

APPLICATION NOTE 700111E SQUEEZE DELAY AND RETRACTION OPERATION

This document is intended to explain the use of SQUEEZE DELAY and three types of RETRACTION (Momentary, Maintained Closure, Air over Oil) which can be programmed in the EN1000/EN1001 Single Function Series Controls and EN1000/EN1001 Cascade Controls.

For further information on programming, see Instruction Manual 700120 for EN1000/EN1001 Single Function Controls and Instruction Manual 700194 for EN1000/EN1001 Cascade Controls.

Sections specified below are only applicable to indicated type of control.

SECTION	SINGLE FUNCTION	CASCADE
2.1.1	✓	
2.1.2		✓
2.2.1	✓	
2.2.2		✓
2.3.1	✓	
2.3.2		✓

All other sections apply to any EN1000/EN1001 Control.

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1.0 SQUEEZE DELAY OPERATION

Some applications require the welder arms be opened wide to allow the electrodes to access areas to be welded. SQUEEZE DELAY was designed for use with welding guns and stationary machines incorporating standard air cylinders and valves without retraction features. The additional time provided by the SQUEEZE DELAY will allow the electrodes to travel a greater distance and simulate the retraction function. SQUEEZE DELAY is only active in the first sequence of a REPEAT sequence.

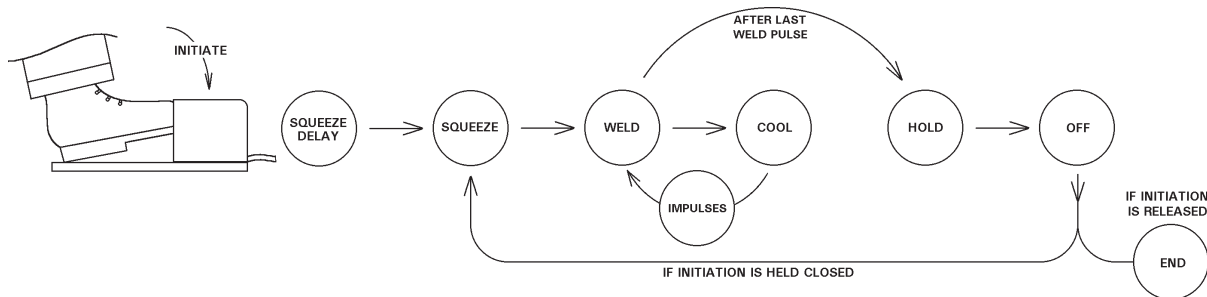


Figure 1-1. SQUEEZE DELAY

1.1 CONTROL FUNCTION DURING SQUEEZE DELAY

Setting the control for SQUEEZE DELAY will provide additional time before the programmed SQUEEZE time in all schedules. The SQUEEZE indicator LED on the Control Panel will dim slightly during the programmed SQUEEZE DELAY time. SQUEEZE DELAY time occurs only during the first SQUEEZE of a series of repeated welding sequences (REPEAT mode). SQUEEZE DELAY will be present in all schedules even if no other data has been entered.

SQUEEZE DELAY is not intended for use with SEAM or ANTI-TIE DOWN modes of operation. If not required, set **S.d.** to **00**.

1.2 PROGRAMMING SQUEEZE DELAY

1. Press SELECT push button repeatedly until FUNCTION indicator LED has advanced past SLOPE COUNT to enter data in EXTENDED FUNCTIONS (**EF**).

NOTICE

None of the FUNCTION indicator LEDs will be lit and DATA display will show **EF**. This indicates that control is in EXTENDED FUNCTION mode. In this mode, SCHEDULE push buttons are used to step through available EXTENDED FUNCTIONS.

2. Scroll through the EXTENDED FUNCTIONS until **S.d.** appears in SCHEDULE display.
3. Press PROGRAM/OPERATE push button to place the control in PROGRAM mode.
4. Press DATA push buttons until desired SQUEEZE DELAY time (time = number of cycles) is displayed in DATA display.
5. Press ENTER push button to store the desired data.
6. Select and enter CYCLE MODE=**01** (REPEAT).
7. Adjust SQUEEZE and OFF times to allow the electrodes to open only a short distance between repeated welding sequences.
8. Press PROGRAM/OPERATE push button to put the control in OPERATE mode.

2.0 RETRACTION OPERATION

Retraction is used for welding guns and stationary machines with cylinders and valves configured for retraction operation. Retraction is accomplished by de-energizing a valve solenoid, allowing the electrode arms to separate further than normal to allow large parts to be placed between welding electrodes.

The retraction valve can be activated by a *Momentary* (**P.O.=08**) switch closure that toggles the electrodes between the retracted and non-retracted state or a *Maintained* (**b.S.=09**) closure. *Air Over Oil* Retraction (**P.O.=07**) is used on welding guns and stationary welders that incorporate special air over oil cylinders.

2.1 MOMENTARY RETRACTION – P.O.=08

PROGRAMMING MOMENTARY RETRACTION

1. Provide a constant closure of TS1-TLS1/AUX1 to TS1-GND (Single Function Controls) or TS1-WFS1/AUX1 to TS1-GND (Cascade Controls).
2. Press SELECT push button repeatedly until FUNCTION indicator LED has advanced past SLOPE COUNT to enter data in EXTENDED FUNCTIONS (**EF**).

NOTICE

None of the FUNCTION indicator LEDs will be lit and DATA display will show **EF**. This indicates that control is in EXTENDED FUNCTION mode. In this mode, SCHEDULE push buttons are used to step through available EXTENDED FUNCTIONS.

