VALCOR SCIENTIFIC
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SPRINGFIELD, NJ 07081
USA

# SV690C Series
# Operator and Maintenance Manual

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**REVISIONS**

| ECO # | REV LTR | PAGE NUMBERS REVISED | DATE | APPROVED |
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| | NAME | DATE |
|---|---|---|
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| | **SV690C OMM** |
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| - | ALL | Initial Release |

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| | VSF-E-0038 |
| | SHEET 2 |

# TABLE OF CONTENTS

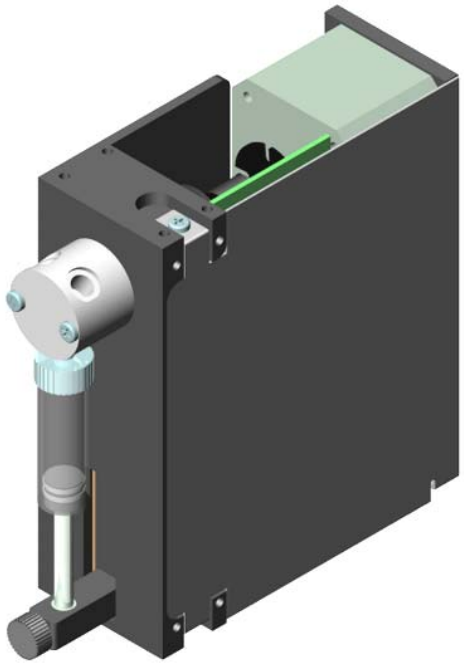
# 1. INTRODUCTION – SV690C SERIES PUMPS

The SV690C Series is a precision OEM pump module designed for use with automated instrumentation. All typical aspiration and dispensing operations expected from an OEM syringe module can be accomplished with this unit. The stepper motor driven syringe will accurately and precisely handle fluids from 5µL to 12.5 mL. Standard resolution is 3,000 steps per full syringe stroke and can be set into Hi-Res mode providing 24,000 steps.

A SV690C Series is ideal for experienced instrument manufacturers who are looking to maximize the investment they have already made in existing instrumentation, by using the SV690C Series as a direct replacement for the competitive product. This pump utilizes standard communication protocols and mounting configurations used by other compact pump designs, thereby eliminating the need to perform expensive and time consuming re-development.

This manual was created specifically for the use of instrument designers with the knowledge of existing firmware of similar designs or those looking to upgrade and /or retrofit existing applications. In order to make your product transition quick and simple, a QUICK START CONFIGURATION GUIDE is included in this manual that illustrates only those areas that are unique to the Valcor SV690C Series.

For those customers that are just being introduced to the SV690C Series design, this manual includes basic information you will require to get started. However, a complete SV690C Series Precision Pump Software Manual is available upon request.



SV690C Precision Pump Module

# QUICK START CONFIGURATION GUIDE
# (for replacing an XP3000)

## Configuration Jumpers

The SV690C Series has the configuration jumpers located in different locations (see figure on Sheet 7). The functions of the jumpers are also slightly different. Please see below for jumper settings compared to XP3000 with standard software and microstep-enabled software:

| Function | SV690C Series | XP (std) | XP (micro) | Action |
|---|---|---|---|---|
| Protocol[1] | N/A | JP1-2 | N/A | Installed = OEM |
| Reserved[2] | J2-1 | | | |
| EEPROM Mode | J2-2 | JP1-3 | JP1-3 | Installed = Autostart |
| Overload Detection | J2-3 | JP1-1 | JP1-1 | Installed = Disabled |
| Communication Rate | J2-4 | JP1-4 | JP1-4 | Installed = 38.4 K/125K |
| Valve[3] | J2-5 | JP4, 1-2 | N/A | Installed = 120º Valves |

Note 1 – The SV690C Series has automatic protocol detection.
Note 2 – A spare jumper is provided on J2-1.
Note 3 – The SV690C Series has a jumper to select between 120º 3-port valve, and all other valve types (90º).

## RS485 Termination Jumpers

The SV690C Series has the configuration jumpers located in different locations (see figure Sheet 7). Pumps are shipped with termination jumpers installed. Remove them if not needed.

| Function | SV690C Series | XP3000 | Action |
|---|---|---|---|
| RS485A | J9-1 | JP2, 1-2 | Installed = Terminated |
| RS485B | J9-2 | JP2, 3-4 | Installed = Terminated |
| CAN | J9-3 | N/A | Installed = Terminated |

