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CHEMINERT® MODEL C55 & C65(Z) SELECTORS INSTALLATION & MAINTENANCE

Technical Note 821

The Cheminert® C55 (HPLC) and C65 (LC) series selectors are integrated motor/valve assemblies designed specifically to be built into OEM systems.

INITIAL PRECAUTIONS

After unpacking the injector, leave the protective cap over the valve ports until you are ready to install the unit. As supplied, all surfaces are clean and free of contaminants, and must be kept clean to prevent valve damage. Open ports and fittings cause unnecessary risk of particulate matter entering the valve and scratching the sealing surfaces, which is the most frequent cause of premature valve failure.

WARNING: The most common source of particulate and chemical contamination is tubing which has not been properly cleaned before installation in the valve. Failure to observe proper cleanliness procedures during installation of the valve voids the manufacturer's warranty.

INSTALLATION

MOUNTING

Mount the unit in a horizontal position. Avoid any orientation that positions the control board on the bottom, where it could be damaged by leakage. Mounting hole locations are shown in **Figure 1**. There are four 4-40 tapped mounting holes on the valve face of the gearbox and another four on the side of the gear housing.

NOTE: 8 and 10 port valves with 1/4-28 fittings have larger bodies which block the mounting holes on the valve face, as highlighted in the red box of **Figure 1**.