3. Scroll through the EXTENDED FUNCTIONS until **P.O.** appears in SCHEDULE display.
4. Press PROGRAM/OPERATE push button to place the control in PROGRAM mode.
5. Use the DATA push buttons to display **08** in DATA display.
6. Press ENTER push button to store the data.
7. Open the retraction switch held closed in Step 1.
8. Press PROGRAM/OPERATE push button to put the control in OPERATE mode.

2.1.1 MOMENTARY RETRACTION IN SINGLE FUNCTION CONTROLS

While the RETRACTION PROCESS OUTPUT is enabled, the TS1-TLS1/AUX1 terminal is configured as a retraction input. The Temperature Limit Switch normally connected to terminal TS1-TLS1/AUX1 should be moved to TS1-NW1. A momentary closure from TS1-TLS1/AUX1 to TS1-GND will toggle the valve from the ON to the OFF state. These contacts are normally tied to a momentary type switch that is independent from the initiation switch. When the valve is off and the gun is in a fully retracted state, the control cannot initiate a weld sequence and an ERROR **E.r.=27** message will appear on the display if initiation is attempted. Only when the valve is on and the electrodes are in the pre-weld or extended position will the initiations be enabled. When Valve 3 is on, VALVE 3 indicator LED on the Control Panel will be blinking.

The valve output between TS1-SV5 and TS1-SV6 is enabled by toggling the TS1-TLS1/AUX1 to TS1-GND switch. This output remains on during and after a weld as long as switch is not activated.

2.1.1 MOMENTARY RETRACTION IN SINGLE FUNCTION CONTROLS (cont.)

SUCCESSIVE schedules can be used with MOMENTARY RETRACTION.

When the retraction valve is on, the control may not be placed into PROGRAM mode. The TS1-TLS1/AUX1 (retraction input) must be momentarily activated.

If the TS1-TLS1/AUX1 input switch is held **closed** for a long period of time, ERROR *E.r.=06* message will be displayed, but the error condition is abandoned and the valve output **will be toggled** upon the opening of TS1-TLS1/AUX1 from TS1-GND. The Control Panel indication of Valve 3 output (retraction valve) will not indicate the status of PROCESS OUTPUT.

MOMENTARY RETRACTION CONNECTIONS FOR SINGLE FUNCTION CONTROLS

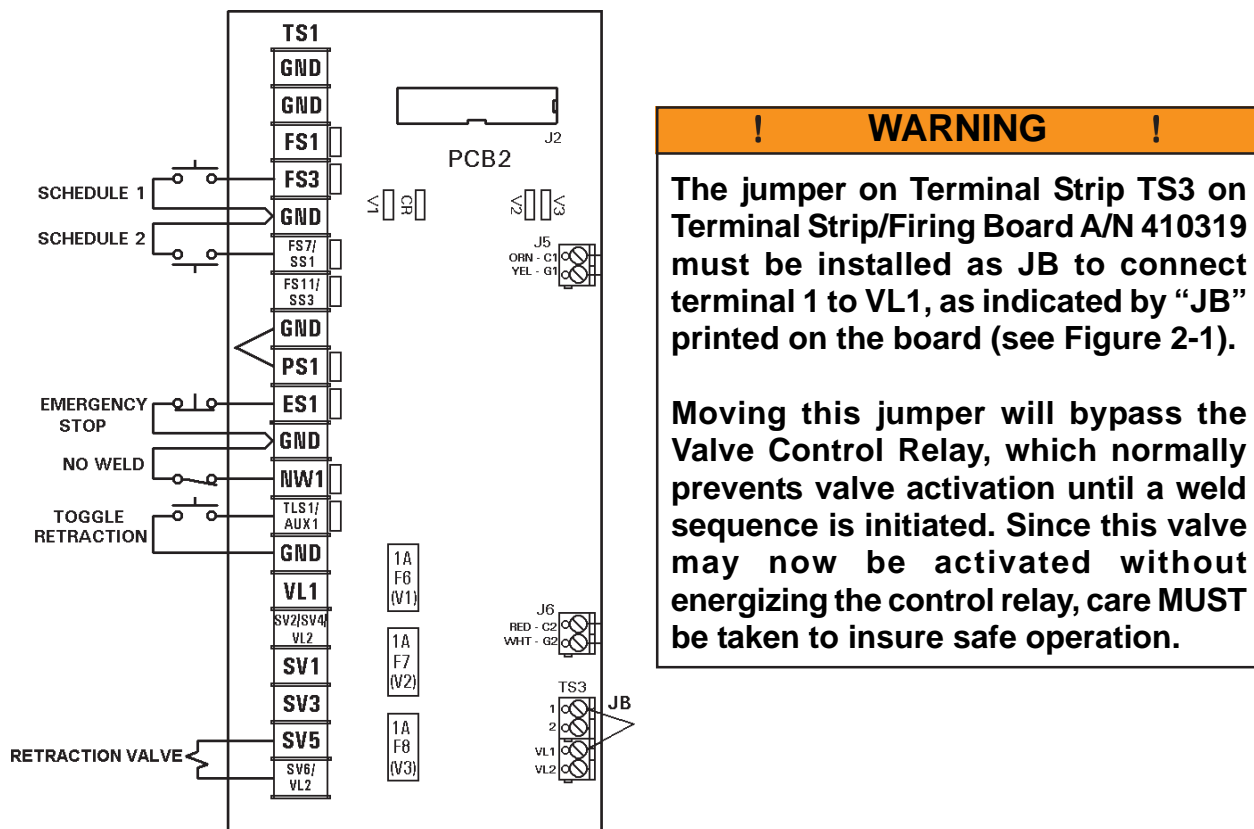


Figure 2-1. *Momentary Retraction connections for Single Function Controls*

2.1.2 MOMENTARY RETRACTION IN CASCADE CONTROLS

While the RETRACTION PROCESS OUTPUT is enabled, the TS1-WFS1/AUX1 terminal is configured as a retraction input. The Water Flow Switch, if connected to terminal TS1-WFS1/AUX1 could be moved to TS1-NW1. A momentary closure from TS1-WFS1/AUX1 to TS1-GND will toggle the retraction valve from the ON to the OFF state. These contacts are normally tied to a momentary type switch that is independent from the initiation switch. When the valve is off and the gun is in a fully retracted state, the control cannot initiate a weld sequence and an ERROR *E.r.=27*

2.1.2 MOMENTARY RETRACTION IN CASCADE CONTROLS (cont.)

message will appear on the display if initiation is attempted. Only when the valve is on and the electrodes are in the welding position will the initiations be enabled.