## Software Compatibility

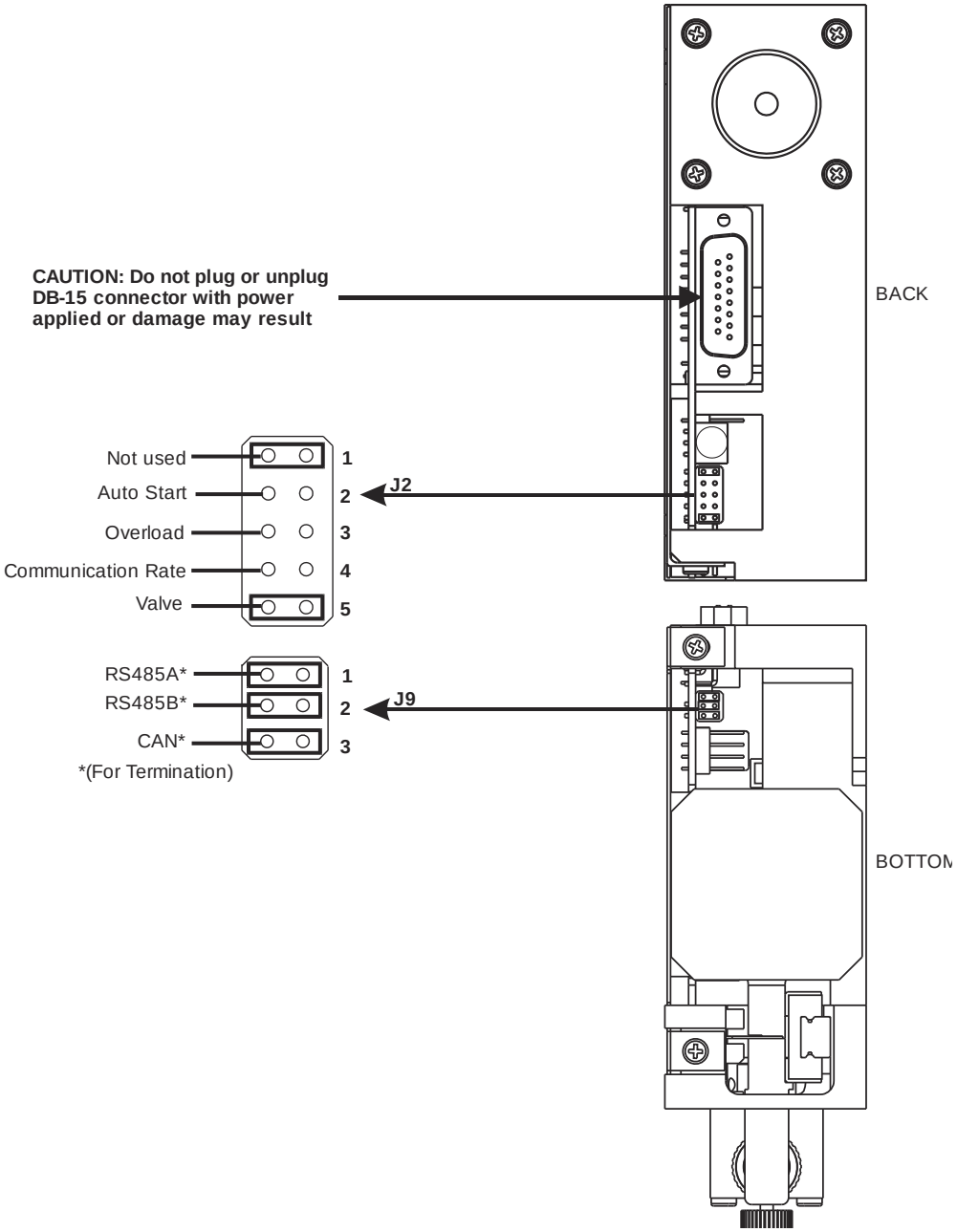
The SV690C Series is 100% compatible with the XP3000 protocols and documented command set. There are some commands and responses that are different as shown below:

| Command | Value | Description | Difference |
|---|---|---|---|
| ^ | < n > 0..255 | Sets threshold value for fluid detection | N/A for SV690C[1] |
| z | None | Set position count to encoder count | N/A for SV690C[1] |
| ?4 | | Report actual position of plunger | N/A for SV690C[1] |
| ?22 | | Report current value from fluid sensor | N/A for SV690C[1] |
| & | | Report firmware version | New response[2] |
| # | | Report firmware checksum | New response[2] |

Note 1 – The SV690C Series does not include a valve fluid detector circuit or a high resolution encoder. These commands are accepted, but are not functional.

Note 2 – The SV690C series has different electronics and firmware. These report commands will respond with the same amount of characters, but with different response data.

# QUICK START CONFIGURATION GUIDE
# SV690C SERIES JUMPER LOCATIONS



# SPECIFICATIONS

Downloadable specifications can be found on the Valcor website: www.valcor.com

## HARDWARE

### J3 Mating Connectors

| Manufacturer | Description | Manufacturer's P/N |
|---|---|---|
| AMP | 15 pin female-solder cup, receptacle | 747909-2 |
| Cinch | 15 pin female-solder cup, receptacle | DA-155 |
| | | |
| AMP | Plastic shield with male screw retainers | 207908-4 |
| Cinch | Plastic shield with male screw retainers | SDH-15GL-CS |

### J3 Wiring

Power and communication is supplied via a single cable to the SV690C Series.

| Pin | Function | Details |
|---|---|---|
| 1 | 24 VDC | See Below |
| 2 | RS232 TxD line | Output Data |
| 3 | RS232 RxD line | Input Data |
| 4 | RTS | |
| 5 | CAN HI Signal line | |
| 6 | CAN LO Signal line | |
| 7 | AUX Input #1 | TTL Level (4.7K Ω pullup) |
| 8 | AUX Input #2 | TTL Level (4.7K Ω pullup) |
| 9 | Ground | Power and Logic |
| 10 | Ground | Power and Logic |
| 11 | RS485 A line | |
| 12 | RS485 B line | |
| 13 | AUX Output #1 | TTL Level (1KΩ pullup Max Source/Sink current = ±20 mA) |
| 14 | AUX Output #2 | TTL Level (1KΩ pullup Max Source/Sink current = ±20 mA) |
| 15 | AUX Output #3 | TTL Level (1KΩ pullup Max Source/Sink current = ±20 mA) |