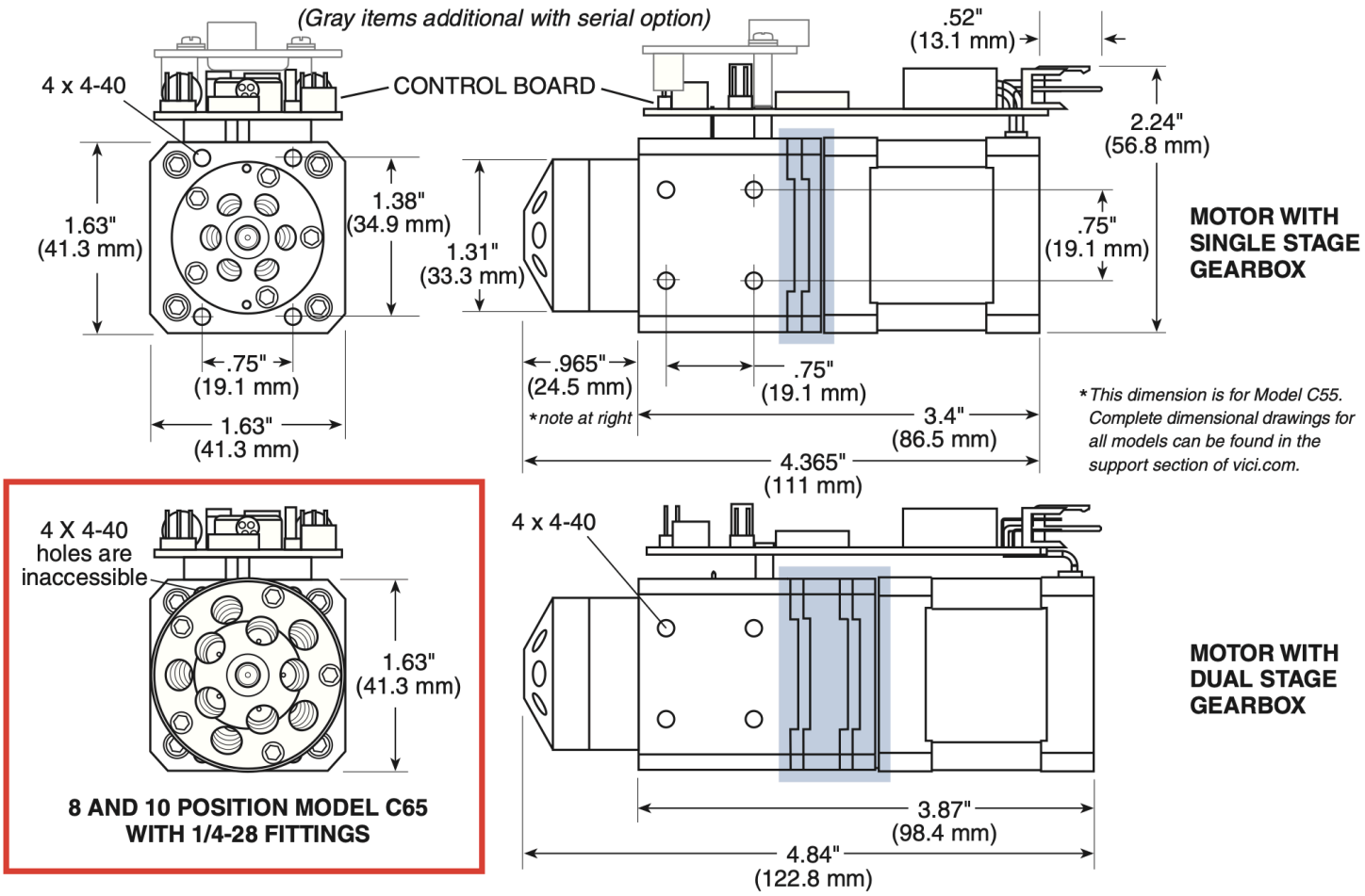
ELECTRICAL CONNECTIONS

Cables for electrical connections can either be ordered from VICI or constructed in-house. To order from VICI, request product numbers I-25176 for the I/O control cable and I-24780 for the power cable.

If you prefer to make your own cables for I/O control and power:

1. Use a Molex 26-03-4020 shell and 08-58-0111 contacts with 22 awg stranded wire to supply 24 volt current (3 amps recommended) to the connector marked J1 (See **Figure 3**). The motor can draw as much as 2.5 amps during movement so make sure there is adequate power available, and do not share power with other sensitive circuits.

FIGURE 1: Dimensions for models with single stage gearbox (top) and dual stage gearbox (bottom). The shading indicates the area to check for a quick model identification.



VALVE SCHEMATICS & SWITCHING TIMES

FIGURE 2: Valve schematics

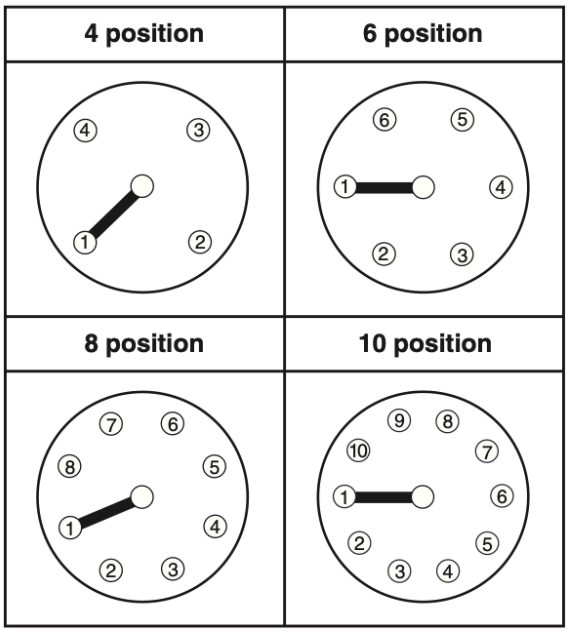


Table 1: Time required to move between positions

SINGLE STAGE		
	1 POSITION	EACH ADDTL. POSITION
4 positions	150 ms	111 ms
6 positions	115 ms	71 ms
8 positions	96 ms	55 ms
10 positions	85 ms	43 ms

DUAL STAGE		
	1 POSITION	EACH ADDTL. POSITION
6 positions	269 ms	230 ms
8 positions	212 ms	173 ms
10 positions	184 ms	133 ms
12 positions	154 ms	118 ms

NOTE: On the initial power up, the actuator automatically executes a startup sequence to find its location flag. This sequence, which takes 1.45 seconds on a single stage actuator and 4.2 seconds on a dual stage actuator, ends with the valve in position 1. After the sequence is finished, the valve can be positioned as desired.

2. Use an Amphenol 65846-015LF shell and 47715-000LF contacts to make the connection to Connector J3, which provides the contact closure input and detects the output of the position sensor (see **Figure 4** and **Table 2**).

Position feedback is obtained from the A and outputs shown in **Figure 4**. These are 5 volt tolerant, 3 volt logic outputs, sourcing and sinking a maximum of 20 milliamperes each. An output will go high (+3V) when the valve reaches the respective position.