The valve output (Process Output valve) between TS10-SV17 and TS10-SV18 is enabled by toggling the TS1-WFS1/AUX1 to TS1-GND switch. This output remains on during and after a weld as long as the switch is not activated.

SUCCESSIVE schedules can be used with MOMENTARY RETRACTION.

When the retraction valve is on, the control may not be placed into PROGRAM mode. The TS1-WFS1/AUX1 (retraction input) must be momentarily activated.

If the TS1-WFS1/AUX1 input switch is held **closed** for a long period of time, an ERROR *E.r.=06* message will be displayed, but the error condition is abandoned and the valve output **will be toggled** upon the opening of TS1-WFS1/AUX1 from TS1-GND. The Control Panel indication of the Process Output valve (retraction valve) will not indicate the status of PROCESS OUTPUT.

MOMENTARY RETRACTION CONNECTIONS FOR CASCADE CONTROLS

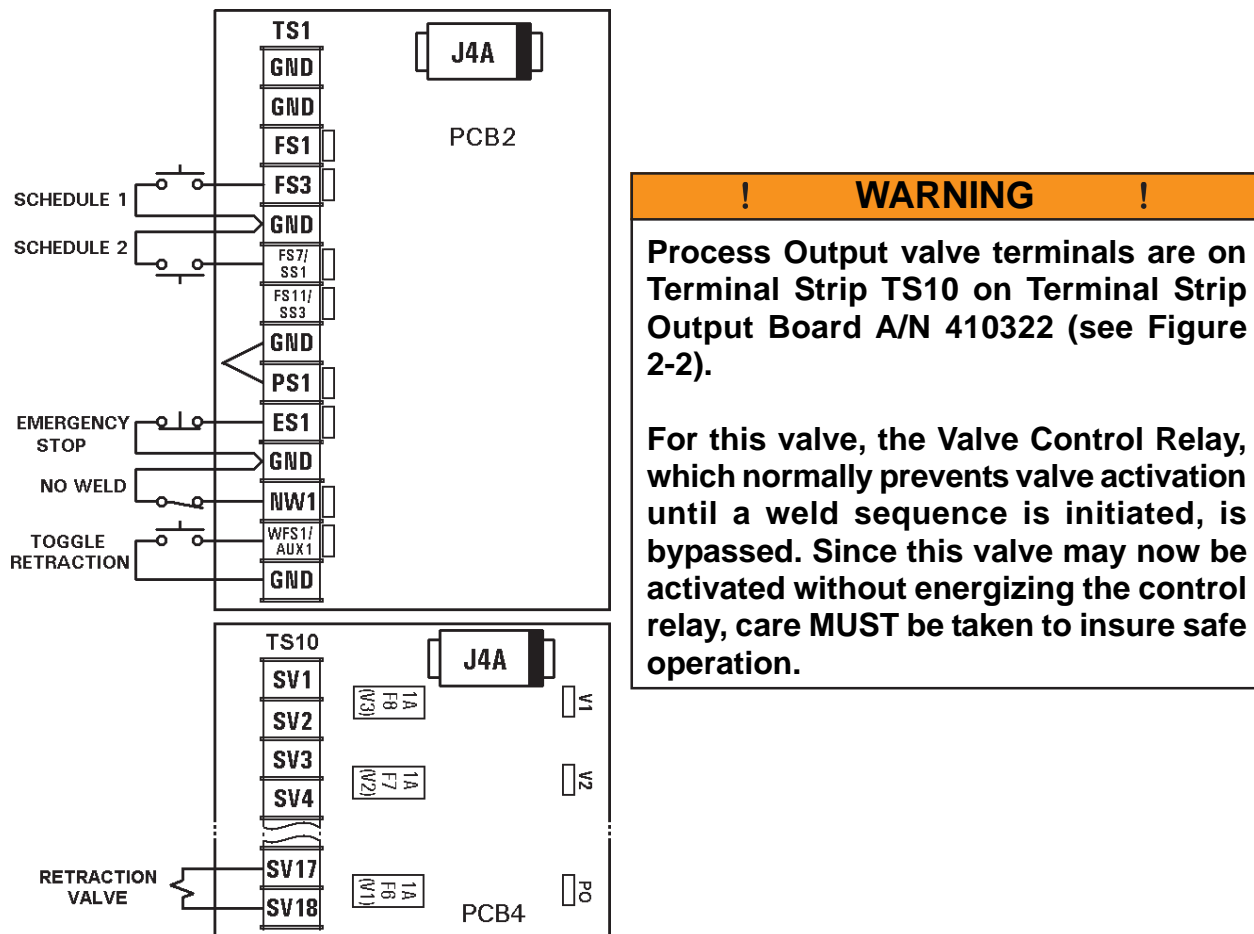


Figure 2-2. *Momentary Retraction connections for Cascade Controls*

2.2 MAINTAINED CLOSURE RETRACTION – *b.5.=09* (THREE STAGE FOOT-SWITCH RETRACTION ADDITION)

PROGRAMMING MAINTAINED CLOSURE RETRACTION

1. Provide a constant closure of TS1-TLS1/AUX1 to TS1-GND (Single Function Controls) or TS1-WFS1/AUX1 to TS1-GND (Cascade Controls).
2. Press SELECT push button repeatedly until FUNCTION indicator LED has advanced past SLOPE COUNT to enter data in EXTENDED FUNCTIONS (**EF**).