**CAUTION:** Do not plug or unplug DB-15 connector with power applied or damage may result.

### Power Supply Requirements

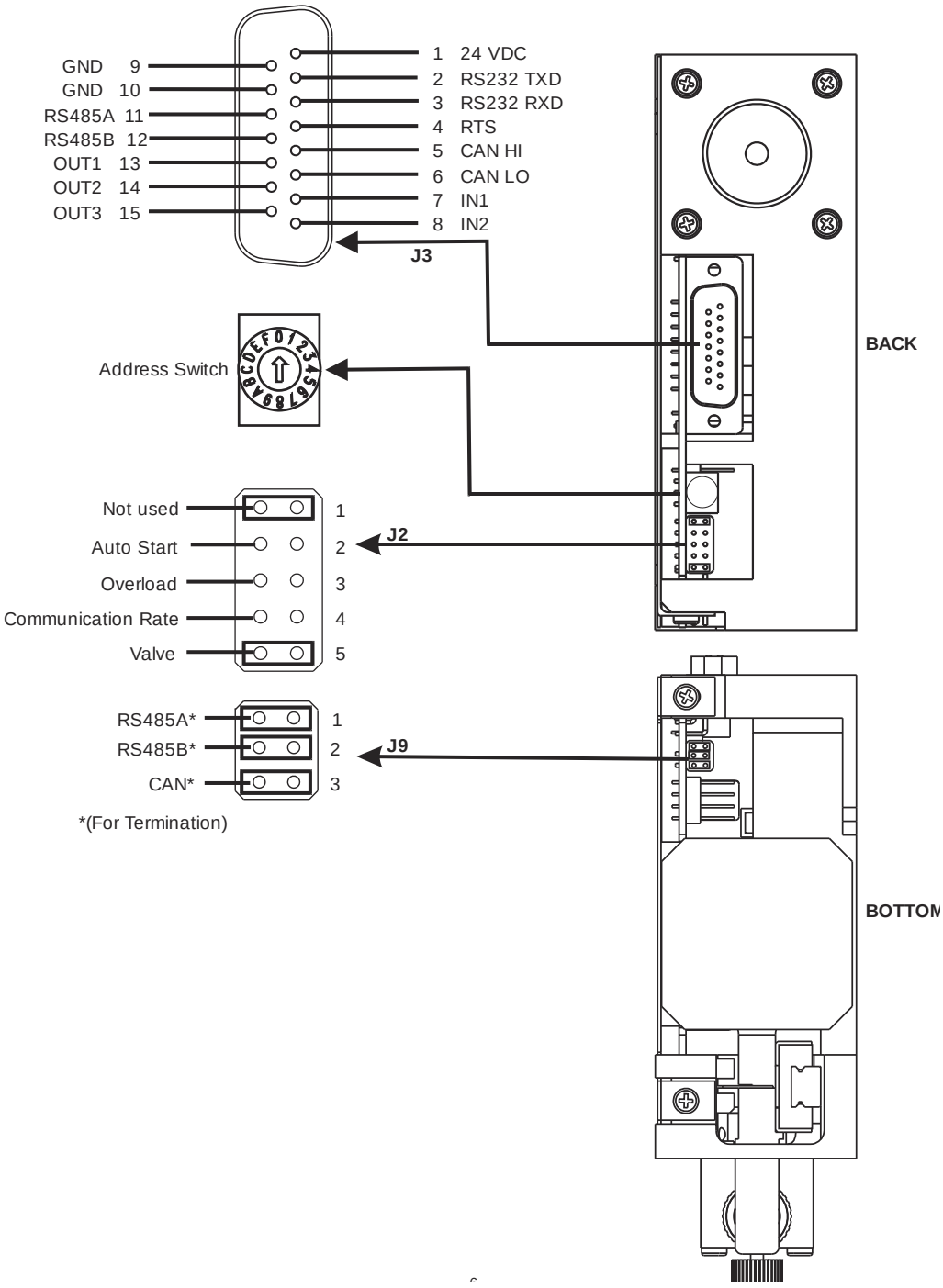
Linear or switching supplies may be used.

| | |
|---|---|
| Output Voltage | 24 VDC Nominal ±10% |
| Output Current | ≥ 1.5 Amp Peak |

## Fluid Connections

The SV690C Series has 1/4”-28 fittings as the standard configuration. M-6 connections can also be obtained through special order. Please contact Valcor for details.

**ELECTRICAL CONNECTION LOCATIONS**
**SV690C SERIES**



## CONFIGURATIN JUMPER AND SWITCH SETTINGS

**J2**

| Jumper | Function | Jumper Installed | Jumper Removed |
|---|---|---|---|
| J2-1 | Unused | Spare | |
| J2-2 | EEProm Autostart | Enabled | Disabled |
| J2-3 | Plunger Overload | Disabled | Enabled |
| J2-4 | Communication Rate | 38,400 baud (RS232/RS485)<br>125 kbits/s (CAN) | 9,600 baud (RS232/RS485)<br>100 kbits/s (CAN) |
| J2-5 | Valve | 120º 3-ports | Other Valves (90º ports) |

