



**APPLICATION NOTE 700146K**  
**9-16 VALVE EXTENSION (VE) OPTION**  
 FOR EN1000/EN1001 CASCADE/MULTI-VALVE CONTROLS

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The 9-16 VALVE EXTENSION option allows an EN1000 or EN1001 Cascade/Multi-Valve Control to use a total of 16 valves. The required software for this option is integrated within the control. The 9-16 VALVE EXTENSION option may be added to a standard EN1000 or EN1001 Cascade/Multi-Valve Control, if there is no physical interference with other options (i.e., RS232, S99, or TSS). This option can be ordered with 24-240 VAC valve outputs (A/N 410322-001) or 24 VDC valve outputs (A/N 410322-003) – see Application Note 700189 for information on DC Valves.

**NOTICE**

Please contact factory before ordering this option, particularly when multiple options are used.

## 1.0 PROGRAMMING AND HARDWARE REQUIREMENTS FOR EN1000 CASCADE CONTROLS BUILT AFTER JUNE 2000 AND ALL EN1001 CASCADE CONTROLS

### 1.1 HARDWARE REQUIREMENTS

- or
- (1) 410322-001 – 9-16 Valve Extension Terminal Strip Output Board – 24-240 VAC valve output
  - (1) 410322-003 – 9-16 Valve Extension Terminal Strip Output Board – 24 VDC valve output
  - (1) 410321 (EN1000) or 410363 (EN1001) – Cascade/Multi-Valve Program Board (with PROM firmware version 619011-002 **ORIG** or later or 619044-002 **ORIG** or later)
  - (1) Application Note 700146 – 9-16 Valve Extension Option

### 1.2 PROGRAMMING

To access the EXTENDED VALVES 9 to 16:

1. Put the control in PROGRAM mode.
2. Use SELECT and stop at VALVE MODE.
3. Use the SCHEDULE push buttons and select **E.O.** (EXTENDED OUTPUT).
4. Program the VALVES as normally done with the first 8 VALVES.
5. Press ENTER.

No further programming is required. Programming is similar to controls w/o the expansion card. (No even odd rules apply) Since the firmware revision which resulted in PROM firmware version 619011-002 (June 2000), the weld control detects the Extended Output board automatically if the option is present in the control and is properly connected.

All Cascade Controls with EXTENDED VALVE option used in controls built prior to June 2000 (controls with PROM firmware version 619011-001) must follow the instructions in Section 2.0.

## 2.0 PROGRAMMING AND HARDWARE REQUIREMENTS FOR EN1000 CASCADE CONTROLS BUILT PRIOR TO JUNE 2000

### 2.1 HARDWARE REQUIREMENTS

(1) 410321 – Cascade/Multi-Valve Program Board (after 1-98; before 1-98, PCB Assembly 410321-003 was used)

### 2.2 PROGRAMMING VALVES 1 to 16 (before PROM firmware version 619011-002)

1. Select an EVEN numbered schedule to begin initiation (for the example, schedule 20).
2. Program the desired weld parameters in the EVEN numbered schedule only (i.e., SQUEEZE, WELD, PERCENT CURRENT, HOLD, OFF, IMPULSES, COOL).
3. Program VALVES 1 through 8 in the EVEN numbered schedule (for the example, schedule 20).
4. Program **04** in CYCLE mode in the EVEN numbered schedule.
5. Advance to the next consecutive schedule (for the example, schedule 21).
6. Program VALVES 9 through 16 in the ODD numbered schedule (schedule 21).

