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3. OX CONTROLLER MODULE

3.1 DESCRIPTION

The OX Controller Module, hereafter referred to as the Controller Module, contains all the control, monitoring, and interface components for the metering operations. The Controller Module measures 14 3/4" wide, 11 3/4" deep, 5 1/4" high (feet included) and weighs approximately 17 pounds. The operator controls are located on the front panel and the interface connections are located on the rear panel.

3.1.1 Front Panel Controls & Indicators (Figure 3.1)

The front panel contains the switches and pushwheel for controlling the system. The following standard items are located on the front panel.

1. START/STOP Switch
2. RATE Pushwheel
3. 1/0 (On/Off) Switch

3.1.1.1 START/STOP Switch (Figure 3.1 Item 1)

This momentary illuminated rocker switch activates pump operation when "START" is pressed and halts pump operation when "STOP" is pressed.

A green indicator illuminates in the switch after pressing "START".

A red indicator illuminates in the switch after pressing "STOP".

3.1.1.2 RATE Pushwheel (Figure 3.1 Item 2)

This 3 digit, pushwheel switch determines the meter rate by directly controlling the speed of the stepping motor drive. The minimum is "0" and the maximum is the maximum RPM (revolutions per minute) of the motor. (see the Title Page section of this manual)

Example: A controller setting of "125" represents 12.5% of the motor's maximum RPM.

Pressing the "+" will increase the selected number by 1 and pressing "-" will decrease the selected number by 1. This allows the user to select any motor speed, linearly, from "000" (0%) to "999" (99.9%).

3.1.1.3 1/0 Switch (Figure 3.1 Item 3)

This 2-position, illuminated, rocker switch turns controller main power (AC input) "ON" (1) or "OFF" (0).

A green indicator light in the switch illuminates when controller power is "ON".

3.1.2 Rear Panel Detail (Figure 3.2)

The rear panel contains the interface connections for the system. The following components are located on the rear panel.

1. Power Entry Module
2. Cable Connector

Figure 3.1 OX Controller Module Front Panel

3.1.2.1 Power Entry Module (Figure 3.2 Item 1)

The power entry module contains a receptacle for a standard IEC power cord, a voltage selector switch and main fuse holder.

CAUTION

Before plugging in the system, insure the line voltage setting appearing in the window agrees with the available line voltage. Damage to the equipment could result if the two voltages do not match.

Refer to the Title Page section of this manual to determine the power connection and fuse specifications for this Controller Module.

The design of the power entry module requires the line cord be disconnected before either the voltage select switch is changed or a line fuse is removed. Perform the following steps if it is necessary to change the setting of the line voltage select switch. (Refer to Figure 3.4)

1. Disconnect the line cord at the power entry module and open its cover.

2. Remove the selection cam from the unit and replace it oriented so the desired voltage will appear in the window when the cover is closed.

CAUTION

Rotating the voltage select cam while it is in the module may damage the module.

3. With the voltage select cam in the proper position, close the cover and replace the line cord. If the cover does not completely close, open the cover and slightly reposition the voltage select cam.

3.1.2.2 Pump Connector (Figure 3.2 Item 2)

The pump connector (Amp Series One CPC 14 pin) is used for making the electrical connections to the Motor/Base Module.

CAUTION

Never connect or disconnect the cable from this connector while power is on. Damage to the equipment may result.

3.2 OPERATION

The Controller Module provides all the control, monitoring, and interface functions for the metering operations.

The basic function is to meter a quantity of liquid based on the RATE pushwheel setting. This is accomplished with a high degree of precision (0.1%) through the combination of solid-state electronics controlling a motor which drives a high accuracy, valveless, positive displacement pump. The Controller and Motor/Base Modules are electrically connected together by a cable.

The operation of the Controller Module is divided into two sections; Motor Control and Normal mode.

