

User Operation Manual:
Motorized Valve Controller for Valved Sources



RIBER

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BEFORE YOU BEGIN

Safety Precautions

As with all industrial electronic equipment, safety depends on proper installation, use and maintenance of the instrument. Riber USA has designed the Motorized Valve Controller (MVC) with operator safety in mind.

Please read in full this operation manual before attempting to install or operate the MVC. Refer to your respective facility guidelines on the installation of electronic equipment.

Under no circumstances should the MVC be used for a purpose other than intended nor in a manner that may create a potentially hazardous condition should a failure occur in the operation of the system.

To avoid possible shock, power down the Motorized Valve Controller (MVC) before connecting/disconnecting cables.

To avoid possible shock, do not open the enclosure of the Motorized Valve Controller (MVC). Contact Riber USA for servicing.

Product Concerns

CAUTION: The servo motor and cables are NOT bakeable, to avoid damage to the system please remove the servo motor assembly and cables from the valved source prior to baking. The servo motor assembly is NOT bakeable.

CAUTION: It is imperative the Motorized Valve Controller (MVC) be properly configured to the valved source to which it will be installed. Failure to properly configure the MVC could result in damage to the unit as well as damage to the valved source. Please refer to the [System Configuration](#) section for details on how to configure the MVC to your valved source. If further information is necessary, or if you are unsure of the type of valved source you are using, then please contact Riber USA.

CAUTION: To avoid damage to the servo motor driver in the Motorized Valve Controller, please power off the unit before disconnecting either cable to the servo motor assembly.

CAUTION: If using a valved cracker source for corrosive materials, please take extra precaution when setting the torque values for the servo motor. Incorrect values can damage the sensitive PBN sealing mechanism utilized in these sources. Ensure that any adjustable mechanical stop on the source has been properly set to protect the source from overtravel prior to installation of the servo motor.

Specifications

Operating Temperature	0 to 55°C	
Operating Humidity	0-85%; non-condensing	
Operating Altitude	5000 ft. (1520 m)	
AC Input Voltage	1 ϕ : 200~255V @ 50/60Hz \pm 5%	
AC Input Frequency	50 or 60Hz \pm 5%	
Servo Motor Max Torque (Large)	3.82 NM (400W motor)	
Servo Motor Max Torque (Small) <i>optional</i>	0.95 NM (100W motor)	
Rack Size	2U (full rack)	
Physical Dimensions	Controller (2U full rack) Weight: 18.3 lbs (8.32 kg) Height: 3.5 in (8.9 cm) Width: 19 in (48.2 cm) Depth: 20 in (50.8 cm)	Servo Motor Assembly Weight: 5.7 lbs (2.6 kg) Height: 2.4 in (6.0 cm) Width: 2.4 in (6.0 cm) Length: 7.75in (19.65 cm)

Support

For product related questions or assistance, please use the contact information below:

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INTRODUCTION

Product Description

The Motorized Valve Controller (MVC) allows the precise control of the valve mechanism of most valved effusion sources for MBE systems. The MVC has been designed with the end user in mind, by incorporating reliable, high quality components.

The MVC incorporates high precision motion control hardware which allows highly accurate, reproducible valve positions and corresponding beam fluxes. By utilizing a precision AC servo motor with an integrated 10,000 count/revolution optical encoder, the MVC is able to precisely control beam flux over the full range of valve travel.

The Motorized Valve Controller consists of two main components: 1) a rack mounted controller that powers and reads out the servo motor position. 2) the servo motor assembly that mounts directly onto the valved source to control valve travel.

The servo motor can be controlled one of three ways:

- **Jog Wheel-** The user can control valve operation via the CW/CCW rotation of the jog wheel on the front of the controller.
- **Predefined Position-** Three pre-defined positions can be programmed to the A/B/C buttons located on the front panel of the controller. The user is able to set the predefined position and “jump” quickly to the programmed set points.
- **Remote Operation-** The Motorized Valve Controller can be connected to the process control PC via a standard RS-232 serial interface. The MVC is compatible with most major equipment vendor process software and emulates the eurotherm EI-Bisynch protocol.