### PROGRAM EXAMPLE

SCHEDULE 20		SCHEDULE 21	
SQUEEZE	00 - 99 CYCLES	SQUEEZE	00
WELD	00 - 99 CYCLES	WELD	00
PERCENT CURRENT	00 - 99 PERCENT	PERCENT CURRENT	00
HOLD	00 - 99 CYCLES	HOLD	00
OFF IMPULSES	01 TO 99 IMPULSES	OFF IMPULSES	01
COOL	00-99 CYCLES	COOL	00
<b>VALVE MODE</b>	<b>VALVES 1 TO 8</b>	<b>VALVE MODE</b>	<b>VALVES 9 TO 16</b>
<b>CYCLE MODE</b>	<b>*** 04 ***</b>	<b>CYCLE MODE</b>	<b>** 00, 01, 02, 03, 04 **</b>
SLOPE MODE	00 - 02 UP/DOWN	SLOPE MODE	00
SLOPE COUNT	00 - 99 CYCLES	SLOPE COUNT	00
CONTACTOR	00-08	CONTACTOR	00

#### NOTICE

In a CHAINED sequence, all even schedules **MUST** be programmed with CYCLE mode **04**, even though the last schedule may not require VALVES 9 to 16.

## 3.0 OPERATION WITH 9-16 VALVE EXTENSION OPTION FOR EN1000 CASCADE CONTROLS BUILT PRIOR TO JUNE 2000

### 3.1 FIRST STAGE INITIATION (FS1 to GND)

Upon an FS1 to GND foot switch closure, First Stage initiation will activate any programmed VALVES (1 through 16) if initiation on an **EVEN numbered schedule**. First Stage initiation will activate any programmed VALVES (9 through 16) when initiating on an **ODD numbered schedule**.

Initiation of the First Stage allows for testing of the valves during programming.

### 3.2 SECOND STAGE INITIATIONS (FS3 to GND or FS7 to GND or FS11 to GND)

For sequences using VALVES 9 through 16, it is necessary to use two schedules. The first schedule stores the weld parameters and valve data only for VALVES 1 through 8. **The first schedule of any sequence MUST be an EVEN numbered schedule.** The second (ODD) schedule should contain only valve data for VALVES 9 through 16.

The easiest way to avoid errors with the EVEN-ODD rule on initiations is to program your schedules beginning on schedule 20 or 40. This way, the machine can be initiated using FS7 or FS11. These initiations select schedule 20 or 40 respectively before initiating them.

To sequence a schedule to completion, the CYCLE mode **04** will allow the EVEN numbered schedule to select VALVES 9 through 16 on the NEXT consecutive schedule (21 in our example) and activate them simultaneously with the first 8 VALVES.

### 3.3 CYCLE MODE PROGRAMMING

The most important thing to remember is that in order to use 16 valves, two schedules must be used in an EVEN-ODD sequence and the first schedule must have a CYCLE mode of **04**.