**J9**

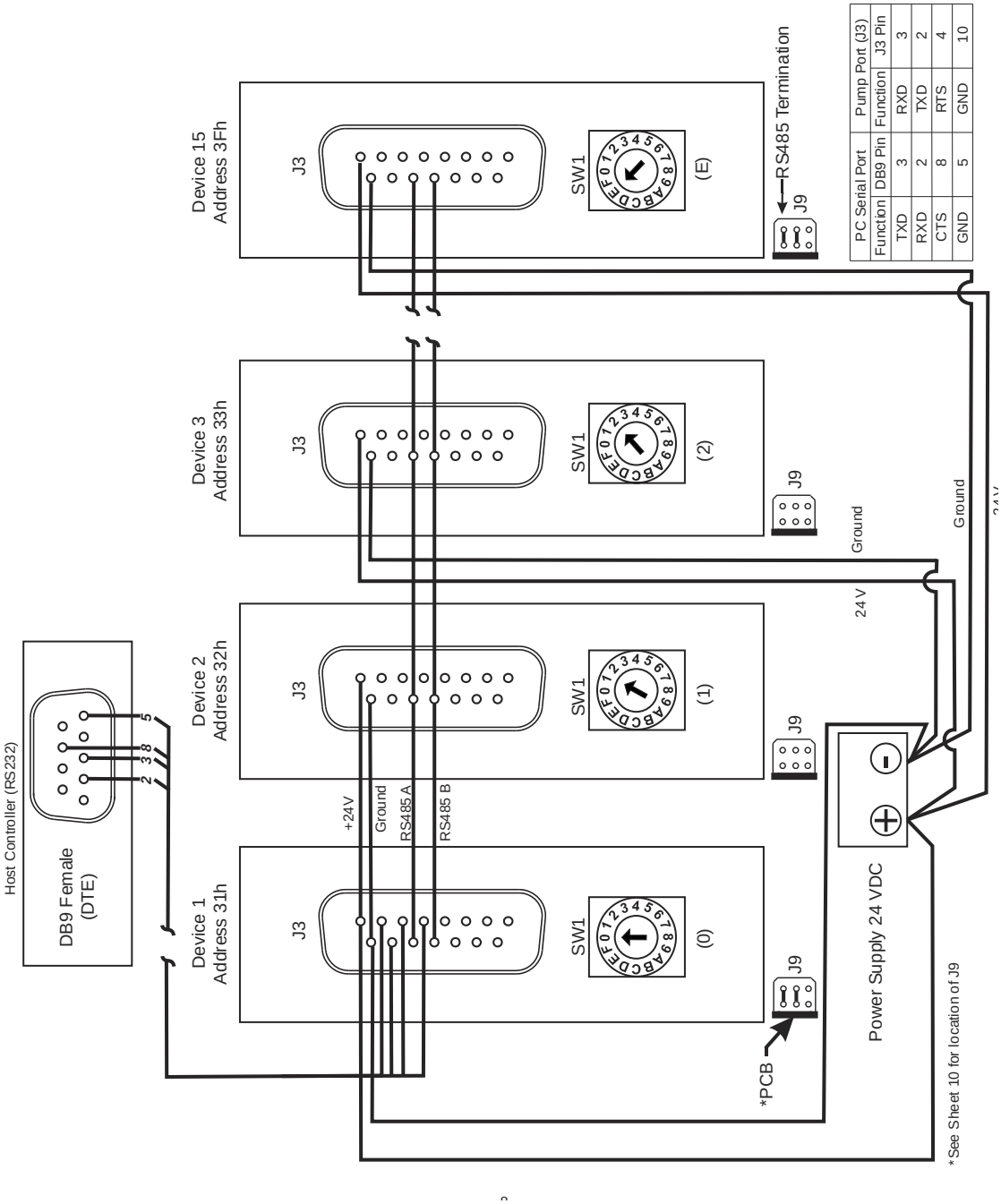
| Jumper | Function | Jumper Installed | Jumper Removed |
|---|---|---|---|
| J9-1 | RS485 Termination A | Terminated | Not Terminated |
| J9-2 | RS485 Termination B | Terminated | Not Terminated |
| J9-3 | CAN Termination | Terminated | Not Terminated |

### Address Switch

The address switch is used to provide each SV690C Series a unique address in a multi-pump application. The address switch has 16 locations (0 – E). The F address location is used to activate the self-test. The address locations can be set by using a small flathead screwdriver and rotating the switch in either direction to the appropriate address.