NOTICE

None of the FUNCTION indicator LEDs will be lit and DATA display will show **EF**. This indicates that control is in EXTENDED FUNCTION mode. In this mode, SCHEDULE push buttons are used to step through available EXTENDED FUNCTIONS.

3. Scroll through the EXTENDED FUNCTIONS until *b.5.* appears in SCHEDULE display.
4. Press PROGRAM/OPERATE push button to place the control in PROGRAM mode.
5. Use the DATA push buttons to display *09* in DATA display.
6. Press ENTER push button to store the data.
7. Open the retraction switch held closed in Step 1.
8. Press PROGRAM/OPERATE push button to put the control in OPERATE mode.

2.2.1 MAINTAINED CLOSURE IN SINGLE FUNCTION CONTROLS

EN1000/EN1001 Single Function Series Controls incorporating PROM firmware version 619016-002R or later will have the Maintained Closure Retraction feature added.

Once *b.5.* is set to *09*, the control will enter the MAINTAINED CLOSURE RETRACTION mode. This RETRACTION implementation is different from *P.O.=07* or *P.O.=08* in that it uses one foot switch that has a maintained/latched contact that the control uses to turn on the retraction output Valve 3. The software has a power-on interlock of the Valve 3 output to block Valve 3 from turning on with power on. This feature, simple as its operation may be, will help users implement this type of retraction without putting high voltage on one pole and/or in the same conduit as the low voltage foot switch wiring.

The valve output between TS1-SV5 and TS1-SV6 is enabled by closing the TS1-TLS1/AUX1 to TS1-GND switch. This output remains on during and after a weld as long as the switch remains closed.

SUCCESSIVE schedules can be used with MAINTAINED CLOSURE RETRACTION.

When the retraction valve is on, the control may not be placed into PROGRAM mode.

The Control Panel indication of Valve 3 output (retraction valve) will not indicate the status of PROCESS OUTPUT.

2.2.1 MAINTAINED CLOSURE IN SINGLE FUNCTION CONTROLS (cont.)

MAINTAINED CLOSURE CONNECTIONS FOR SINGLE FUNCTION CONTROLS

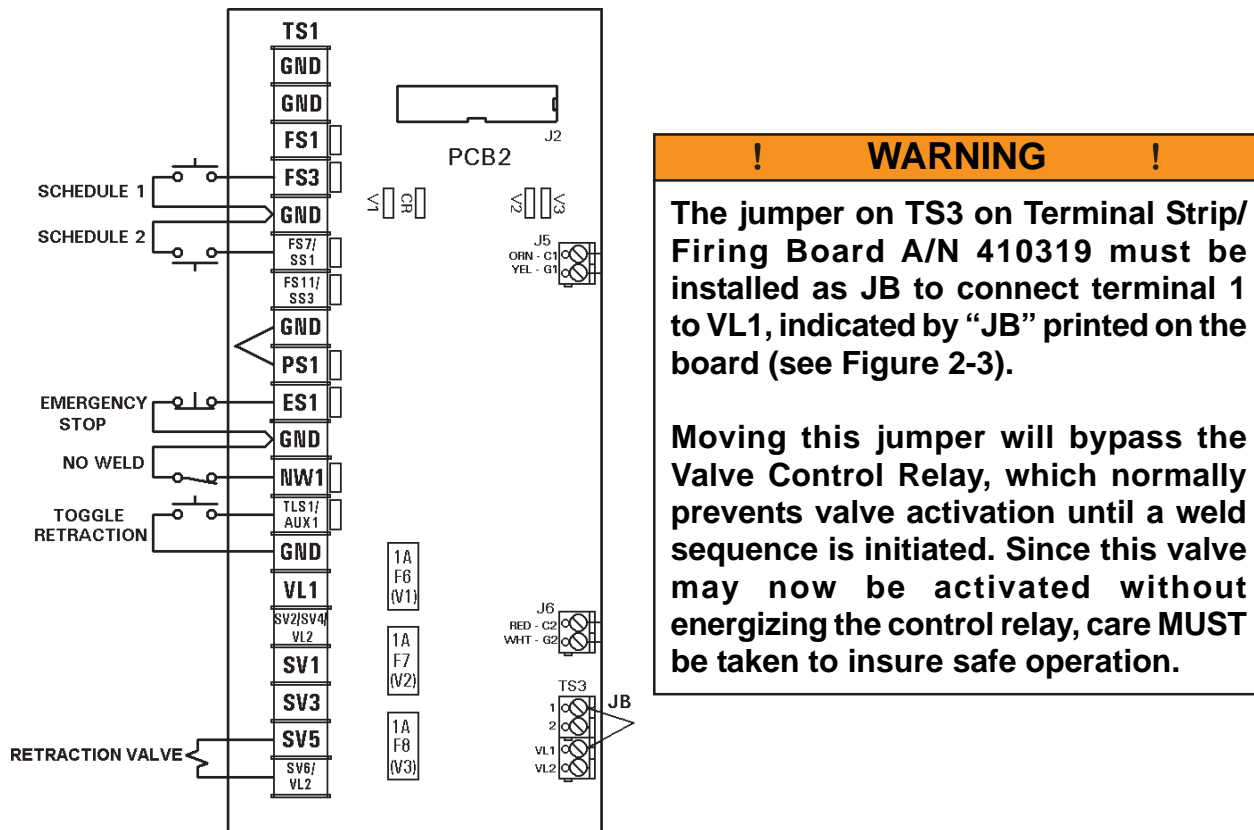


Figure 2-3. *Maintained Closure Retraction connections for Single Function Controls*