INSTALLATION

This section will explain how to setup the Motorized Valve Controller (MVC), for use on your valved source.

WARNING: Before making any cable connections, check to make sure the power switches (front and rear) are in the off position. Failing to do so may cause injury or damage to the equipment. Never install/remove the motor cabling with the power on to the unit as damage can occur.

Install the Controller in the Electronics Rack

The following procedure is used to install the controller into the electronics rack.

1. Make sure the power switches are in the off position; there is one switch on the front and rear of the unit.
2. Mount the controller in your electronics rack.
3. At the rear of the controller, connect the AC power cord to the controller. Do not attempt to run the controller using the incorrect voltage or damage will occur. The input voltage must be between 200 and 255 VAC.
4. Connect the other end to a proper AC outlet, you may need to contact your facility support personal for this operation.
5. Connect the Motor Power Cable to the rear of the controller.
6. Connect the Motor Encoder Cable to the rear of the controller.

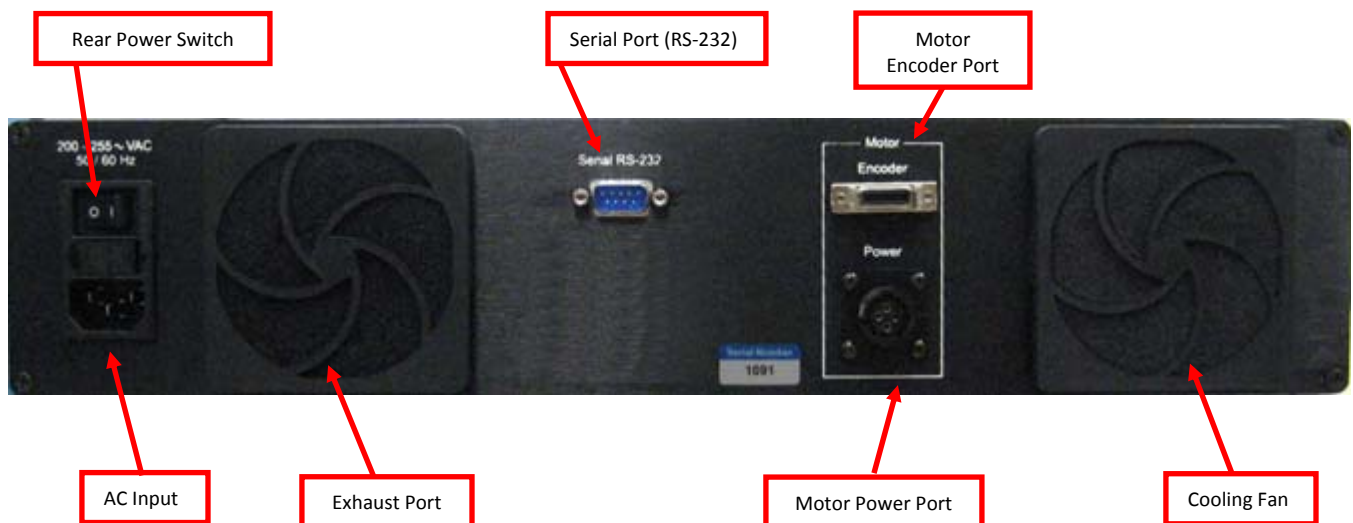


Figure 1- Motorized Valve Controller – Rear Panel

Install the Servo Motor Assembly on the Source

The following procedure is used to install the servo assembly on the valved source.