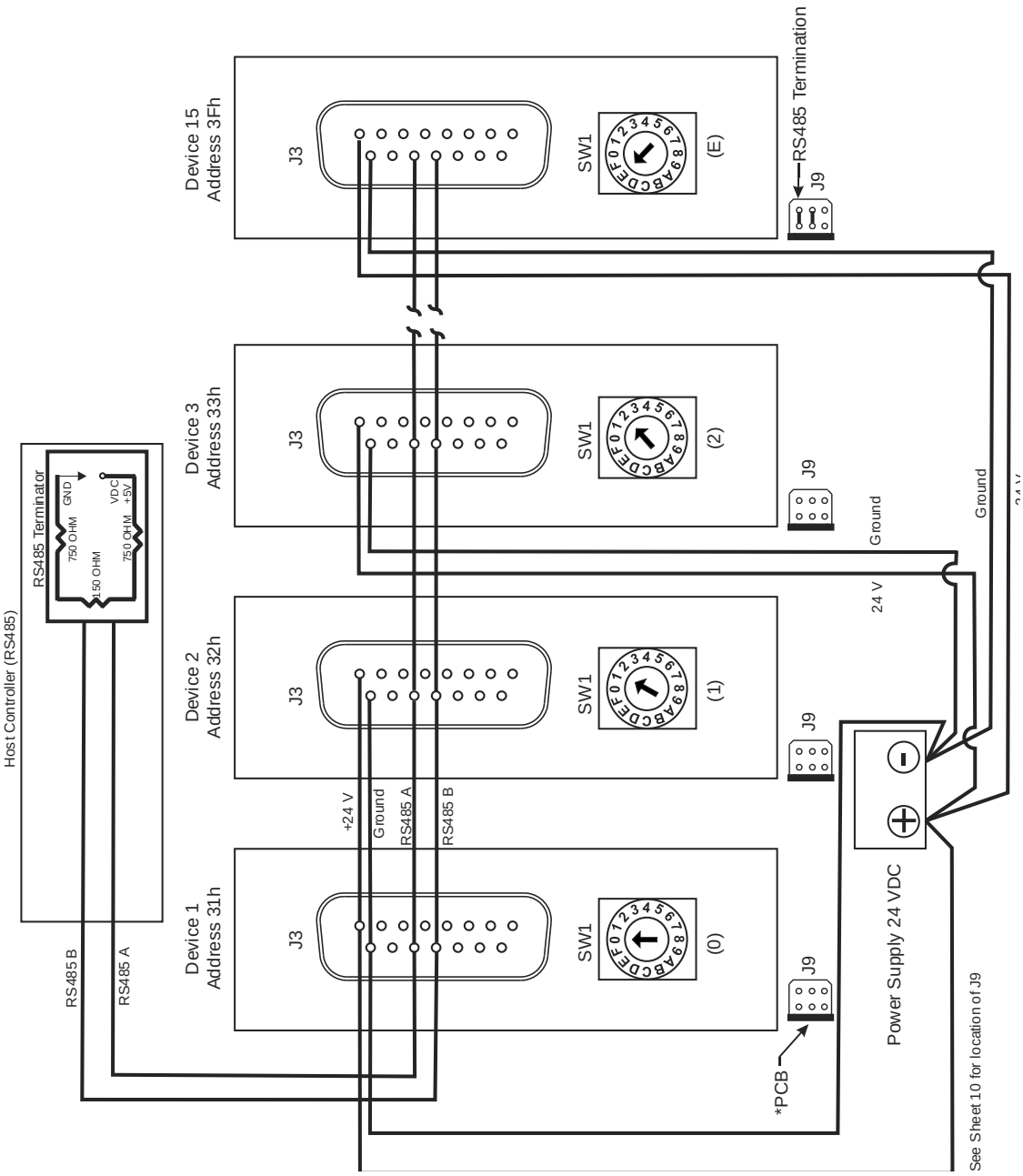

Address Switch

# RS232 CABLING DIAGRAM

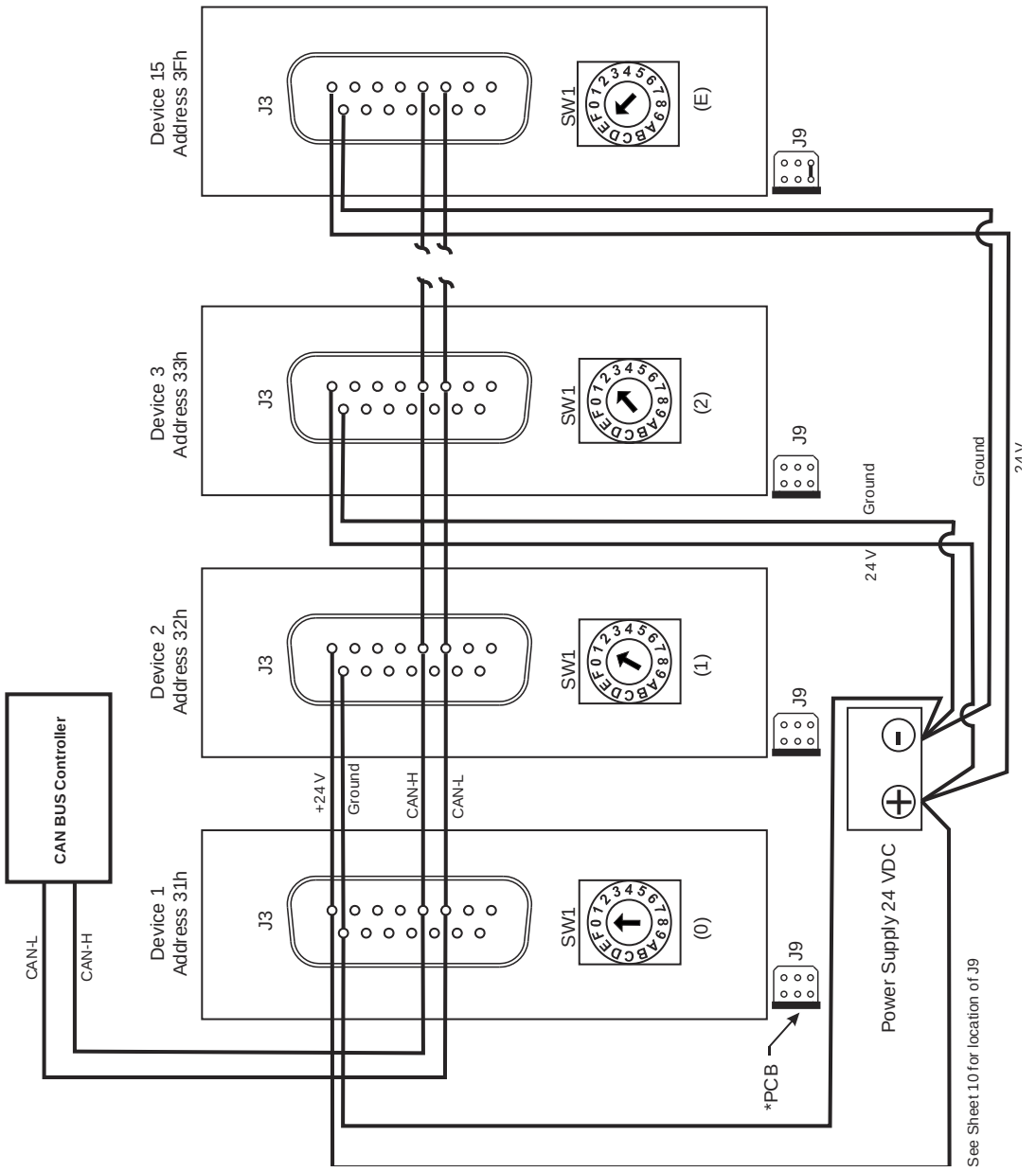



| PC Serial Port | | Pump Port (J3) | |
|---|---|---|---|
| Function | DB9 Pin | Function | J3 Pin |
| TXD | 3 | RXD | 3 |
| RXD | 2 | TXD | 2 |
| CTS | 8 | RTS | 4 |
| GND | 5 | GND | 10 |