2.2.2 MAINTAINED CLOSURE IN CASCADE CONTROLS

Once **b.5.** is set to **09**, the control will enter the MAINTAINED CLOSURE RETRACTION mode. This RETRACTION implementation is different from **P.O.=07** or **P.O.=08** in that it uses one foot switch that has a maintained/latched contact that the control uses to turn on the retraction output PO Valve. The software has a power-on interlock of the PO valve output to block PO Valve from turning on with power on. This feature, simple as its operation may be, will help users implement this type of retraction without putting high voltage on one pole and/or in the same conduit as the low voltage foot switch wiring.

The valve output between TS10-SV17 and TS10-SV18 is enabled by closing TS1-WFS1/AUX1 to TS1-GND switch. This output remains on during and after a weld as long as switch remains closed.

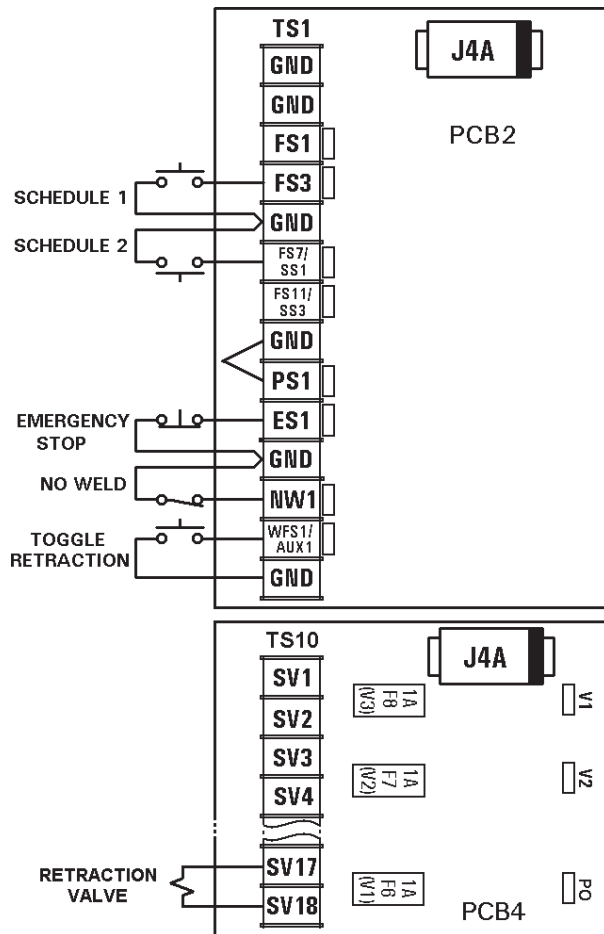
SUCCESSIVE schedules can be used with MAINTAINED CLOSURE RETRACTION.

When the retraction valve is on, the control may not be placed into PROGRAM mode.

The Control Panel indication of the PO valve output (retraction valve) will not indicate the status of PROCESS OUTPUT.

2.2.2 MAINTAINED CLOSURE IN CASCADE CONTROLS (cont.)

MAINTAINED CLOSURE RETRACTION CONNECTIONS FOR CASCADE CONTROLS



! WARNING !

Process Output valve terminals are on Terminal Strip TS10 on Terminal Strip Output Board A/N 410322 (see Figure 2-4).

For this valve, the Valve Control Relay, which normally prevents valve activation until a weld sequence is initiated, is bypassed. Since this valve may now be activated without energizing the Control Relay, care **MUST** be taken to insure safe operation.

Figure 2-4. *Maintained Closure Retraction connections for Cascade Controls*

2.3 AIR OVER OIL RETRACTION – P.O.=07

Air Over Oil Retraction is used on welding guns and stationary welders that incorporate special air over oil cylinders.

PROGRAMMING AIR OVER OIL RETRACTION

1. Press SELECT push button repeatedly until FUNCTION indicator LED has advanced past SLOPE COUNT to enter data in EXTENDED FUNCTIONS (**EF**).

NOTICE

None of the FUNCTION indicator LEDs will be lit and DATA display will show **EF**. This indicates that control is in EXTENDED FUNCTION mode. In this mode, SCHEDULE push buttons are used to step through available EXTENDED FUNCTIONS.

2. Scroll through EXTENDED FUNCTIONS until **P.O.** appears in SCHEDULE display.
3. Press PROGRAM/OPERATE push button to place the control in PROGRAM mode.
4. Use the DATA push buttons to display **07** in DATA display.
5. Press ENTER push button to store the data.
6. Scroll through EXTENDED FUNCTIONS until **S.d.** appears in the SCHEDULE display.
7. Press the DATA push buttons until desired SQUEEZE DELAY time (time = number of cycles) is displayed in the DATA display.
8. Press ENTER push button to store the data.
9. Press SCHEDULE push buttons to advance SCHEDULE display to **b.L.** (BLOCKING DELAY).

NOTICE

EXTENDED FUNCTION b.L. can only be accessed when P.O.=07 is programmed.

10. Press the DATA push buttons until desired BLOCKING DELAY time appears in DATA display.
11. Press ENTER push button to store the data.
12. Using the following example, enter CHAINED schedules that will control the *extend* and *intensify* valve sequencing.

NOTICE

Schedule 00 uses Valve 1 to activate the *extend* valve for 20 cycles.