CAUTION: Do not attempt to source or sink more than 20 mA from either output.

FIGURE 3: Power connector J1, pin view.

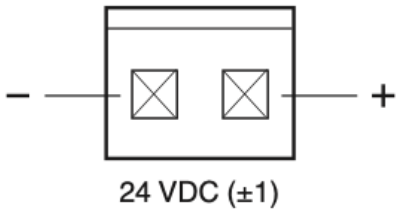
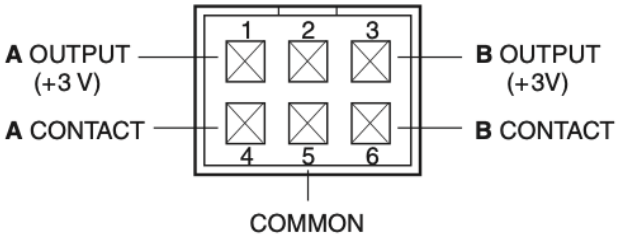


FIGURE 4: Control connector J3, pin view.



MOTOR CONTROL METHODS

STEP CONTACT CLOSURE

Applying a connection between the common and "A contact" pins causes the selector to move to the next position in the direction set Table 2: Connector J3 by Jumper 1. (See "Jumper Settings" on page 3) The connection pin assignments must be opened before another step can be made.

HOME CONTACT CLOSURE

Applying a connection between the common and "B contact" pins causes the selector to move to the HOME position (position 1) in the direction set by Jumper 1. (See "Jumper Settings" on page 3) The connection must be opened before another step can be made.

TABLE 2: Connector J3 pin assignments (Colors are in reference to VICI cable I-25176)

PIN #	COLOR	FUNCTION
1	Green	A output (3.3 VDC)
2		Unused
3	White	B output (3.3 VDC)
4	Black	A contact
5	Shield	Common
6	Red	B contact

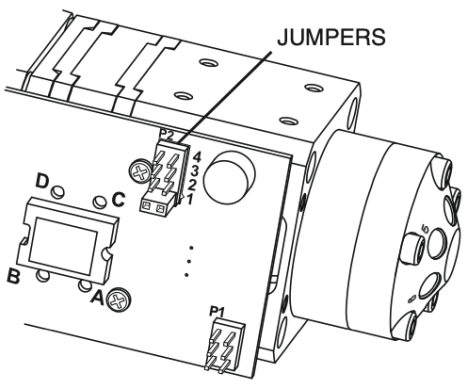
JUMPER SETTINGS

Factory-set jumpers determine the actuator motor's angle of rotation (a function of the number of ports in the valve head) and direction of rotation; the default direction is clockwise (i.e., stepping from position 1 to position 2), as viewed from the motor end of the assembly.

Figure 5 shows the jumper locations, with a jumper installed in jumpers position 1. *Jumper 4 is always installed for mult-iposition (selector applications.* (For two position applications, refer to Technical Note 819.)

Configuration information is presented verbally below. For a graphic presentation of the decision process, refer to **Figure 6**.

FIGURE 5: Location of jumpers



SETTING THE ROTATION DIRECTION

1. Interrupt power to the motor by detaching power connector J1.
2. Remove/install jumper 1 as required. (Refer to **Table 3**)
3. Re-attach connector J1. The change takes effect when the motor is powered up.

TABLE 3: Jumper settings for rotation direction (as viewed from the motor end)

DIRECTION	JUMPER 1
Clockwise	No
Counter-clockwise	Yes

SETTING THE ANGLE OF ROTATION

If you are changing the valve head to one with a different number of ports, jumpers 2 and 3 must be reconfigured. Remember that jumper 4 must remain empty for two position applications.

To set the motor for the proper amount of rotation:

1. Interrupt power to the motor by detaching power connector J1.
2. Refer to **Figure 1** to determine if the unit has a single stage gearbox or a dual stage gearbox.
3. Consult **Table 4** to determine the correct jumper arrangement, and install jumpers as indicated. (For the purpose of determining rotation, the number of ports referenced means the number of ports forming a circle around the center port; the center port itself is not counted.)
4. Re-attach connector J1. The change takes effect when the motor is powered up.