# RS485 CABLING DIAGRAM



# CAN CABLING DIAGRAM



# SOFTWARE
# RS/232 AND RS485 COMMAND SUMMARY

## Control Commands

| Command | Operand Range <n>* ( )=Microstep Mode Limits | Default Operand | Power Up Default | Command Description | Operand Description |
|---|---|---|---|---|---|
| R | N/A | N/A | | Execute command string | |
| x | 0…3 | N/A | | Execute next command in buffer based on auxiliary inputs | <0> = Execute if Input 2 is Low and Input 1 is Low<br><1> = Execute if Input 2 is Low and Input 1 is High<br><2> = Execute if Input 2 is High and Input 1 is Low<br><3> = Execute if Input 2 is High and Input 1 is High |
| X | N/A | N/A | | Re-execute last executed command string | |
| G<n> | 0…30000 | 0 | | Repeat command sequence | 0 = Loop forever |
| g | N/A | N/A | | Mark the start of a repeat sequence | |
| M<n> | 0…30000 | | | Delay command execution | Milliseconds |
| H<n> | 0 – 2 | 0 | | Halt command execution | <0> = Wait for [R] or either input 1 or 2 to go low<br><1> = Wait for [R] or input 1 to go low<br><2> = Wait for [R] or input 2 to go low |
| T | N/A | N/A | | Terminate command | |

* Operand range listed is for 3000 step/stroke pumps only

# SOFTWARE
# RS/232 AND RS485 COMMAND SUMMARY - Continued

## Initialization Commands

| Command | Operand Range <n>* ( )=Microstep Mode Limits | Default Operand | Power Up Default | Command Description | Operand Description |
|---|---|---|---|---|---|
| Z<n> | 0…40 | 0 | | Initialize plunger, valve to the right | <0> = Initialize at full plunger force<br><1> = Initialize at low plunger force<br><2> = Initialize at lower plunger force than<br><3> = Initialize at speed 16, low plunger force<br><4> = Initialize at speed 18, low plunger force<br><5-9> = same as <0><br><10-40> = initialize at defined plunger speed |
| Y<n> | 0…40 | 0 | | Initialize plunger, valve to the left | Same as Z<n> |
| W<n> | 0…40 | 0 | | Initialize plunger without valve | Same as Z<n> |
| z<n> | 0…3000 (0…24000) | 0 | | Set pump's internal position counter to value specified | |
| k<n> | 0…120 (0…960) | | 24 | Syringe dead volume command | |

* Operand range listed is for 3000 step/stroke pumps only

# SOFTWARE
# RS/232 AND RS485 COMMAND SUMMARY - Continued

**Plunger Movement Commands** (Note: Argument limits are for 3000 step/stroke pumps)

| Command | Operand Range <n>* ( )=Microstep Mode Limits | Default Operand | Power Up Default | Command Description | Operand Description |
|---|---|---|---|---|---|
| A<n> | 0…3000 (0…24000) | 0 | | Move plunger to absolute position | |
| a<n> | 0…3000 (0…24000) | 0 | | Move plunger to absolute position, not busy | |
| P<n> | 0…3000 (0…24000) | 0 | | Relative pickup | |
| p<n> | 0…3000 (0…24000) | 0 | | Relative pickup, not busy | |
| D<n> | 0…3000 (0…24000) | 0 | | Relative dispense | |
| d<n> | 0…3000 (0…24000) | 0 | | Relative dispense, not busy | |

## Valve Commands

| Command | Operand Range <n>* ( )=Microstep Mode Limits | Default Operand | Power Up Default | Command Description | Operand Description |
|---|---|---|---|---|---|
| I | N/A | N/A | | Move valve to Input position | |
| O | N/A | N/A | | Move valve to Output position | |
| B | N/A | N/A | | Move valve to Bypass position | |
| E | N/A | N/A | | Move valve to Extra position. Valid for 4 position valves only. | |

* Operand range listed is for 3000 step/stroke pumps only

# SOFTWARE
# RS/232 AND RS485 COMMAND SUMMARY - Continued

## Set Commands

| Command | Operand Range <n>* ( )=Microstep Mode Limits | Default Operand | Power Up Default | Command Description | Operand Description |
|---|---|---|---|---|---|
| K<n> | 0…100 (0…800) | | 10 | Backlash steps | |
| L<n> | 1…20 | | 14 | Set acceleration/deceleration slope | |
| v<n> | 0…1000 | | 900 | Set start velocity in Hz | |
| V<n> | 1…6000 | | 1400 | Set top velocity in Hz | |
| S<n> | 0…40 | | 11 | Set speed | |
| c<n> | 1…2700 | | 900 | Set cutoff velocity in Hz | |
| h<n> | 0…100 | | 10 | Set syringe hold current in % | |
| m<n> | 0…100 | | 75 | Set syringe run current in % | |
| C<n> | 0…025 | | 0 | Cutoff velocity in steps | |
| N<n> | 0…2 | | 0 | Set microstep positioning and velocity mode | <0> = Both microstep position and velocity mode off<br><1> = Microstep position mode on, velocity mode off<br><2> = Both microstep position and velocity mode on |
| J<n> | 0…7 | | | Sets the 3 TTL auxiliary outputs | |
| J<ppppn> | <pppp> 1-3000<br><n> 0…7 | | | Set auliliary outputs based on syringe position | |
| ^<n> | 0…255 | | | Non-functional command | |
| b | N/A | N/A | | Non-functional command | |

* Operand range listed is for 3000 step/stroke pumps only

# SOFTWARE
# RS/232 AND RS485 COMMAND SUMMARY - Continued

## Eeprom Commands

| Command | Operand Range <n>* ( )=Microstep Mode Limits | Default Operand | Power Up Default | Command Description | Operand Description |
|---|---|---|---|---|---|
| s<n> | 0…14 | | | Load program string into EEprom | |
| e<n> | 1…14 | | | Execute EEprom string | |
| U | | | | Set pump configuration parameters | Refer to Software Manual |
| u | 1…16 | | | Set system configuration parameter into EEprom | For factory use only |