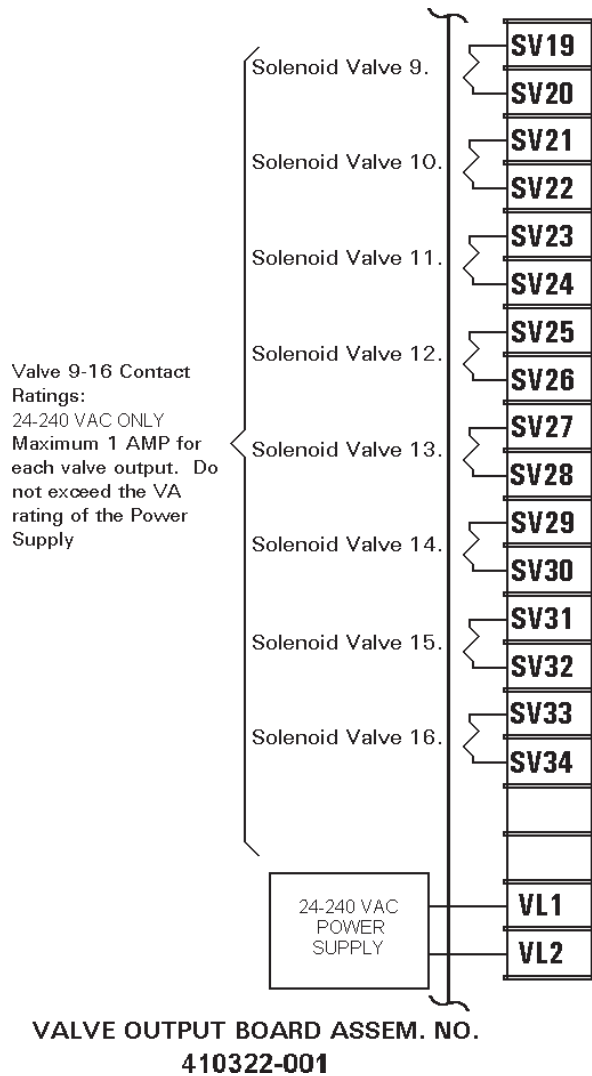
#### CHAINING

If schedule 21 is programmed with a CYCLE mode of **04**, it will be chained to schedule 22. In this case, repeat the steps used in programming schedules 20 and 21 for schedules 22 and 23, and so on if more schedules are necessary.

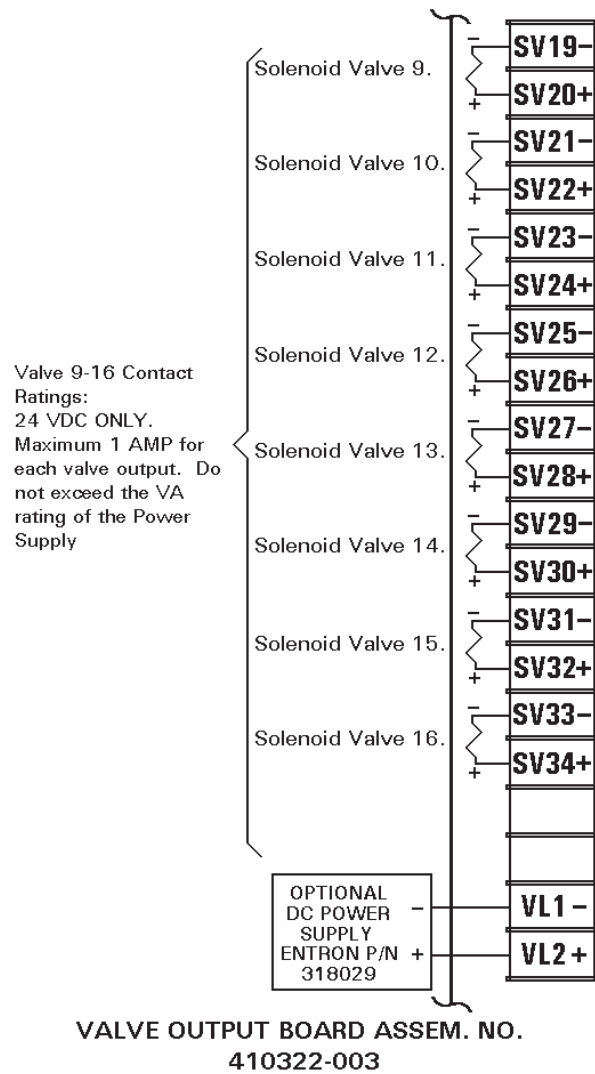
#### REPEAT AND SUCCESSIVE

The ODD numbered schedule can also be programmed with a CYCLE mode of **01** for REPEAT sequences or **03** for SUCCESSIVE sequences.