1. Make sure the controller power switches are in the off position; there is one switch on the front and rear of the unit.
2. Loosen the assembly mount thumb screws until the tip is flush with the housing.
3. Make sure the clamping screw on the helical coupler is loose to allow the helical coupler to be installed on the lead screw stem; the set screw is a 2.5mm Allen key.
4. Carefully slide the motor assembly onto the lead screw assembly on the source; make sure the lead screw slides smoothly into the helical coupling of the motor assembly. **DO NOT FORCE THE MOTOR AND VALVE MATE AS DAMAGE CAN OCCUR.**
5. Continue to push the motor assembly towards the Valve Source body until both meet flush.
6. Slowly rotate the motor assembly while tightening one of the three thumb screws; you should feel the thumb screw seat against one of the indexing dimples in the Valved Source body.
7. Firmly tighten all three thumb screws, the motor assembly should be locked in place now. Verify that the motor assembly cannot rotate.
8. Adjust the helical coupling so that there is at least 2mm of clearance between the face of the helical coupling and components of the lead screw assembly. The face of the helical coupling should not be allowed to make contact with any parts of the lead screw assembly while rotating.
9. Using a 2.5mm Allen key, tighten the helical coupling set screw to clamp the coupler to the lead screw stem.
10. Connect the motor power cable from the MVC to the motor mounted on the Valved Source.
11. Connect the motor encoder cable from the MVC to the motor mounted on the Valved Source.
12. The Motorized Valve Controller (MVC) can now be powered on.

