycles (or desired HOLD time)
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count..... 00 cycles
VALVE MODE ..... 03 (Valve 1 and 2 for positive half-cycle mode)
CYCLE MODE ..... 03 (SUCCESSIVE mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

SCHEDULE 01

SQUEEZE count..... 02 cycles (or desired SQUEEZE time)
WELD count..... 01 WELD cycle
PERCENT CURRENT..... desired PERCENT CURRENT for negative half-cycle
HOLD count ..... 02 cycles (or desired HOLD time)
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count..... 00 cycles
VALVE MODE ..... 05 (Valve 1 and 3 for negative half-cycle mode)
CYCLE MODE ..... 00 (SINGLE SPOT mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

The following programming examples are for seam welding. These examples show minimum allowable times for all functions. Any of the following schedules as well as those preceding, can be modified to tailor them to a particular application. For example, adding pulsation to a half-cycle weld sequence is simply a matter of programming the number of IMPULSES desired and programming the desired COOL time between IMPULSES.

NOTICE

With the Half-Cycle option installed, the user only has one independently programmable 110 VAC valve output (V1).

When programming positive unipolar welds, both V2 and the solenoid valve V1 must be on simultaneously. This is because the relays are normally open and require a voltage input to switch the gate pulses. Similarly, in programming negative unipolar welds, V3 and the solenoid output valve V1 must be on simultaneously. If full-cycle welds are required, both V2 and V3 as well as the solenoid valve V1 must be on simultaneously.

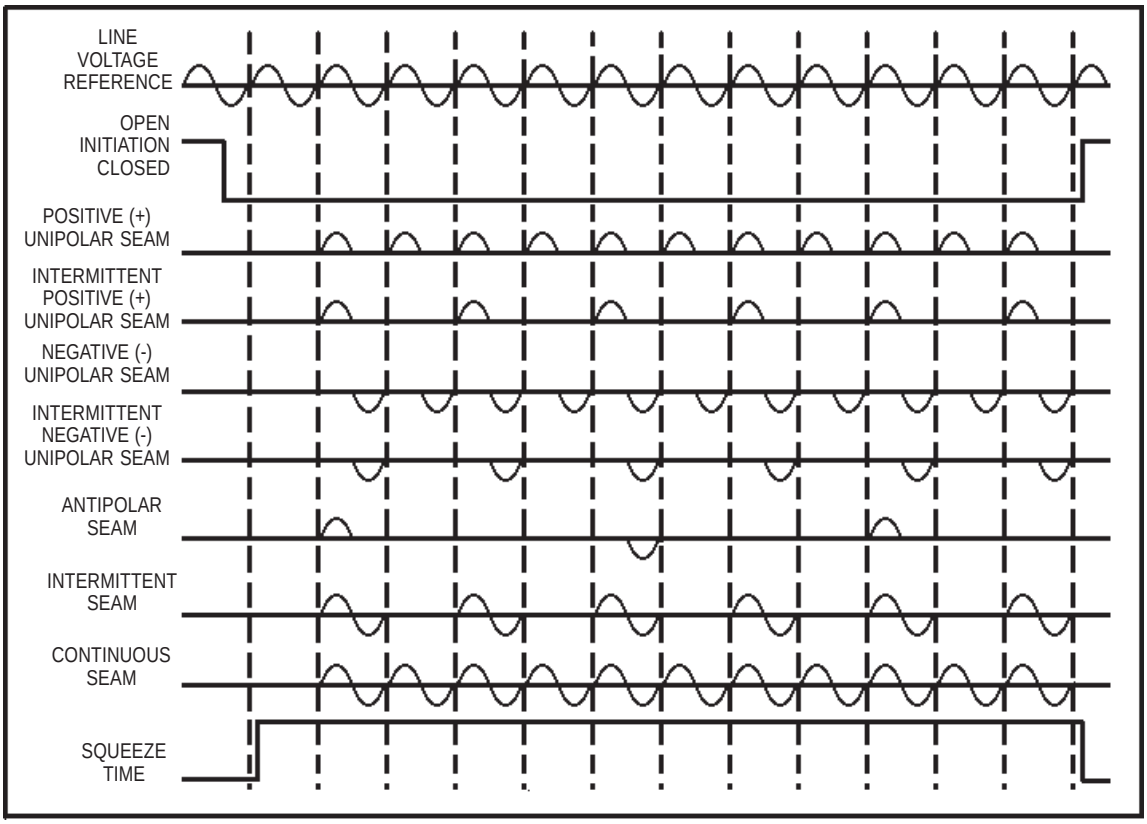

Figure 3.