* Operand range listed is for 3000 step/stroke pumps only

# SOFTWARE
# RS/232 AND RS485 COMMAND SUMMARY - Continued

## Report Commands

| Command | Operand Range <n>* ( )=Microstep Mode Limits | Default Operand | Power Up Default | Command Description | Operand Description |
|---|---|---|---|---|---|
| Q | N/A | N/A | | Report system status | |
| ? | N/A | N/A | | Report absolute plunger position | |
| ?0 | N/A | N/A | | Same as ? | |
| ?1 | N/A | N/A | | Report start velocity in Hz | |
| ?2 | N/A | N/A | | Report peak velocity in Hz | |
| ?3 | N/A | N/A | | Report cutoff velocity in Hz | |
| ?4 | N/A | N/A | | Same as ? | |
| ?5 | N/A | N/A | | Same as ? | |
| ?6 | N/A | N/A | | Reports valve position (I, O, B, E) | |
| ?10 | N/A | N/A | | Report command buffer status | |
| ?12 | N/A | N/A | | Report number of backlash steps | |
| ?13 | N/A | N/A | | Report status of Aux 1 input | |
| ?14 | N/A | N/A | | Report status of Aux 2 input | |
| ?15 | N/A | N/A | | Report number of pump initializations. Counter not implemented, will always report 1 | |
| ?16 | N/A | N/A | | Report number of plunger movements. Counter not implemented, will always report 1 | |
| ?17 | N/A | N/A | | Report number of valve movements. Counter not implemented, will always report 1 | |
| ?18 | N/A | N/A | | Number of valve movements since last ?18 | |
| ?19 | N/A | N/A | | Reports if pump is initialized with a Y, Z, z, or W command.<br>0 = not initialized<br>1 = initialized | |
| ?20 | N/A | N/A | | Report firmware checksum | |
| ?22 | N/A | N/A | | Non-functional command for compatibility, will always return 255 | |
| ?23 | N/A | N/A | | Report firmware version | |
| ?24 | N/A | N/A | | Report the syringe's dead volume as set by the k command | |
| ?25 | N/A | N/A | | Report hold current in % | |
| ?26 | N/A | N/A | | Report run current in % | |
| ?27 | N/A | N/A | | Report EEPROM configuration data as set by the u command | |
| ?28 | N/A | N/A | | Report if 3 or 4 position valve is installed (jumper status) | |
| ?29 | N/A | N/A | | Same as Q | |
| ?30-?44 | N/A | N/A | | Report user EEPROM execution strings | |

* Operand range listed is for 3000 step/stroke pumps only

# SOFTWARE
# RS/232 AND RS485 COMMAND SUMMARY - Continued

## Report Commands - continued

| Command | Operand Range <n>* ( )=Microstep Mode Limits | Default Operand | Power Up Default | Command Description | Operand Description |
|---|---|---|---|---|---|
| F | N/A | N/A | | Same as ?10 | |
| & | N/A | N/A | | Same as ?23 | |
| # | N/A | N/A | | Same as ?20 | |
| RZ | N/A | N/A | | Same as ? | |
| RV | N/A | N/A | | Same as & and ?23 | |
| % | N/A | N/A | | Same as ?18 | |

* Operand range listed is for 3000 step/stroke pumps only

# SOFTWARE
# CAN COMMAND SUMMARY

## **On-the-fly Commands** Frame Type = 0

| Command | Operands | Command Description |
|---|---|---|
| V | Same as RS232/RS485 | Top Velocity |
| T | N/A | Terminate |

## **Action Commands** Frame Type = 1

| Command | Operands | Command Description |
|---|---|---|
| | | All RS232/RS485 commands, with the exception of Report commands, are valid Action commands in CAN bus Mode. |

## **Common Commands** Frame Type = 2

| Command | Operands | Command Description |
|---|---|---|
| 0 | N/A | Reset mode |
| 1 | N/A | Start loaded command |
| 2 | N/A | Clear loaded command |
| 3 | N/A | Repeat last command, like X |
| 4 | N/A | Stop action immediately, same as T command |

# SOFTWARE
# CAN COMMAND SUMMARY - Continued

**Report Commands** Frame Type = 4

| Command | Operands | Command Description |
|---|---|---|
| 0 | N/A | Plunger position |
| 1 | N/A | Reports encoder position, like ?4 |
| 2 | N/A | Same as report command 0 |
| 3 | N/A | Reports valve position, like ?6 |
| 4 | N/A | Top velocity, like ?2 |
| 6 | N/A | Start velocity, like ?1 |
| 7 | N/A | Cutoff velocity, like ?3 |
| 10 | N/A | Buffer status, like F |
| 12 | N/A | Backlash steps, like ?12 |
| 13 | N/A | Input 1 status, like ?13 |
| 14 | N/A | Input 2 status, like ?14 |
| 15 | N/A | Number of pump initializations, like ?15. Note, currently not implemented, always returns a 1 |
| 16 | N/A | Number of plunger movements, like ?16. Note, currently not implemented, always returns a 1 |
| 17 | N/A | Number of valve movements, like?17. Note, currently not implemented, always returns a 1 |
| 18 | N/A | Number of valve movements since last report, like ?18 |
| 19 | N/A | Report if pump is initialized. 1 + initialized, 0 = not initialized |
| 20 | N/A | Firmware checksum, like ?20 |
| 22 | N/A | Non-functional command to maintain backward firmware compatibility. Will always return 255 |
| 23 | N/A | Firmware version, like & |
| 24 | N/A | Syringe dead volume, like ?24 |
| 29 | N/A | Current status, like Q |

# MAINTENANCE

## Recommended Maintenance

| Daily Maintenance | Action |
|---|---|
| Inspect syringe seals and valves for leaks and proper operation | Replace as required |
| Inspect tubing fittings for leaks | Tighten or replace as required |
| Inspect for any fluid or material on outside of pump | Clean as required |
| "Park" inactive syringes | Flush with DI water at end of use and "park" syringe full of system fluid in full down position |