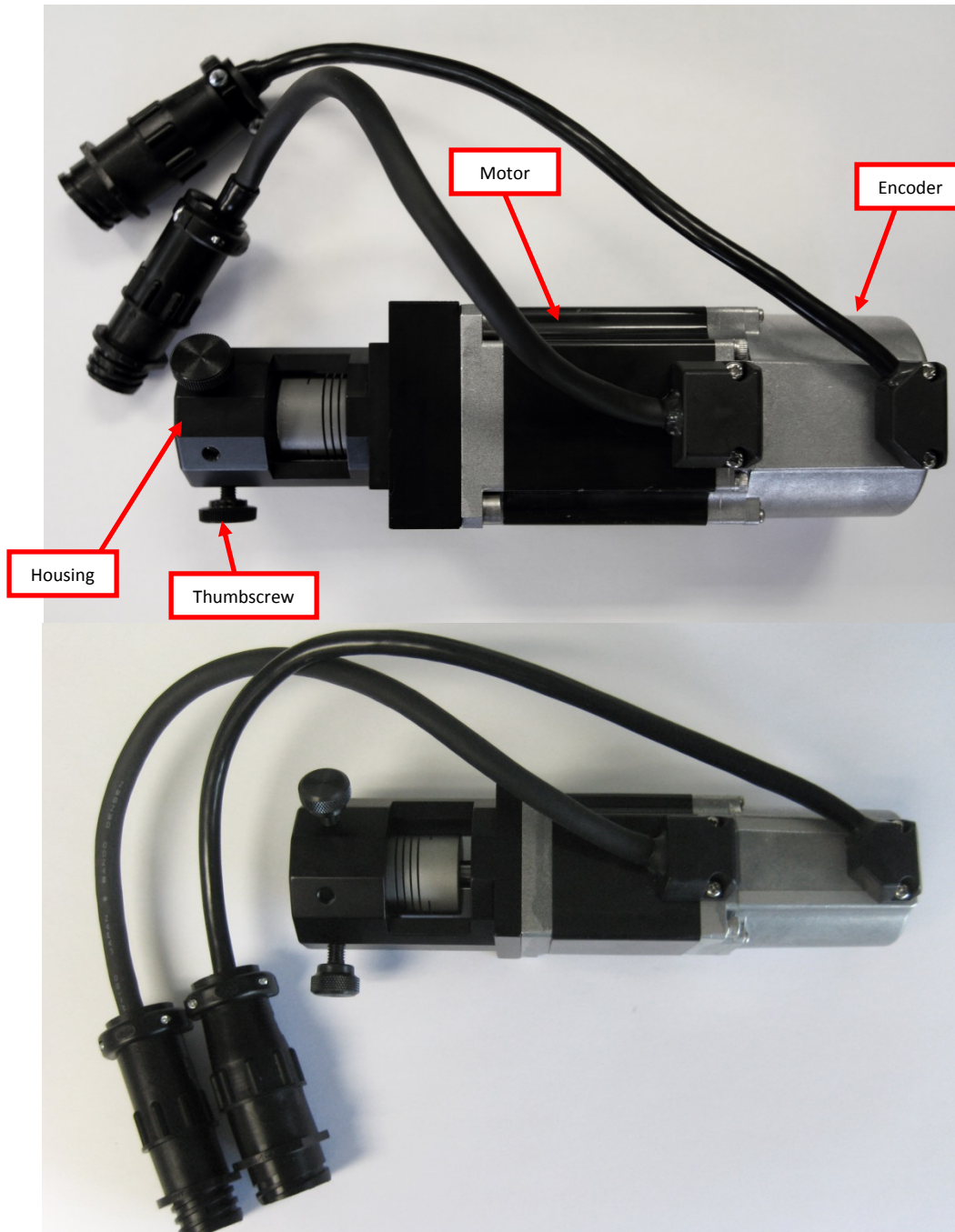


Figure 2 - Motor Assembly. Top: 400W Large Motor. Bottom: 100W Small Motor

OPERATION

This section will familiarize you with the operation of the Motorized Valve Controller (MVC) rack mounted controller.

Features – FRONT PANEL

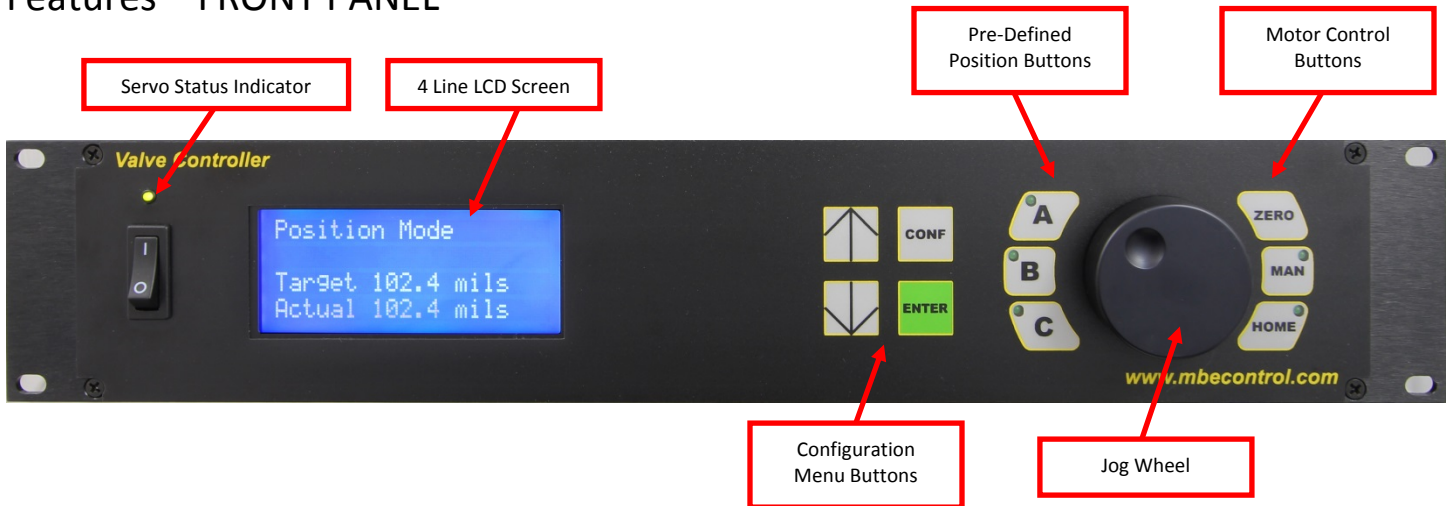


Figure 3 - Motorized Valve Controller (MVC) – Front Panel

Startup

To power on the controller, both the rear power switch and the front power switch must be turned on. These 2 switches are wired in series. Once both power switches have been set to the “on” position, startup of the controller takes approximately 60 seconds to complete. During startup the Servo Status Indicator and the LCD should turn-on; If the Servo Status Indicator does not illuminate, check the following:

1. Power/Encoder cables are connected to the rear of the MVC.
2. Power/Encoder cables are connected to the Servo Motor Assembly.