SCHEDULE 00

SQUEEZE count (EXTEND) 20 cycles
 WELD/HEAT count 10 cycles
 PERCENT CURRENT 00 percent
 HOLD count 00 cycles
 OFF count/Advance Step 05 cycles
 IMPULSES 01 (no impulses)
 COOL count 00 cycles
 VALVE MODE 01 (Valve 1)
 CYCLE MODE 02 (chained)
 SLOPE MODE 00 (no slope)
 SLOPE COUNT 00 cycles

SCHEDULE 01

SQUEEZE count (INTENSIFY) 10 cycles
 WELD/HEAT count 15 cycles
 PERCENT CURRENT 85 percent
 HOLD count 10 cycles
 OFF count 00 cycles
 IMPULSES 01 (no impulses)
 COOL count 00 cycles
 VALVE MODE 03 (Valve 1 & 2)
 CYCLE MODE 00 (non repeat)
 SLOPE MODE 00 (no slope)
 SLOPE COUNT 00 cycles

2.3.1 AIR OVER OIL RETRACTION IN SINGLE FUNCTION CONTROLS

For EN1000 or EN1001 Single Function Controls, Air Over Oil Retraction is only available in PROM firmware version 619016-002G (or later).

This feature requires the use of three solenoid valve outputs. The first output (Valve 1) is assigned to the *extend* solenoid. When the control is initiated, the *extend* valve is turned on, and the electrodes will approach the work under low pressure. The *intensify* valve (Valve 2) is then turned on once the electrodes reach the work and welding pressure is applied. The control continues onto WELD time and HOLD time. At the end of HOLD time, both the *extend* and *intensify* valves are shut off and a BLOCKING DELAY timer is then started. At the end of BLOCKING DELAY, the *blocking* valve (Valve 3) is turned on. This valve is connected to the *extend* port of the cylinder and when energized or closed, the return stroke can be halted before the gun completely opens. Initiating the *extend* valve will de-energize the *blocking* valve.

AIR OVER OIL RETRACTION is available through EXTENDED FUNCTION **P.O.=07**.

Because of the longer time that is required for the electrodes to go from the fully retracted state to the closed state, a SQUEEZE DELAY time is necessary. The SQUEEZE DELAY time is in addition to any scheduled SQUEEZE time. The control will only go through SQUEEZE DELAY when initiated from a fully retracted state. If the control is initiated when the *blocking* valve is on, the control will not go through SQUEEZE DELAY.

RETRACTION TOGGLE

When the control is programmed for AIR OVER OIL RETRACTION, FS1 can be used as an input to advance/retract the gun. When extending, the gun will advance during the programmed SQUEEZE DELAY time (using Valve 1). Valve 1 will de-energize and ADVANCE STOP will begin. Valve 3 will turn on immediately after the programmed ADVANCE STOP time (programmed OFF time on schedule 00 in Figure 2-7).

The following steps assume that a *blocking* valve is connected between TS1-SV5 and TS1-SV6 (Valve 3 output):

1. Connect a normally open momentary close type switch between TS1-FS1 and TS1-GND.
2. Program SQUEEZE DELAY to time the advance of the gun to a ready position.
3. Program an OFF time in the first of the two schedules comprising the weld sequence. This OFF time is designated as ADVANCE STOP time. This time will only occur during the FS1 toggle activation. It will not affect an actual weld sequence, since the first schedule is a non-welding part of the sequence.

NOTICE

The timing of SQUEEZE DELAY (Step 2) and OFF/ADVANCE STOP (Step 3) is counted in half cycle increments in order to double adjustment resolution.

To advance the electrodes, a momentary closure of FS1 will energize Valve 1.

The *blocking* valve will turn on immediately at the end of a programmed ADVANCE STOP time. Travel distance will depend on SQUEEZE DELAY plus ADVANCE STOP. In addition, inertia of the gun, oil pressure, etc., may influence travel distance.

2.3.1 AIR OVER OIL RETRACTION IN SINGLE FUNCTION CONTROLS (cont.)

While the *blocking* valve is energized, the Control Panel will indicate this status by blinking the VALVE 3 LED. In this state, the control does not allow programming changes.

To return the electrodes to a fully retracted state, a momentary closure of FS1 will de-energize Valve 3. The Emergency Stop input may also be used to retract the electrodes. The Valve 3 output will remain off after the Emergency Stop is activated.

In REPEAT sequences when programmed OFF time is shorter than or equal to BLOCKING time, only BLOCKING DELAY time takes place. When OFF time is greater than BLOCKING time, the *blocking* valve will turn on at the end of BLOCKING DELAY time and the control will continue through an OFF time that is equal to OFF time minus BLOCKING time.

When the control is in sequence and is in SQUEEZE DELAY or in BLOCKING DELAY time periods, the SQUEEZE and OFF indicator LEDs (respectively) will dim to half their intensity while the control continues through these times.

When **P.O.=07** is enabled, SQUEEZE DELAY time and BLOCKING DELAY time are in place for all 50 schedules.

SUCCESSIVE schedules can be used with AIR OVER OIL RETRACTION.

BEAT DURING SQUEEZE (**b.E.=01**) by definition will not work well with PROCESS OUTPUT **07** as the electrodes will completely open and the *blocking* valve will not turn on.