TABLE 4: Jumper settings for number of ports

SINGLE STAGE			DUAL STAGE		
JUMPER:	**2**	**3**	**JUMPER:**	**2**	**3**
4 post.	Yes	Yes	6 post.	Yes	Yes
6 post.	No	No	8 post.	No	No
8 post.	Yes	No	10 post.	Yes	No
10 post.	No	Yes	12 post.	No	Yes

RESTORING THE DEFAULT BAUD RATE

To restore the baud rate to the factory default of 9600:

1. Interrupt power to the motor by detaching power connector J1.
2. Remove jumpers 3 and 4, noting their location for proper re-installation.
3. Install a jumper as shown in **Figure 6**.
4. Re-attach connector J1. The rate change takes effect when the motor is powered up.
5. Detach power connector J1 and restore jumpers 3 and 4 to their previous configuration.
6. Re-attach connector J1.

FIGURE 6: Jumper position to restore default baud rate

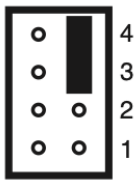
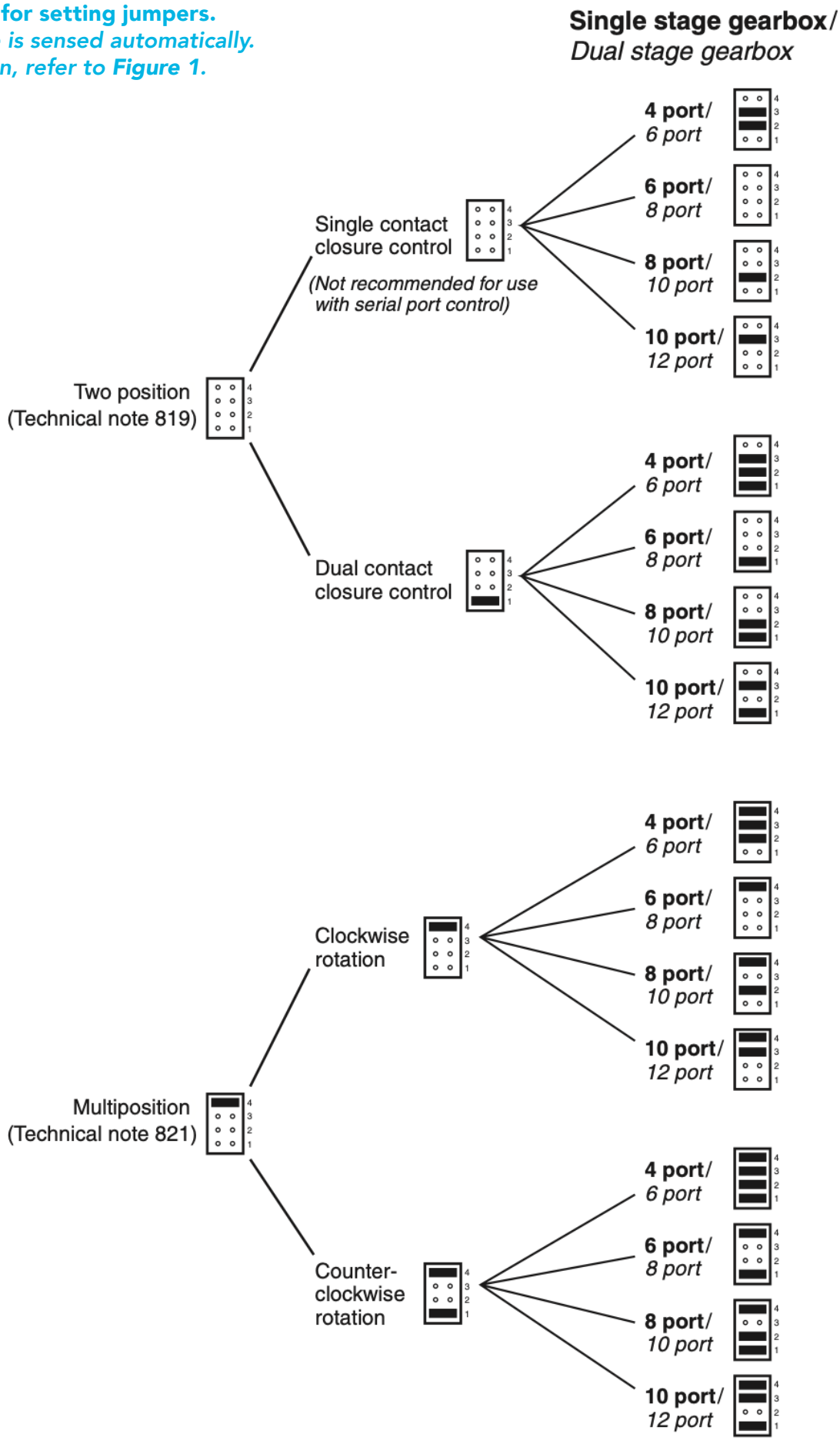