Once the controller has completed the boot process, the current position of the motor is set to zero and the controller begins to maintain this position. There are two ways to calibrate the zero (or HOME) position:

Calibrate Zero Method A:

1. Press **MAN** on the controller front panel (servo control is disabled).
2. Rotate the valve by hand until the user specified zero position is reached, this is usually a B.E.P. from a gauge or from feeling the valve close.
3. Press **ZERO** on the controller front panel to reset the zero position.
4. Press **MAN** again to enable servo control.
5. The controller will now maintain this new zero position.

Calibrate Zero Method B:

(Do not use without first checking configuration settings or damage may occur):

1. Press **ZERO** on the controller front panel.
2. The motor will begin to rotate the valve in the closing direction defined in the configuration menu. At the point that measured torque exceeds the defined “home” torque the motor will stop turning.
3. After a few second delay, the controller will begin to maintain this new zero position.

Configuration

Several configuration parameters can be set within the valve controller. To enter the configuration mode, press the **CONF** button on the front panel. Navigation through the configuration menu is done via the up/down arrow buttons, a parameter value can be changed using the jog wheel. Once the desired value is set, press the **ENTER** button to register the change. To cancel the new value, select a different parameter using the up or down arrows without pressing **ENTER**. To exit configuration mode, press the **CONF** button again and the new values will be saved to memory. The first 2 parameters require a power cycle after changing the values. A message will appear if a power cycle is required. The list of parameters follows.

- **Motor Rotation Direction:** The direction that the motor will turn to open the valve as viewed from the back of the motor looking towards the source. Select CW for clockwise and CCW for counterclockwise.
- **Motor Type:** Two different size motors are available for the valve controller. The smaller motor is 100 Watts and the larger motor is 400 Watts. Refer to the technical specifications in this manual for more information about the motor parameters.
- **Speed:** The speed in rotations per minute (RPM) that the motor will turn when changing valve position in normal operation.
- **Torque (%):** The maximum torque the motor will apply while moving to a new position and in maintaining the current position. The torque value is expressed as a percentage of the maximum rated continuous torque of the motor. See table below for torque values.
- **Acceleration Time:** The time in milliseconds over which the motor will accelerate from zero velocity to the positioning velocity. Limiting the acceleration provides for smoother operation of the valve and produces less strain on the mechanical components.
- **Deceleration Time:** The time in milliseconds over which the motor will accelerate from the positioning velocity to zero velocity. Limiting the acceleration provides for smoother operation of the valve and produces less strain on the mechanical components.
- **Position Gain (r/s):** Position Loop Proportional Gain (KPP) adjusts the proportional gain of the position control loop, thereby affecting system stiffness and response. Higher gains reduce position error and increase responsiveness. However, if the setting is too high, it may generate oscillation or noise in the system. **Default value is 35.**

- **Velocity Gain (r/s):** Velocity Loop Proportional Gain (KVP) sets the proportional gain for the velocity loop. Higher values make the velocity loop more responsive. However, setting it too high will cause excessive vibration or noise. **Default value is 500.**
- **Homing Speed (RPM):** The speed in RPM at which the valve will rotate when searching for the home position.
- **Homing Torque (%):** The maximum torque that the motor will apply when searching for the home position. This torque should be negative because it's applied in the closing direction. The torque value is expressed as a percentage of the maximum rated continuous torque of the motor. See table below for torque values.
- **Units:** The units that will be displayed on the front panel LCD. The choices are: none, mils, mm, um, and turns
- **Scaling:** The factor that scales encoder counts to the value that is controlled and displayed by the controller. It is expressed as counts per unit (mil, um, mm, etc...) There are 10,000 encoder counts per rotation. If the screw advances 1000 mils (1 inch) per 40 turns the scaling factor would be $(40 \text{ turns} \times 10,000 \text{ counts}) / 1000 \text{ mils} = 400,000 / 1000 = 400$
- **Minimum Position:** The minimum position the valve can be set to. This should normally be set to zero.
- **Maximum Position:** The maximum position the valve can be set to.
- **Position A:** The position value associated with preset A
- **Position B:** The position value associated with preset B
- **Position C:** The position value associated with preset C
- **RS-232 Address:** The address for remote serial communications
- **Protocol:** Use EI-Bisynch in most cases. Crystal is a variation to work with Riber software.