## 4.0 VALVE EXTENSION OUTPUT BOARDS



**Figure 4-1.** 24-240 VAC Valve Output Board diagram



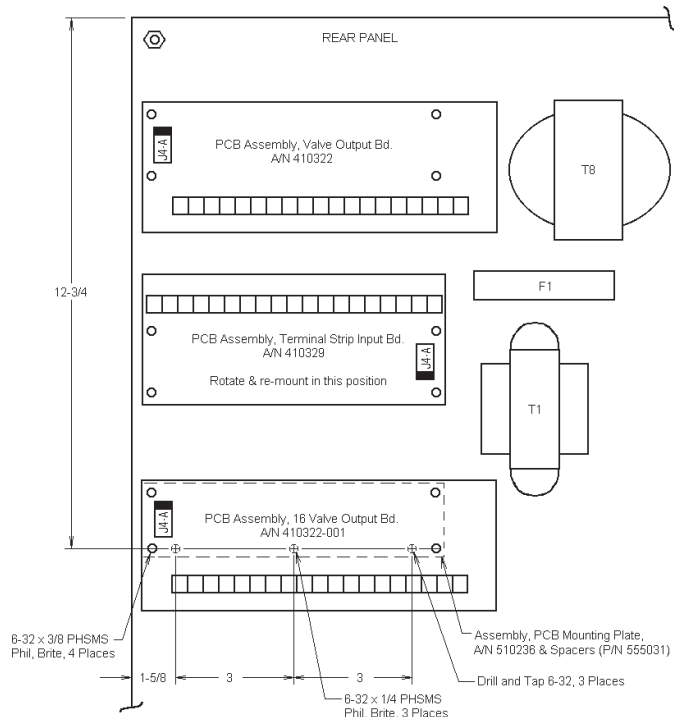
**Figure 4-2.** 24 VDC Valve Output Board diagram

## 5.0 INSTALLATION INSTRUCTIONS

### 5.1 CUSTOMER INSTALLATION OF 9-16 VALVE OUTPUT OPTION In an existing “L”, “H”, “G” or “U” Cabinet

600764-001 VAC Valves	600764-002 VDC Valves	PARTS LIST – Side Mounted Control Panel	
QUANTITY	PART NO.	DESCRIPTION	
1	410322-001	Assembly, PCB, 9-16 Valve Extension Board, 24-240VAC	
	1	410322-003 Assembly, PCB, 9-16 Valve Extension Board, 24VDC	
1	1	510236 Assembly, PCB, Mounting Plate	
1	1	322435 Harness Assembly, TS10 to TS15	
1	1	322436 Harness Assembly, J4A-J4A-J4A-J4A	
4	4	555031 Spacer, 6-32 x 1/2, 1/4 Hex Brass, Brite	
3	3	557003 6-32 x 1/4 PHSMS, Phil, Brite	
4	4	557006 6-32 x 3/8 PHSMS, Phil, Brite	
or	1	421214-035 Wiring Diagram, EN1000-Series/VE	
	1	421438-007 Wiring Diagram, EN1001-Series/VE	
	1	700146 Application Note, VE Option	

1. Remove **ALL** power to control. Open door.
2. Remove J4A-J4A-J4A harness from Program Board/Terminal Strip Output Board/Terminal Strip Input Board.
3. Remove the four (4) screws holding the Terminal Strip Input Board (A/N 410329) to its mounting bracket. Rotate the board 180° (so the terminal strip is at the top) and re-mount the board using the same four (4) screws.
4. Drill and tap rear panel per Figure 5-1, be sure to vacuum or otherwise remove **ALL** metal chips before adding Mounting Plate (A/N 510236) to rear panel using 3 ea. 6-32 x 1/4 PHSMS, Phil Brite. Add extra spacer (P/N 555031) to each existing spacer (4 places) to offset PCB 1" from panel.
5. Mount 9-16 Valve Extension PCB (A/N 410322-001 or -003) to bracket (P/N 510236) using four (4) #6-32 x 3/8 PHSMS, Phil, Brite. See Figure 5-1.
6. Connect J4A-J4A-J4A-J4A Harness (A/N 322436) and Harness Assembly TS10 to TS15 (A/N 322435) per Wiring Diagram included with this kit.



**Figure 5-1. Mounting detail for “L”, “H”, “G”, or “U” Cabinet**

#### NOTICE

On the Wiring Diagram, the dark band on connectors indicates stripe on ribbon harness. Harness **MUST** be installed with ribbon harness stripe oriented correctly.