AIR OVER OIL RETRACTION CONNECTIONS FOR SINGLE FUNCTION CONTROLS

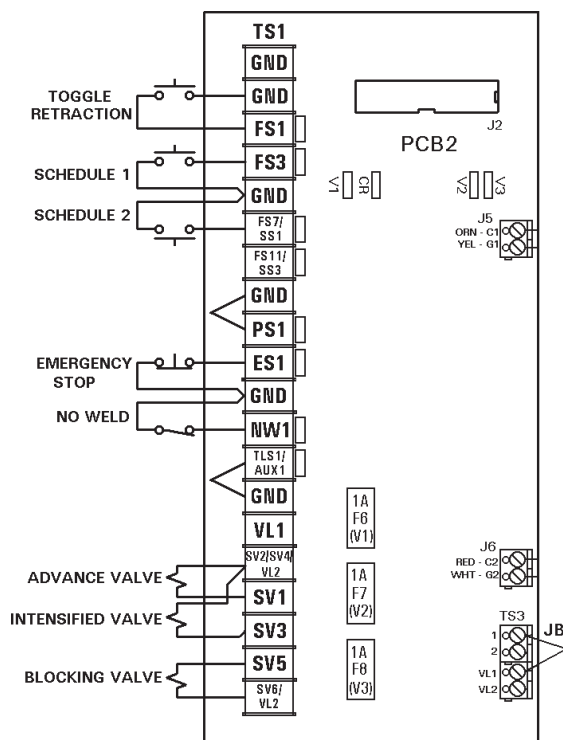


Figure 2-5. Air Over Oil Retraction connections for Single Function Controls

! WARNING !

The jumper on Terminal Strip TS3 on Terminal Strip/Firing Board A/N 410319 must be installed as JB to connect terminal 1 to VL1, as indicated by "JB" printed on the board (see Figure 2-5).

Moving this jumper will bypass the Valve Control Relay, which normally prevents valve activation until a weld sequence is initiated. Since this valve may now be activated without energizing the control relay, care **MUST** be taken to insure safe operation.

2.3.2 AIR OVER OIL RETRACTION IN CASCADE CONTROLS

This feature requires the use of three solenoid valve outputs. The first output (Valve 1) is assigned to the *extend* solenoid. When the control is initiated, the *extend* valve is turned on, and the electrodes will approach the work under low pressure. The *intensify* valve (Valve 2) is then turned on once the electrodes reach the work and welding pressure is applied. The control continues onto WELD time and HOLD time. At the end of HOLD time, both the *extend* and *intensify* valves are shut off and a BLOCKING DELAY timer is then started. At the end of BLOCKING DELAY, the *blocking* valve (PO Valve) is turned on. This valve is connected to the *extend* port of the cylinder and when energized or closed, the return stroke can be halted before the gun completely opens. Initiating the *extend* valve will de-energize the *blocking* valve.

AIR OVER OIL RETRACTION is available through EXTENDED FUNCTION **P.O.=07**.

Because of the longer time that is required for the electrodes to go from the fully retracted state to the closed state, a SQUEEZE DELAY time is necessary. The SQUEEZE DELAY time is in addition to any scheduled SQUEEZE time. The control will only go through SQUEEZE DELAY when initiated from a fully retracted state. If the control is initiated when the *blocking* valve is on, the control will not go through SQUEEZE DELAY.

RETRACTION TOGGLE

When the control is programmed for AIR OVER OIL RETRACTION, TS1-FS1 can be used as an input to advance/retract the gun. When extending, the gun will advance during the programmed SQUEEZE DELAY time (using Valve 1). Valve 1 will de-energize and ADVANCE STOP will begin. PO Valve will turn on immediately after the programmed ADVANCE STOP time (programmed OFF time on schedule 00 in Figure 2-7).

The following steps assume that a *blocking* valve is connected between TS10-SV17 and TS10-SV18 (PO Valve output):

1. Connect a normally open momentary close type switch between TS1-FS1 and TS1-GND.
2. Program SQUEEZE DELAY to time the advance of the gun to a ready position.
3. Program an OFF time in the first of the two schedules comprising the weld sequence. This OFF time is designated as ADVANCE STOP time. This time will only occur during the TS1-FS1 toggle activation. It will not affect an actual weld sequence, since the first schedule is a non-welding part of the sequence.

NOTICE

The timing of SQUEEZE DELAY (Step 2) and OFF/ADVANCE STOP (Step 3) is counted in half cycle increments in order to double adjustment resolution.

To advance the electrodes, a momentary closure of TS1-FS1 will energize Valve 1.

The *blocking* valve will turn on immediately at the end of a programmed ADVANCE STOP time. Travel distance will depend on SQUEEZE DELAY plus ADVANCE STOP. In addition, inertia of the gun, oil pressure, etc., may influence travel distance.

While the *blocking* valve is energized, the Control Panel will indicate this status by blinking the PO VALVE LED. In this state, the control does not allow programming changes.

2.3.2 AIR OVER OIL RETRACTION IN CASCADE CONTROLS (cont.)

To return the electrodes to a fully retracted state, a momentary closure of TS1-FS1 will de-energize PO Valve. The Emergency Stop input may also be used to retract the electrodes. The PO Valve output will remain off after the Emergency Stop is activated.

In REPEAT sequences when programmed OFF time is shorter than or equal to BLOCKING time, only BLOCKING DELAY time takes place. When OFF time is greater than BLOCKING time, the *blocking* valve will turn on at the end of BLOCKING DELAY time and the control will continue through an OFF time that is equal to OFF time minus BLOCKING time.

When the control is in sequence and is in SQUEEZE DELAY or in BLOCKING DELAY time periods, the SQUEEZE and OFF indicator LEDs (respectively) will dim to half their intensity while the control continues through these times.

When **P.O.=07** is enabled, SQUEEZE DELAY time and BLOCKING DELAY time are in place for all 100 schedules.

SUCCESSIVE schedules can be used with AIR OVER OIL RETRACTION.

BEAT DURING SQUEEZE (**b.E.=01**) by definition will not work well with PROCESS OUTPUT **07** as the electrodes will completely open and the *blocking* valve will not turn on.