## SYRINGE REPLACEMENT

**To replace the syringe, prime all fluid from the syringe, and follow the steps below:**

**1.** To replace the syringe, lower the plunger driver.

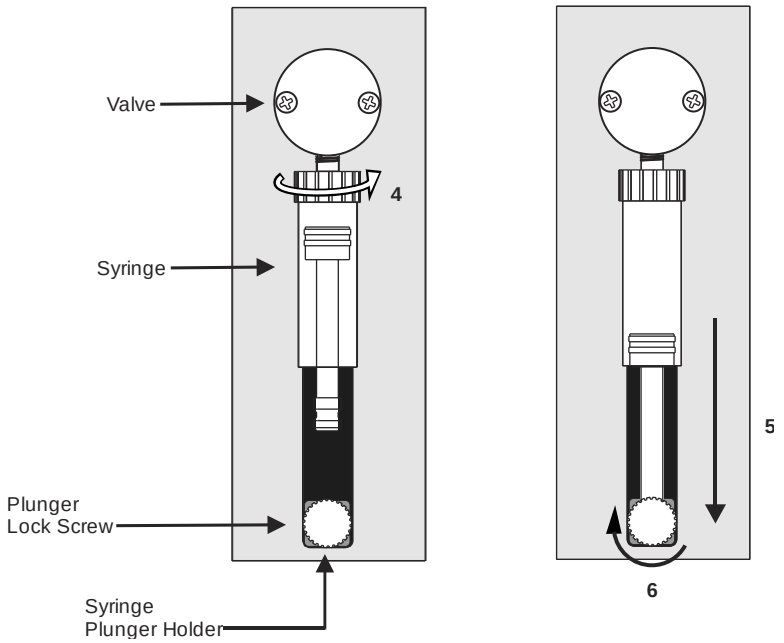
- For 3000 step/stroke pumps, if the power is on, this can be done by sending the "A3000R" command or if the pump is powered off, manually lower the plunger by pushing firmly down on the syringe plunger holder.
- For 24000 step/stroke pumps, with the power on, send the "A24000R" command. You cannot manually lower the plunger on 24000 step/stroke pumps.

**2.** Turn the plunger lock screw counterclockwise 3 turns.

**3.** Turn the syringe counter clockwise and remove from the valve.

To install the syringe follow the setps below:

4. Screw the threaded portion of the syringe clockwise into the valve.
5. Fully seat the plunger into the syringe plunger holder.
6. Securely tighten (clockwise) the plunger lock screw.
7. Initialize the pump.



# VALVE REPLACEMENT

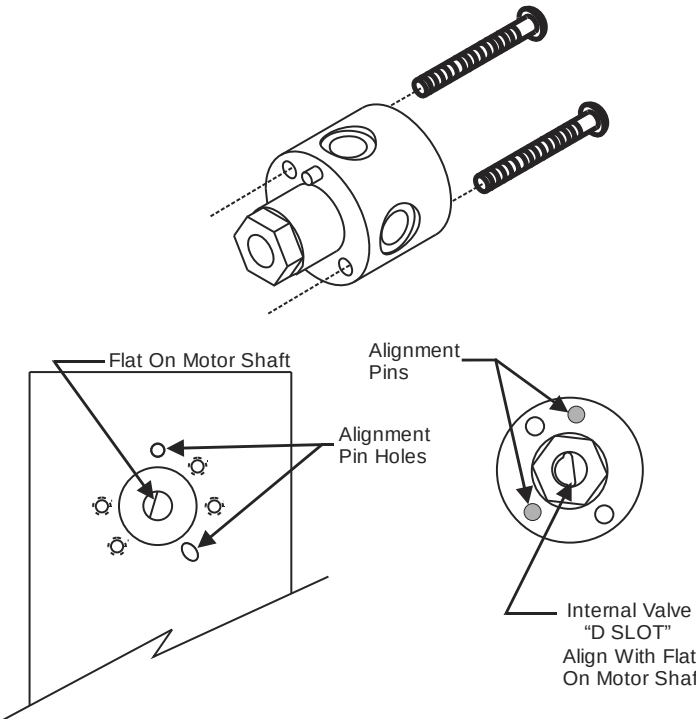
**NOTE: Valcor syringe pump valves are interchangeable among pumps. Refer to the "Configuration Jumper and Switch settings", ( Sheet 11) for instructions.**

**To replace the valve, prime all fluid from the syringe, and follow the steps below:**

1. Remove syringe as described in steps 1 – 3 on Sheet 25.
2. Disconnect the tubing from the valve.
3. Remove the two valve screws used to secure the valve to the panel.
4. Remove the valve from the pump.

**To install the valve follow the below steps:**

5. Align internal valve "D" slot with the flat on the motor shaft.
6. Gently push and rotate the valve into the correct position to align the pins with the holes in the panel.
7. Securely tighten (clockwise) the plunger lock screws.
8. Initialize the pump.



# ORDERING INFORMATION

## ACCESSORIES AND REPLACEMENTS

To view or download Accessories and/or Replacement items available for the SV690C Series pumps, please visit our website at www.valcor.com.

## ORDERING INFORMATION/CUSTOMER SERVICE

Valcor is committed to exceeding our customers expectations when it comes to our products and services. To place an order or inquire on the SV690C Series or any Valcor product, please contact Valcor at one of the following:

Valcor Engineering Corporation
2 Lawrence Road
Springfield, NJ 07081
(973) 467-8400
(973) 467-9592 (FAX)
scientific@valcor.com
www.valcor.com

## WARRANTY AND RETURNS

We design and manufacture our syringe pumps to be the most reliable product available. We stand behind the SV690C Series pumps with a 1 year warranty on material and workmanship, excluding abuse and misuse. If notified of such defects during the warranty period, Valcor will, at its option, either repair or replace products which prove to be defective.

Please refer to the Valcor website www.valcor.com for detailed warranty and return information.