7. Close door. Reapply power.

## 5.2 CUSTOMER INSTALLATION OF 9-16 VALVE OUTPUT OPTION In an existing “T/D” Cabinet

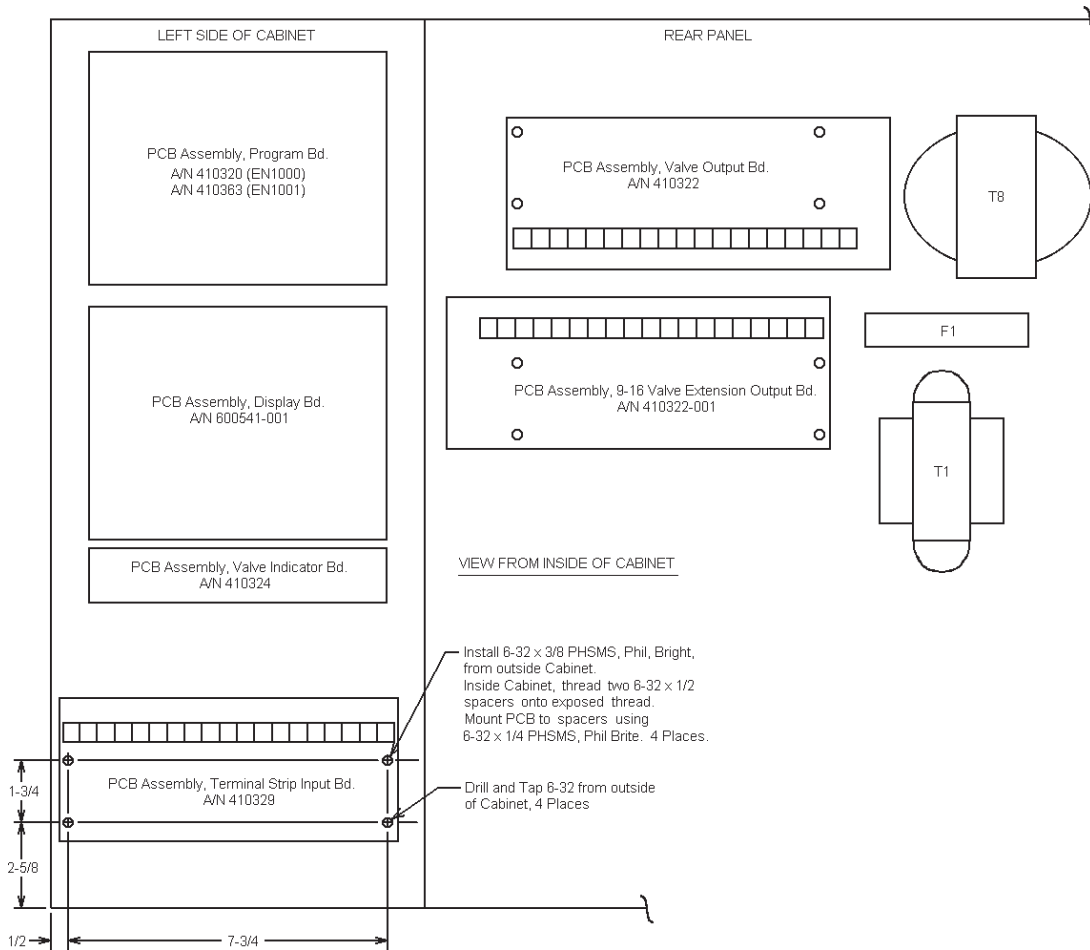
600764-003 VAC Valves	600764-004 VDC Valves	PARTS LIST – Side Mounted Control Panel	
QUANTITY	PART NO.	DESCRIPTION	
1		410322-001	Assembly, PCB, 9-16 Valve Extension Board, 24-240VAC
	1	410322-003	Assembly, PCB, 9-16 Valve Extension Board, 24VDC
1	1	322435	Harness Assembly, TS10 to TS15
1	1	322357-001	Harness Assembly, J4A-J4A-J4A-J4A
12	12	555031	Spacer, 6-32 x 1/2, 1/4 Hex Brass, Brite
4	4	557003	6-32 x 1/4 PHSMS, Phil, Brite
4	4	557006	6-32 x 3/8 PHSMS, Phil, Brite
1	1	421214-035	Wiring Diagram, EN1000-Series/VE
1	1	421438-007	Wiring Diagram, EN1001-Series/VE
1	1	700146	Application Note, VE Option