AIR OVER OIL RETRACTION CONNECTIONS FOR CASCADE CONTROLS

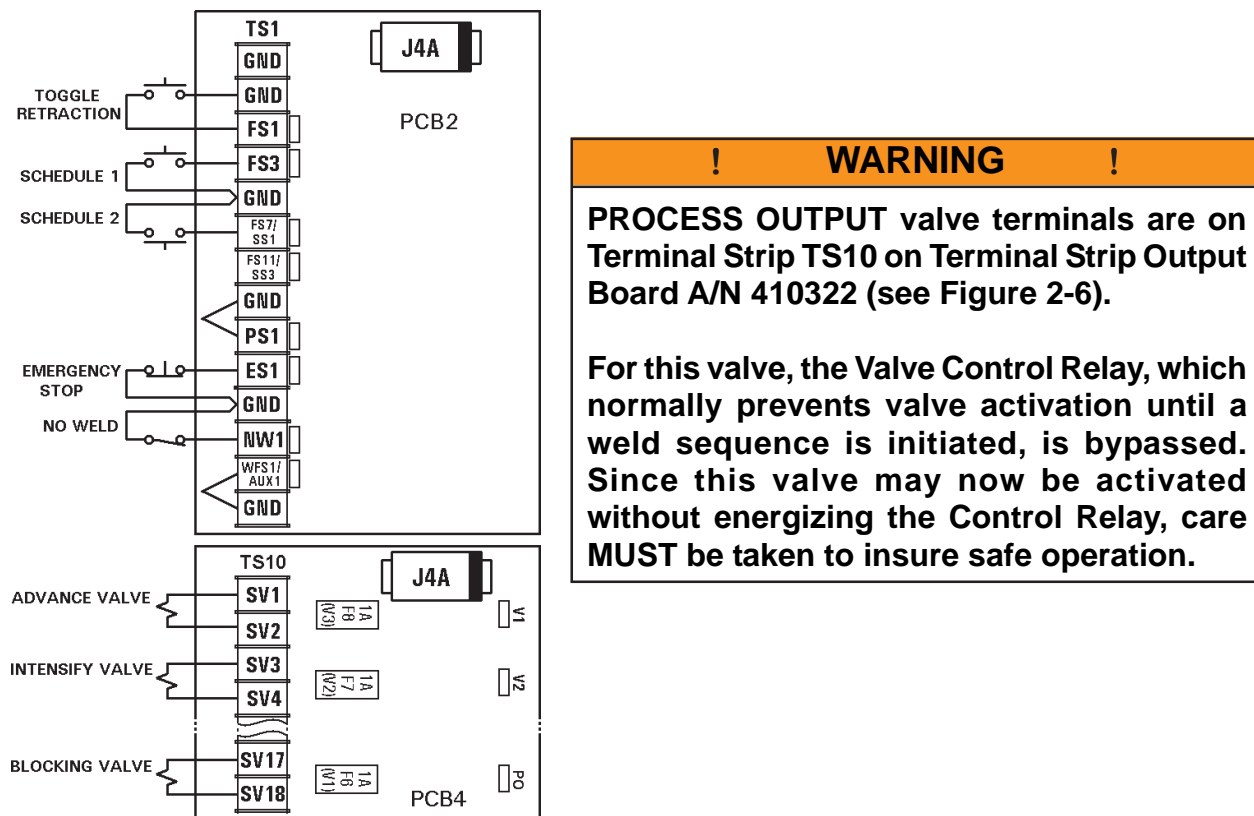


Figure 2-6. Air Over Oil Retraction connections for Cascade Controls

2.3.3 TIMING CHART ANALYSIS

Detailed sequencing of the cylinder can be better understood by studying sequence timing charts (Figure 2-7) which are discussed in the following sections.

SECTION A

Section A details a basic sequence and how it may begin. The *blocking* valve may be on or off and will be cleared by an Emergency Stop. FS3 is then initiated and schedule 00 is started.

Since the *blocking* valve is off, the sequence begins with SQUEEZE DELAY (if programmed) and then proceeds into SQUEEZE time (EXTEND). A VALVE MODE of **01** is selected to turn on Valve 1 only. Schedule 00 is CHAINED to schedule 01. Schedule 01 begins and enters into SQUEEZE time (INTENSIFY), WELD time, and HOLD time. A VALVE MODE of **03** is selected to enable both Valve 1 (*extend*) and Valve 2 (*intensify*). After HOLD time is complete, the BLOCKING DELAY (if programmed) begins. When this DELAY is complete, Valve 3 (*blocking*) turns on. The control then waits for the next initiation, leaving the *blocking* valve on.

SECTION B

Section B is the same as Section A but, since Valve 3 (*blocking*) is on, the sequence skips SQUEEZE DELAY and immediately begins schedule 00 with SQUEEZE time (EXTEND).

SECTION C

Section C illustrates how a sequence can be terminated by an Emergency Stop. When the Emergency Stop is detected, the sequence is aborted and all valves and weld output are turned off. As can be seen, when the Emergency Stop is closed, the *blocking* valve is not turned back on.

SECTION D

Section D shows a single sequence similar to Section A, followed by a REPEAT sequence. Since OFF time is less than BLOCKING time, the sequence will REPEAT when the BLOCKING time has ended.

SECTION E

Section E illustrates that different schedules may be selected having common SQUEEZE DELAY and BLOCKING times.

SECTION F

Section F shows how a momentary switch attached to FS1 can toggle the gun from retracted to non-retracted mode or vice-versa. After a momentary closure of FS1, SQUEEZE DELAY is followed by ADVANCE STOP before BLOCKING occurs.