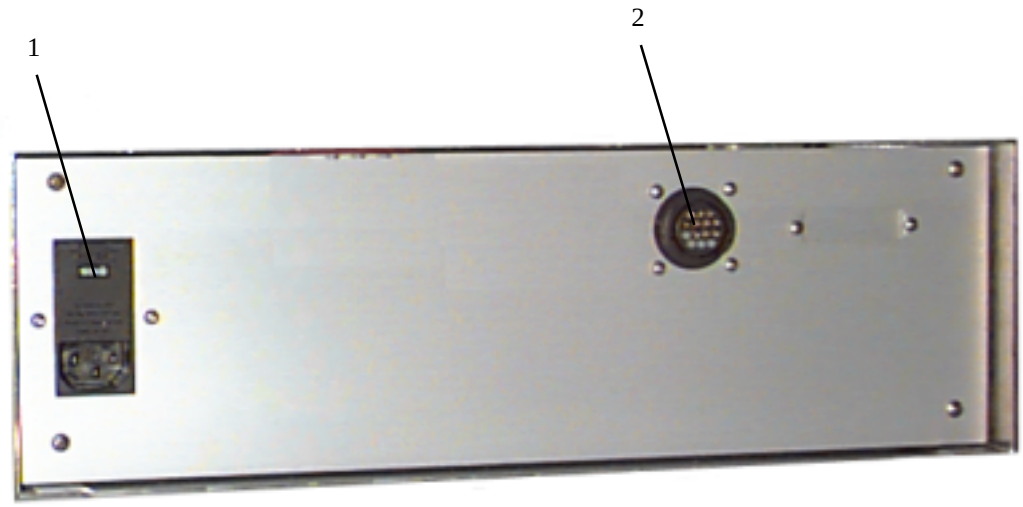

Figure 3.2 OX Controller Module Rear Panel

3.2.1 Motor Control

The rotation of the piston within the Pump Module is monitored by a spindle sensor that is used to detect stalls. The sensor is mounted on the frame of the Motor/Base Module and detects a target mounted on the spindle.

3.2.1.1 Stall Detect

A motor stall condition is generated if a signal from the spindle sensor is not detected for each revolution commanded to the motor. In a stepping motor system, a stall has occurred if more steps than the 200 required for a revolution have been commanded without a subsequent signal from the spindle sensor. A small margin above 200 steps is allowed to prevent minor variations from incorrectly signaling a stall.

When a stall occurs, you will hear the motor starting, but then it will stop. It will continue to start then stop until the power is turned Off.

3.2.2 Normal Operation

The following steps provide instructions on setting up and using the Controller Module for normal operation.

1. Set the RATE pushwheel setting to meet your requirements. As a general guideline, start with 500 (50%).

2. Switch the 1/0 power switch to "1".

3. Start Metering mode by using the START/STOP switch.

4. Switching the START/STOP switch to "START" will start the metering operation. The motor will operate and stop after the switch is toggled to the "STOP" position.

3.2.3 Stopped Location

Normally, the spindle sensor stops the piston during the intake stroke of the pump. The sensor signals the stepper motor drive circuitry to decelerate, thereby insuring the position at the end of an operation is based on a sensed position, and not a random position.

It is noticeable when the pump is running slow.

If the pump is stopped using the "STOP" button or deactivating the trigger signal, the pump stops on the next hall signal. If the pump is stopped using the "RESET" button or by turning the power off, the pump stops at a random position.

3.3 INSTALLATION

General operating practices provide the best guidelines for locating the components of the system. The Controller Module should be located for ease of use during all phases of operation and maintenance.

3.4 OPTIONS

IVEK Corporation offers a variety of options to best meet the customer's needs. Following is a list and description of available options for the Controller Module. Refer to the Title Section of this manual for the list of options provided with this system.

3.4.1 Reset Switch/Fault Indicator

The reset switch/fault indicator signals the operator when a stall fault has occurred. A fault is generated if four stalls of the motor are detected. When a fault occurs, the operation stops and the RESET switch illuminates and a fault output is generated.

The RESET switch illuminates when a fault has occurred. Pressing the switch turns the RESET light off and resets the system. If the system immediately faults again, refer to Table 3 'Common Operation Problems and Solutions' in Chapter 2 'Operation'.

The optically isolated Fault Out is complimented, i.e. the output conducts when no fault exists and does not conduct when the Controller Module is faulted.

A normally opened or normally closed output is provided that can be designed to either inhibit further metering, alert the operator, or provide a reject signal for integrated process control. Refer to section 3.7 for Fault Out signal specifications.

3.4.2 Forward/Reverse Switch

This 2-position, illuminated rocker switch provides the ability to pump liquid in both directions. In the FORWARD position, liquid is pumped from left to right as viewed from the Pump Module end of the Motor/Base Module. In the REVERSE position, liquid is pumped from right to left as viewed from the pump end of the Motor/Base Module.

A yellow indicator illuminates in the switch for the active setting.

3.4.3 Digital Display

A 3-1/2 digit LCD panel meter is located on the front of the Controller Module. The meter displays the RPM (revolutions per minute).