600764-005 VAC Valves	600764-006 VDC Valves	PARTS LIST – Door Mounted Control Panel	
QUANTITY	PART NO.	DESCRIPTION	
1		410322-001	Assembly, PCB, 9-16 Valve Extension Board, 24-240VAC
	1	410322-003	Assembly, PCB, 9-16 Valve Extension Board, 24VDC
1	1	322435	Harness Assembly, TS10 to TS15
1	1	322356-001	Harness Assembly, J4A-J4A-J4A-J4A
12	12	555031	Spacer, 6-32 x 1/2, 1/4 Hex Brass, Brite
4	4	557003	6-32 x 1/4 PHSMS, Phil, Brite
4	4	557006	6-32 x 3/8 PHSMS, Phil, Brite
1	1	421214-035	Wiring Diagram, EN1000-Series/VE
1	1	421438-007	Wiring Diagram, EN1001-Series/VE
1	1	700146	Application Note, VE Option

1. Remove **ALL** power to control. Open door.
2. Remove J4A-J4A-J4A harness from Program Board/Terminal Strip Output Board/Terminal Strip Input Board.
3. Remove the four (4) screws and Terminal Strip Input Board (A/N 410329) from rear panel of cabinet.
4. Drill and tap the left side of the cabinet per Figure 5-2, be sure to vacuum or otherwise remove ALL metal chips before installing four (4) 6-32 x 3/8 PHSMS, Phil, Brite from outside of cabinet. On the inside of the cabinet, mount two (2) 6-32 x 1/2 spacers (P/N 555031) on each exposed thread (4 places) to offset PCB 1" from cabinet wall.
5. On rear panel, add extra spacer (P/N 555031) to each standoff if needed (spacing should not exceed 1"). Mount 9-16 Valve Extension PCB (A/N 410322-001 or -003) to the four standoffs on the rear panel using four (4) 6-32 x 1/4 PHSMS, Phil, Brite, rotate board as shown in Figure 5-2.
6. Move Terminal Strip Input PCB (A/N 410329) to spacers on left side of cabinet using four (4) screws previously removed. See Figure 5-2.
7. Connect J4A-J4A-J4A-J4A Harness (A/N 322356-001 for “T” Cabinets, A/N 322357-001 for “D” Cabinets) and Harness Assembly TS10 to TS15 (A/N 322435) per Wiring Diagram included with this kit.

*(Instructions continued on following page)*

## 5.2 CUSTOMER INSTALLATION OF 9-16 VALVE OUTPUT OPTION In an existing “T/D” Cabinet (cont.)



**Figure 5-2.** Mounting detail for “T/D” Cabinet

### NOTICE

On the Wiring Diagram, the dark band on connectors indicates stripe on ribbon harness. Harness **MUST** be installed with ribbon harness stripe oriented correctly.

- Close door. Reapply power.