FIGURE 7: Decision tree for setting jumpers.
NOTE: The gearbox type is sensed automatically. For a visual determination, refer to ***Figure 1.***



ACTUATORS WITH OPTIONAL SERIAL CONTROL (MUST BE SPECIFIED AT TIME OF PURCHASE)

RS-232 and RS-485 communication require a terminal emulation program. There are many emulators available for free on the internet. Though the programs vary, in general you will select "Serial" from among various types of connections, select the COM port which will be used, name the connection, and set the port baud rate as shown in Table 7 (9600, or 9K60, is the factory default). The rest of the configurations are fixed at no parity, 8 data bits, 1 stop bit, no hardware or software handshaking.

A three-pin connector is used for the serial interface: pin assignments are listed in the table at right. Use VICI cable I-22697 or make your own with the parts named below the table. The implementation of RS-485 is half-duplex two wire with ground, and uses the same 3 pin output connector as RS-232.

With the software running, check the communication link between the computer and the serial port by typing /?<enter>. If the link is functioning, the menu to the right will appear on your monitor:

TABLE 5: Pin assignments

PIN #	RS-232	RS-485
1	Ground	Ground
2	Transmit to host	A (–)
3	Receive from host	B (+)

Requires: Amphenol shell 102241
Amphenol pins 187756-1
OR VICI cable I-22697

CONTROL COMMAND LIST

GO[nn]	Move to nn position
CW[nn]	Move Clockwise to nn Position
CC[nn]	Move Counter Clockwise to nn Position
CP	Returns Current Position
SB[nnnnn]	Set the Baud Rate to nnnnn
VR	Firmware Version
/?	Displays This List

SERIAL COMMUNICATION PROTOCOL

Serial communication is based on an ASCII string protocol. Carriage Return (OD hex) characters parse the communications by defining the end of each command. Software flow control (Xon/Xoff) and hardware handshaking are not supported. The table below (**Table 6**) describes and explains all the commands available. A fuller explanation follows.

TABLE 6: Commands and descriptions

SERIAL COMMANDS	
CC*n*	Sends the actuator counterclockwise to position *n*, where *n* is A or B
CP	Displays the current position
CW*n*	Sends the actuator clockwise to position *n*, where *n* is A or B
DT*n*	Displays/set an inject delay interval (*n* seconds before the actuator returns to previous position)
E+/E-	Enable/disable the terminal echo and prompt *(not available for RS-485)*
GO*n*	Sends the actuator to position *n*, where *n* is A or B
IC+/IC-	Enable/disable the invalid command response
LF+/LF-	Add/remove line feed to serial string, output only *(not available for RS-485)*
MD	Displays the unit model number
QS+/QS-	Enable/disable quiet serial output during startup *(not available for RS-485)*
R+/R-	Enable/disable position reporting
RC	Report the valve configuration
SB	Displays the current baud rate
SB*nnnn*	Sets the baud rate. Refer to the table below for *nnnn* values.
SN	Displays the unit serial number
TO	Sends the actuator to the opposite position (ignored in single contact closure mode)
TT	Sends the actuator to the opposite position, delays, and returns to original position (ignored in dual contact closure mode)
VR	Displays the part number and date of the firmware
/?	Displays a list of valid commands

COMMAND REFERENCE

NOTE: Repeated direction reversals (CC and CW commands) without passing the internal orientation flag located between the two topmost ports (for example, ports 5 and 6 of a 6 position model) are not recommended, due to possible rotor slippage.