3.4.4 Contact Closure Enable

A terminal strip with two screw terminals (+/-) is added to the rear panel. A contact closure signal at this terminal strip will activate the pump. Removing the signal will deactivate the pump. Refer to section 3.7 for Trigger signal specifications.

3.4.5 24 VDC Optically Isolated Enable

A terminal strip with two screw terminals (+/-) is added to the rear panel. A 24 VDC signal at this terminal strip will activate the pump. Removing the signal will deactivate the pump. Refer to section 3.7 for Voltage Trigger signal specifications.

3.4.6 12 VDC Optically Isolated Enable

A terminal strip with two screw terminals (+/-) is added to the rear panel. A 12 VDC signal at this terminal strip will activate the pump. Removing the signal will deactivate the pump. Refer to section 3.7 for Voltage Trigger signal specifications.

3.4.7 5 VDC Optically Isolated Enable

A terminal strip with two screw terminals (+/-) is added to the rear panel. A 5 VDC signal at this terminal strip will activate the pump. Removing the signal will deactivate the pump. Refer to section 3.7 for Voltage Trigger signal specifications.

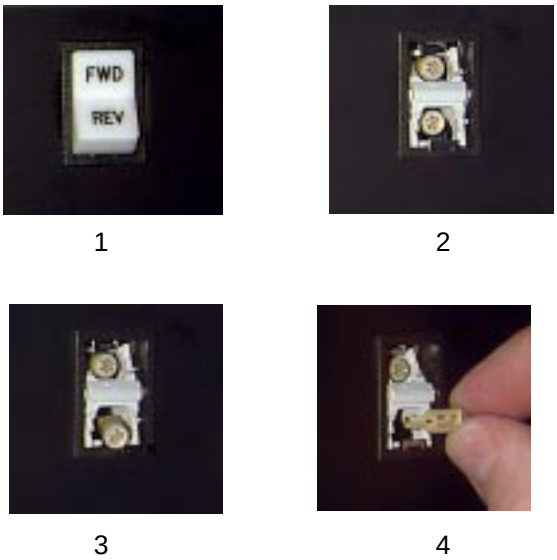

Figure 3.3 LED Disassembly/Assembly

3.5 MAINTENANCE

No periodic maintenance is required on the Controller Module, beyond standard practices for electronic equipment.

3.5.1 Assembly/Disassembly Procedures

The Controller Module contains the following replaceable parts.

- Switch LED's
- Main Power Fuse

3.5.1.1 Switch LED's (Figure 3.3)

The LED's in the START/STOP switch are replaceable.

Disassembly

1. Use your fingers to remove the switch cover. (Image 1 to 2)
2. Locate the metal pull tab and pull out slowly until the LED comes out. (Image 2 to 3)

Assembly

1. Locate the "+" side of the bulb (upper LED sockets have the "+" on the right and lower LED sockets have the "+" on the left) and place into the socket. (Image 4)
2. Snap the switch cover into place. (Image 1)

3.5.1.2 Main Power Fuse (Figure 3.4)

The main power fuse, located in the power entry module on the rear panel, is replaceable. The proper fuse value is described in the Title Page section of this manual.

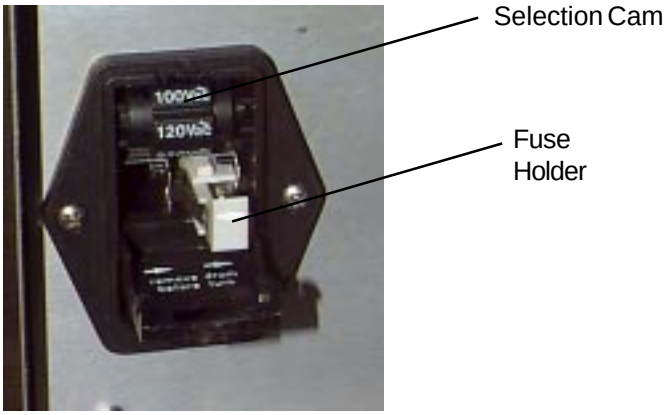

Figure 3.4 Power Entry Module

Disassembly

1. Remove the power cord.
2. Using a small flat blade screwdriver, open the power entry module's cover.
3. Slide the fuse tray out and remove the fuse.

Assembly

1. Install the new fuse into the fuse tray and slide the tray in. The arrow on the fuse holder should point to the right.
2. Close the power entry module's cover.
3. Connect the power cord.

3.6 PROBLEM GUIDE

Table 3.1 contains a list of possible problems, causes and solutions for the Controller Module.