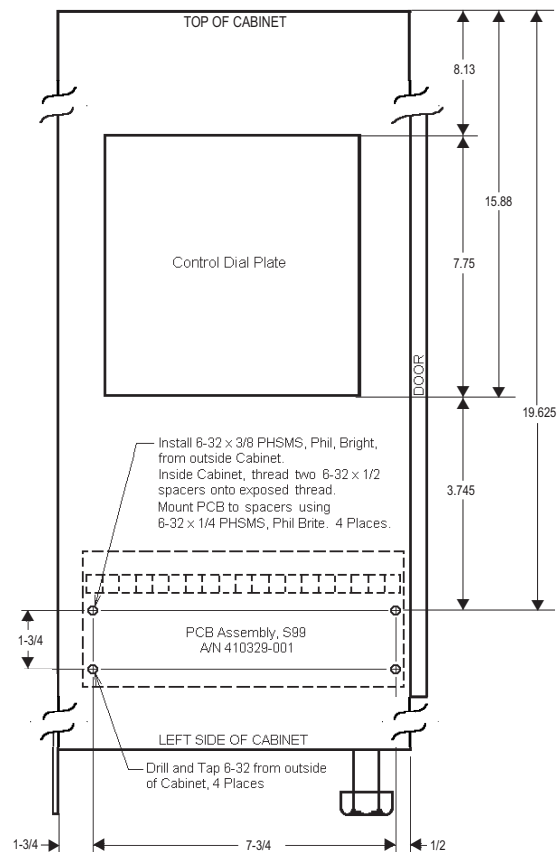


### 5.3 CUSTOMER INSTALLATION OF 9-16 VALVE OUTPUT OPTION AND S99 SCHEDULE SELECT OPTION In an existing “L”, “H”, “G” or “U” Cabinet

600765-001 Door Mtd.	600765-002 Side Mtd.	PARTS LIST	
QUANTITY	PART NO.	DESCRIPTION	
1	1	410322-001	Assembly, PCB, 9-16 Valve Extension Board, 24-240VAC
1	1	410329-001	Assembly, PCB, S99 Schedule Select Board
1	1	510236	Assembly, PCB, Mounting Plate
1	1	322435	Harness Assembly, TS10 to TS15
1		322456	Harness Assembly, J4A-J4A-J4A-J4A-J4A
	1	322457	Harness Assembly, J4A-J4A-J4A-J4A-J4A
12	12	555031	Spacer, 6-32 x 1/2, 1/4 Hex Brass, Brite
7	7	557003	6-32 x 1/4 PHSMS, Phil, Brite
8	8	557006	6-32 x 3/8 PHSMS, Phil, Brite
1	1	421214-042	Wiring Diagram, EN1000-Series/VE/S99
1	1	421438-020	Wiring Diagram, EN1001-Series/VE/S99
1	1	700146	Application Note, VE Option
1	1	700115	Application Note, S99 Option

1. Remove **ALL** power to control. Open door.
2. Remove J4A-J4A-J4A harness from Program Board/Terminal Strip Output Board/Terminal Strip Input Board.
3. Remove the four (4) screws mounting the Terminal Strip Input Board (A/N 410329) to the cabinet. Rotate the Board 180° (so the terminal strip is at the top) and re-mount the Board using the same four (4) screws.
4. Drill and tap the left side of the cabinet per Figure 5-3, be sure to vacuum or otherwise remove **ALL** metal chips before installing four (4) 6-32 x 3/8 PHSMS, Phil., Brite from outside of cabinet. On the inside of the cabinet, mount two (2) 6-32 x 1/2 spacers (P/N 555031) on each exposed thread (4 places) to offset PCB 1" from cabinet wall.
5. Mount S99 PCB (A/N 410329-001) to spacers using four (4) 6-32 x 1/4 PHSMS, Phil., Brite. See Figure 5-3.