Programming example #4: Positive unipolar half-cycle seam welding sequence

Each initiation results in a series of single positive half-cycle welds lasting as long as the initiation is maintained (see Figure 3).

SCHEDULE 00

SQUEEZE count..... 02 cycles (or desired SQUEEZE time)
WELD count..... 01 WELD cycle
PERCENT CURRENT..... desired PERCENT CURRENT for positive half-cycle
HOLD count ..... 02 cycles (or desired HOLD time)
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count..... 00 cycles
VALVE MODE ..... 03 (Valve 1 and 2 for positive half-cycle mode)
CYCLE MODE ..... 00 (SINGLE SPOT mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

Programming example #5: Negative unipolar half-cycle seam welding sequence

Each initiation results in a series of single negative half-cycle welds lasting as long as the initiation is maintained (see Figure 3).

SCHEDULE 00

SQUEEZE count..... 02 cycles (or desired SQUEEZE time)
WELD count..... 01 WELD cycle
PERCENT CURRENT..... desired PERCENT CURRENT for negative half-cycle
HOLD count ..... 02 cycles (or desired HOLD time)
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count..... 00 cycles
VALVE MODE ..... 05 (Valve 1 and 3 for negative half-cycle mode)
CYCLE MODE ..... 00 (SINGLE SPOT mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

Programming example #6: Antipolar half-cycle seam welding sequence

Each initiation results in a series of single half-cycle welds that alternate in polarity as long as the initiation is maintained (see Figure 3). Antipolar seam welding is accomplished by chaining two schedules together and programming the second schedule to REPEAT. The control will sequence through schedule 00 and then schedule 01 and repeat the sequence as long as the initiation is maintained.

SCHEDULE 00

SQUEEZE count..... 02 cycles (or desired SQUEEZE time)
WELD count ..... 01 WELD cycle
PERCENT CURRENT ..... desired PERCENT CURRENT for positive half-cycle
HOLD count ..... 02 cycles (or desired HOLD time)
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count..... 00 cycles
VALVE MODE ..... 03 (Valve 1 and 2 for positive half-cycle mode)
CYCLE MODE ..... 02 (CHAINED mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

SCHEDULE 01

SQUEEZE count..... 02 cycles (or desired SQUEEZE time)
WELD count ..... 01 WELD cycle
PERCENT CURRENT ..... desired PERCENT CURRENT for negative half-cycle
HOLD count ..... 02 cycles (or desired HOLD time)
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count..... 00 cycles
VALVE MODE ..... 05 (Valve 1 and 3 for negative half-cycle mode)
CYCLE MODE ..... 01 (REPEAT mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

NOTICE

For seam welding applications with the EN1000 Weld Control, the EXTENDED FUNCTION **SE** must be set to **01** for examples 4 & 5. Set **SE** to **00** for examples 1, 2, 3, and 6.

Programming example #7: Intermittent full-cycle seam welding sequence

Each initiation results in a series of single full-cycle welds separated by a single cycle of COOL time. The sequence will continue as long as the initiation is maintained.

SCHEDULE 00

SQUEEZE count ..... 02 cycles (or desired SQUEEZE time)
WELD count ..... 01 WELD cycle
PERCENT CURRENT ..... desired PERCENT CURRENT for full-cycle weld
HOLD count ..... 02 cycles
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count ..... 01 cycles
VALVE MODE ..... 07 (Valve 1, 2 and 3 for full-cycle mode)
CYCLE MODE ..... 00 (SINGLE SPOT mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

Programming example #8: Continuous full-cycle seam welding sequence

Each initiation results in continuous full-cycle welding current. The welding current will continue as long as the initiation is maintained and will stop synchronously with the release of the initiation.

SCHEDULE 00

SQUEEZE count ..... 02 cycles (or desired SQUEEZE time)
WELD count ..... 01 WELD cycle
PERCENT CURRENT ..... desired PERCENT CURRENT for full-cycle weld
HOLD count ..... 02 cycles
OFF count ..... 00 cycles
IMPULSES ..... 01 (one IMPULSE)
COOL count ..... 00 cycles
VALVE MODE ..... 07 (Valve 1, 2 and 3 for full-cycle mode)
CYCLE MODE ..... 00 (SINGLE SPOT mode)
SLOPE MODE ..... 00 (NO SLOPE)
SLOPE COUNT ..... 00 cycles

NOTICE

For additional information on programming, refer to Instruction Manual 700120.