NOTE: After changing parameters and exiting configuration mode, do not power off for any reason until waiting 5 seconds to give the controller enough time to save the new parameters. This delay is not necessary for settings that require a power cycling.

To reinitialize all the settings to the default values, hold down the **CONF** key while the unit powers up. This will reset the stored settings to the default value.

Table 1 - Motor Torque Values

Percent Torque	100W motor torque		400W motor torque	
	(oz-in)	(NM)	(oz-in)	(NM)
0	0	0	0	0
10	4.5	0.032	17.9	0.127
20	9.0	0.064	35.8	0.254
30	13.4	0.095	53.8	0.381
40	17.9	0.127	71.7	0.508
50	22.4	0.159	89.6	0.635
60	26.9	0.191	107.5	0.762
70	31.4	0.223	125.4	0.889
80	35.8	0.254	143.4	1.016
90	40.3	0.286	161.3	1.143
100	44.8	0.318	179.2	1.270
200	89.6	0.636	358.4	2.540
300	134.4	0.954	537.6	3.810

Remote Serial Operation

A DB9 connector on the back of the unit allows for remote operation using the Eurotherm compatible EI-Bisynch communications protocol. For additional information on using the EI-Bisynch protocol please contact Riber USA.

The following Mnemonics are used:

PV	Current valve position	Read only
SL	Target valve position	Read / Write
SP	Working target position	Read only
OP	Current valve position in % open	Read only
HS	Maximum position	Read only
ZZ	Remote home	Write only

Writing a value of 0 to ZZ will cause the controller to enter homing mode. Other values have no effect.

The serial port settings are fixed at: 9600 baud rate , 7 data bits, even parity, and 1 stop bit.

NOTE: When using Crystal deposition software from RIBER, a 9600 baud rate, with 7 data bits, even parity, and NO stop bits may be required for serial operation to function. (9600; 7; 2; 0)

The pin-out of the male DB9 connector is shown below:

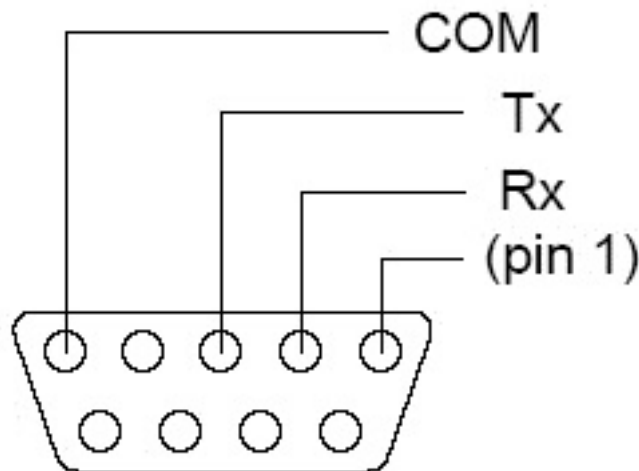


Figure 4 - Serial Port Pin-out

If your controller has a female DB9 connector, it is configured for RS-485 4 wire communications. Please contact Riber USA for more information.

Firmware upgrade

Some units are equipped with a port for upgrading the firmware in the valve controller. To upgrade the firmware, with the power off, remove the USB flash drive from the back of the controller and copy the new firmware file onto the USB flash drive using a PC. This should be the only file on the flash drive.



Figure 5 - Serial Port

Reinsert the USB flash drive into the controller and power it on while holding down the CONF button. The following window will appear after about 40 seconds.



Figure 6 - Firmware Update Screen

Select A to copy the firmware from the USB flash drive to the valve controller. Pressing B will restore the firmware that shipped with the unit. Pressing C leaves the controller unchanged. Please contact Riber USA for the latest firmware. Upgrading or restoring firmware will result in default settings in the configuration.