*(Instructions continued on following page)*



**Figure 5-3.** S99 Mounting detail for “L”, “H”, “G”, or “U” Cabinet

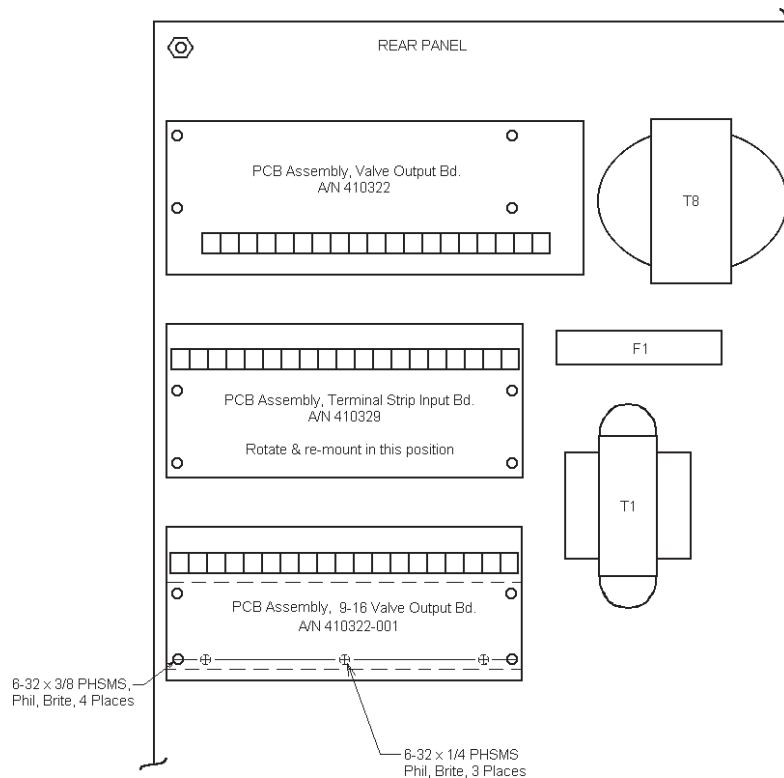
### 5.3 CUSTOMER INSTALLATION OF 9-16 VALVE OUTPUT OPTION AND S99 SCHEDULE SELECT OPTION In an existing “L”, “H”, “G” or “U” Cabinet (cont.)

6. Drill and tap rear panel per Figure 5-4, be sure to vacuum or otherwise remove ALL metal chips before adding Mounting Plate (A/N 510236) to rear panel using 3 ea. 6-32 x 1/4 PHSMS, Phil Brite. Add extra spacer (P/N 555031) to each existing spacer (4 places) to offset PCB 1" from panel.
7. Mount 9-16 Valve Extension PCB (A/N 410322-001) to bracket (P/N 510236) using four (4) 6-32 x 3/8 PHSMS, Phil., Brite. See Figure 5-4.
8. Connect J4A-J4A-J4A-J4A-J4A Harness (A/N 322456 for Door Mounted Cabinets or 322457 for Side Mounted Cabinets) and Harness Assembly TS10 to TS15 (A/N 322435) per Wiring Diagram included with this kit.

**NOTICE**

On the Wiring Diagram, the dark band on connectors indicates stripe on ribbon harness. Harness **MUST** be installed with ribbon harness stripe oriented correctly.

9. Close door. Reapply power.



**Figure 5-4.** 9-16 Valve Extension Mounting detail  
for “L”, “H”, “G”, or “U” Cabinet

## 6.0 LIST OF WIRING DIAGRAMS (available as of 6-12)

421214-035	Wiring Diagram, EN1000/VE-(1-8) Series, 230/380/460/575V
421214-041	Wiring Diagram, EN1000/VE/TSS-(1-8) Series, 230/380/460/575V, with DC Valve Output
421214-042	Wiring Diagram, EN1000/VE/S99-(1-8) Series, 230/380/460/575V, with DC Valve Output
421214-048	Wiring Diagram, EN1000/VE/485-(1-8) Series, 230/380/460/575V
421214-049	Wiring Diagram, EN1000/VE-(SCR), 230/380/460/575V
421438-007	Wiring Diagram, EN1001/VE-(1-8) Series, NEMA Cabinet, 230/380/460/575V
421438-013	Wiring Diagram, EN1001/VE/485-(1-8) Series/SP, NEMA Cabinet, 230/380/460/575V, SP=J4B for MM8
421438-020	Wiring Diagram, EN1001/VE/S99-(1-8) Series, 230/380/460/575V