WARNING

Hazardous voltages exist inside the Controller Module. Under no circumstances should the Controller Module be opened. There are no user serviceable parts inside. Any unauthorized access to the inside will void the warranty.

3.7 SPECIFICATIONS

Motor Speed:	23/34 Frame:	165RPM Max.
(Option)	23/34 Frame:	660RPM Max.
(Option)	23/34 Frame:	1155RPM Max.
(Option)	23/34 Frame:	1650RPM Max.

Trigger Signal Requirements (Option):
Mechanical contact closure or solid state
Signal Rating: +5VDC @ 20mA max.

Voltage Trigger Requirements (Option):
+5, +12, or +24 VDC @ 20mA Max

Reset Switch/Fault Indicator (Option)
(a.k.a Fault Out, Contact Closure)

Max. Switching Power:	60W 110VA
Max. Switching Voltage:	220V AC, DC
Max. Switching Current:	2A
U.L Rating:	0.5A 125VAC, 2A 30VDC, 0.25A 220VDC

Optically Isolated Fault Out Signal Level (Option):
Output can switch a signal of up to 24 VDC and 50 mA. The output consists of the emitter and collector connections to an IC opto-isolator

3.8 MODEL NUMBER

The model number provides important information about the specifics of your Controller Module. Refer to this number when calling IVEK Technical support. The model number for your Controller Module is located in the Title Page section of this manual.

520098 - # # # # # # #

Motor/Base
- **A** - Microspense AP Single End
- **B** - Microspense AP Dual End
- **C** - Microspense AP Rare Earth Motor
- **E** - Heavy Duty 1 Stack
- **F** - Heavy Duty 2 Stack
- **G** - Heavy Duty 3 Stack

Enclosure Finish
- **A** - Powder Coat
- **B** - Stainless Steel

Motor Speed
- **A** - 165 RPM
- **B** - 660 RPM
- **C** - 1155 RPM

Input Interface
- **A** - Standard
- **B** - Contact Closure Enable
- **C** - Optically Isolated 24 VDC Enable
- **D** - Optically Isolated 12 VDC Enable
- **E** - Optically Isolated 5 VDC Enable

Output Interface
- **A** - Standard
- **B** - Contact Closure Fault Out
- **C** - Optically Isolated Fault Out

Front Panel
- **A** - Standard
- **B** - Forward/Reverse Switch
- **C** - RPM Display
- **D** - Forward Reverse Switch & RPM Display

Line Cord & Agency Approval
- **A** - US Cord
- **B** - International Cord
- **C** - US Cord & CE Approval
- **D** - International Cord & CE Approval

3.9 ILLUSTRATED PARTS BREAKDOWN

The illustrated parts breakdown (Figure 3.5) contains the information required for identifying and ordering replacement parts.

Table 3.1 Common Operational Problems And Solutions

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
No power, nothing works.	AC power may be absent or inadequate. Unit not plugged in.	Ensure AC power cord is plugged into a properly grounded outlet and the line voltage setting in the power entry module matches the available line voltage.
	Fuse is blown.	Unplug main power cord from outlet. Remove fuse from rear panel fuse holder. Test fuse conductivity. Install good fuse in rear panel fuse holder.
	Supply Breaker is tripped.	Check or reset breaker at panel.
Controller Module power on and operational, but will not actuate pump.	I/O Cable	Check the cable connection between the Controller Module and Motor/Base Module. Inspect and repair faulty cable.
Controller Module power on and operational, but motor spindle fails to rotate and motor makes a sound that fluctuates in tone. * This condition does not harm the system.	A Pump Module or motor malfunction can cause this problem.	Turn off Controller Module power. Remove Pump Module from Motor/Base Module. Turn on Controller Module and try again. If the motor operates correctly, the pump may need to be cleaned or serviced.
Controller Module power on and operational, but motor spindle fails to rotate, and motor is silent.	A motor malfunction can cause this problem.	Turn off Controller Module power. Check to ensure Motor/Base Module is properly connected to controller. Turn on Controller Module and try again. If the motor operates incorrectly, servicing may be necessary to the Motor or the Controller. Return complete Controller, Motor/Base and Pump Modules to IVEK Corporation for repair. **If none of the above solves the problem, contact IVEK technical support for assistance.**

INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
	520098-########	**OX Controller Module**	**1**
1	662029-005SG	LED, Wedge Based, Multichip, Spec/5 VDC, Std Grn	1
1	662029-005SR	LED, Wedge Based, Multichip, Spec/5 VDC, Std Red	1

Figure 3.5 OX Controller Module (Sheet 1 of 1)