TABLE 7: Baud rate values

BAUD RATE	*nnnn*
4800	4K80
9600	9K60
19200	19K2
38400	38K4
57600	57K6
115200	115K

CC [nn] Moves the actuator in a counterclockwise direction, where nn = a number from 1 to the current set number of positions (set by jumper—see page 3)

Examples

Command: **CC**<enter>
Sends the actuator counterclockwise one position

Command: **CC3**<enter>
Sends the actuator counterclockwise to position 3

CP Displays the current position of the actuator

Example

Command: **CP**<enter>
Returns (via the serial port) the current position, either A or B

CW [nn] Moves the actuator in a clockwise direction, where nn = a number from 1 to the current set number of positions (set by jumper—see page 3)

Examples

Command: **CW**<enter>
Sends the actuator clockwise one position CW3<enter>

Command: **CW3**<enter>

Sends the actuator clockwise to position 3

SB [nnnn] Sets the baud rate, where nnnn = a value from the table at right

Example

Command: **SB19K2**<enter>
Sets the baud rate to 19200

GO [nn] Moves the actuator to position nn via the shortest path, where nn = a number from 1 to the current set number of positions (set by jumper—see page 3)

Examples

Command: **GO**<enter>
Advances the actuator to the next position

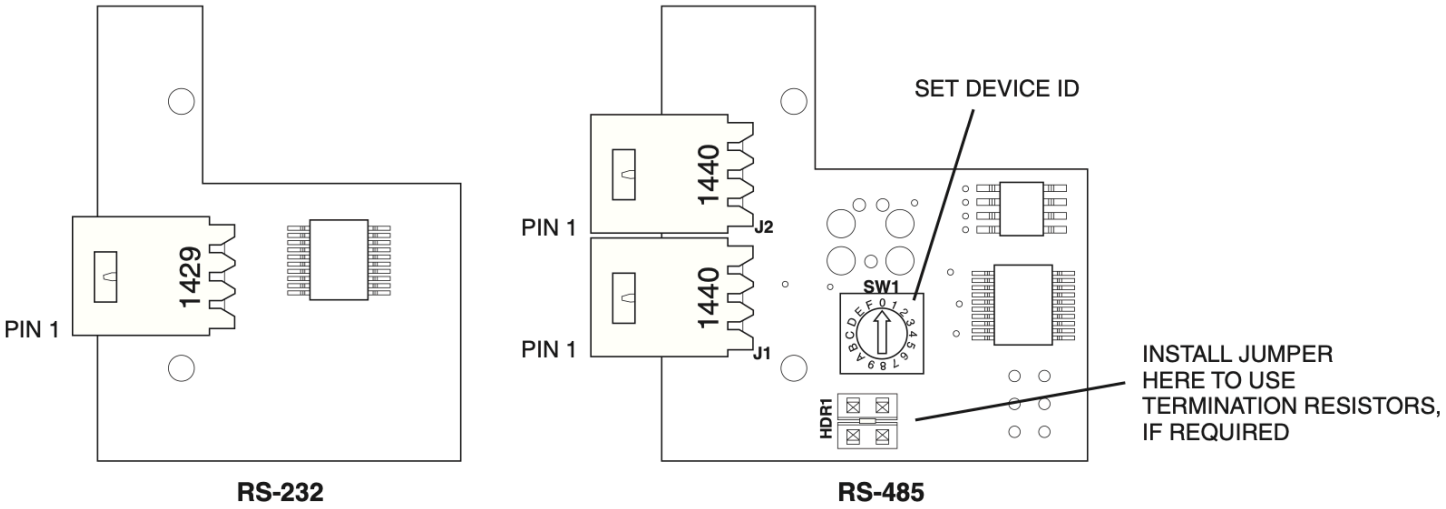
Command: **GO3**<enter>
Moves the actuator to position 3 via the shortest path

VR Reports the current firmware version of the main PCB (via the serial port)

Example

Command: **VR**<enter>
Returns (via the serial port) the current revision of the firmware

FIGURE 8: Serial boards



ADDITIONAL INFORMATION ON THE RS-485 OPTION

HARDWARE PROTOCOL

The RS-485 hardware protocol is half-duplex implementation – two wires with a ground. There are two connectors, J1 and J2, which are connected in parallel to allow easy daisy chaining of multiple devices.

HARDWARE TERMINATION

The RS-485 port on the host computer or controlling device generally includes terminating resistors, so on short cables no termination is required. However, if many devices are attached and/or the actuator is on the end of a long communication cable, the termination jumpers on the furthest device from the master RS-485 controller should have termination enabled. To use termination resistors, install a jumper on the header labeled HDR1, oriented as shown in **Figure 8** on page 6.

HARDWARE ID SET

The firmware requires a serially-addressed ID, which on this board is set by the 16 position rotary switch labeled SW1. The ID is set either as a number from 0 - 9 or a letter from A - F, as selected by the arrow on the face of SW1.

SOFTWARE PROTOCOL

The software protocol requires a forward slash [/] as a beginning-of-message character, followed by a single character ID. The end-of-message character which terminates the command is a <CR>. The standard RS-232 serial port commands are then supported within that protocol.

Example:

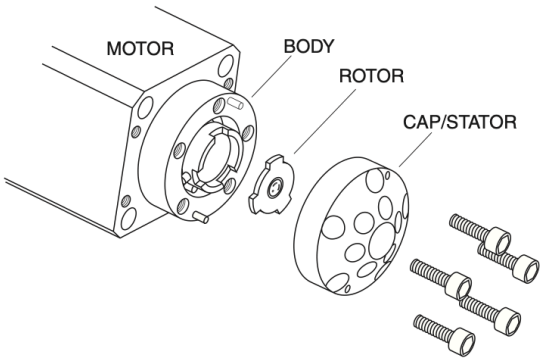
With the settings in **Figure 8**, the RS-232 command **VR**<enter> becomes /**0VR**<enter> in the RS-485 protocol; / is the start-of-message character, **0** is the current ID of the device, and **VR**<enter> is the command to be executed.

NOTE: Of the commands on listed on page 7, **E+/E-, LF+/LF-,** and **QS+/QS-** work only for RS-232; they are not available in RS-485 operation.

CLEANING AND ROTOR REPLACEMENT

These valves have polished sealing surfaces which must be protected during any disassembly or cleaning procedure. Work in a clean environment and always set parts on a soft tissue or clean paper. Cleaning a valve can often be accomplished by flushing all the lines with appropriate solvents. Do not disassemble the valve unless system malfunction is definitely isolated to the valve.

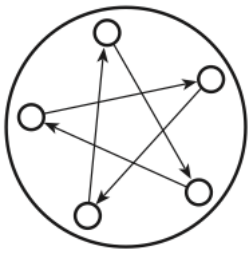
FIGURE 9: Exploded view of a typical injector



DISASSEMBLY (REFER TO FIGURE 9)

1. Use a 3/32" hex driver to remove the 5-40 socket head screws that secure the stator to the valve body. Alternate among the five screws in the sequence indicated in **Figure 10**, loosening them in quarter-turn (90°) increments until all load is removed.
2. To ensure that the sealing surface of the stator is not damaged, rest it on its outer face. Or, if the tubing is still connected, leave it suspended by the tubing.
3. With your fingers or a small tool, gently pry the rotor away from the driver.
4. Examine the rotor sealing surface for scratches. If you see any, the rotor should be replaced.

FIGURE 10: Loosening and tightening order



5. Examine the stator sealing surfaces. If scratches are visible between the ports, that part should be replaced or resurfaced. Call VICI for help in determining if resurfacing is feasible.
6. Clean all the parts thoroughly with an appropriate solvent, taking care that no surfaces get scratched. (A common problem with HPLC is the formation of buffer crystals, which are usually water-soluble.) It is not necessary to dry the rotor.

REASSEMBLY

1. Replace the rotor in the driver, making sure that the rotor sealing surface with its engraved flow passages is facing out. The tabs on the rotor have an asymmetrical pattern to prevent assembly with improper orientation.
2. Replace the stator. Insert the five socket head screws and tighten them gently until they start to get snug. Alternate among the five screws in the sequence indicated in **Figure 10**, tightening them in quarter-turn (90°) increments until the stator is flush against the valve body. Do not over-tighten the screws – they simply hold the assembly together and do not affect the sealing force, which is automatically set as the screws pull the stator against the valve body.
3. Test the valve by pressurizing the system. If it doesn't hold pressure, the valve should be returned to VICI Valco for repair.