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3. DIGIFEEDER CONTROLLER MODULE

3.1 DESCRIPTION

The Digifeeder 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 OVERRANGE Indicator
2 AUTO/MANUAL Switch
3 START/STOP Switch
4 1/0 (On/Off) Switch
5 SLOPE MULTIPLIER Pushwheel

3.1.1.1 OVERRANGE Indicator (Figure 3.1 Item 1)

The Overrange indicator is a red LED and illuminates when the input signal is equal to or above the maximum.

3.1.1.2 AUTO/MANUAL Switch (Figure 3.1 Item 2)

This 2-position, illuminated, rocker switch selects the operating mode “AUTO” or “MANUAL".

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

3.1.1.3 START/STOP Switch (Figure 3.1 Item 3)

If Manual mode is selected this 2-position, 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”.

3.1.1.4 SLOPE MULTIPLIER Pushwheel (Figure 3.1 Item 4)

This 3 digit, pushwheel switch determines the slope setting.

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 slope setting from “000” to “999”.

3.1.1.5 1/0 Switch (Figure 3.1 Item 5)

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

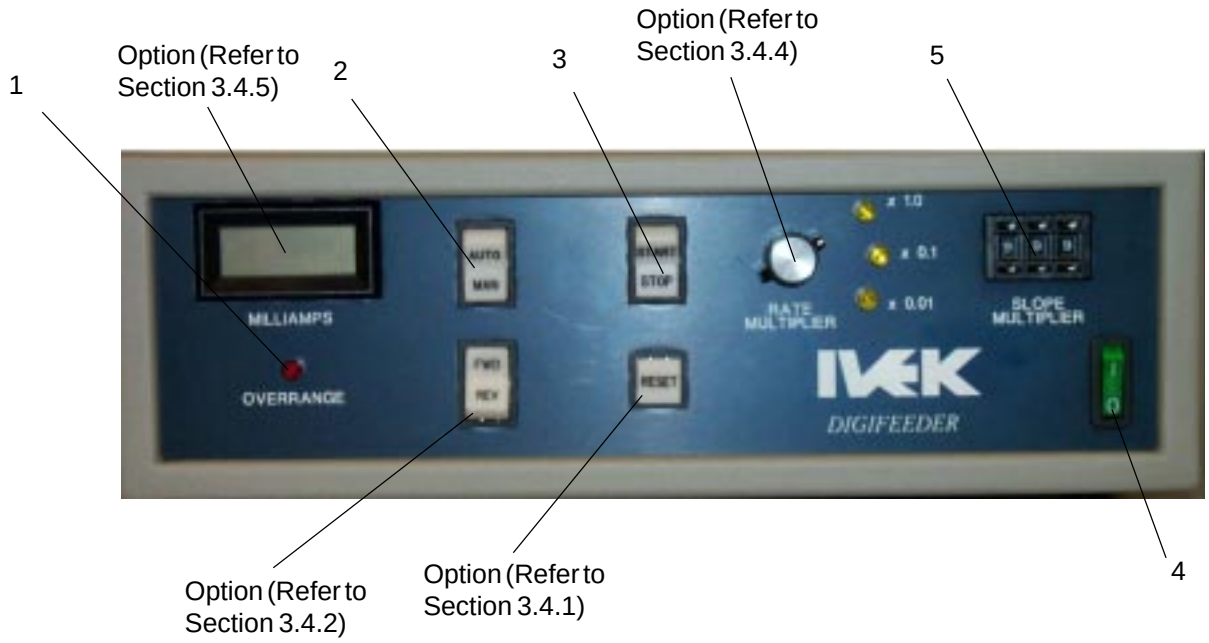

Figure 3.1 Digifeeder Controller Module Front Panel

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 INPUT Terminal Strip
3 Motor Connector

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 INPUT Terminal Strip (Figure 3.2 Item 2)

The Input terminal strip has two screw terminals (+/-) used for the electrical input signal. The signal level at this terminal strip determines the pump output.

3.1.2.3 Motor Connector (Figure 3.2 Item 3)

The motor 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.

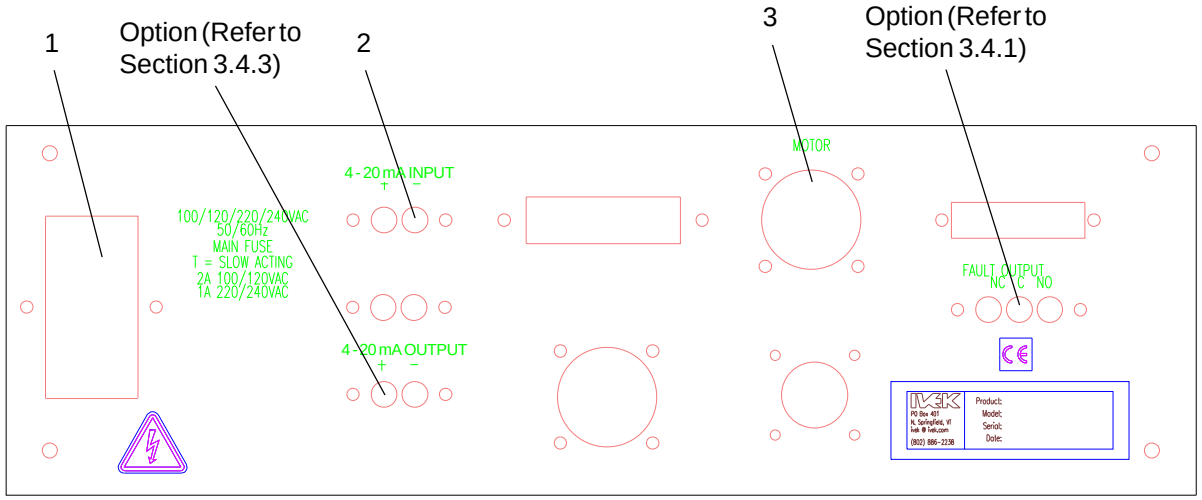

Figure 3.2 Digifeeder Controller Module Rear Panel

3.2 OPERATION

The Controller Module provides all the control, monitoring, and interface functions for the metering operations. Controlled acceleration and deceleration of the stepping motor, stroke counting, and rotation monitoring are some of the functions required to properly drive precision metering pumps.

The basic function is to meter a quantity of fluid in proportion to an input signal. 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 Controller Module accepts a 4 - 20mA input signal at the rear panel terminal strip and converts it to a digital signal to control the speed of the Motor/Base Module. A 4mA signal will generate no motor speed and a 20mA signal will generate the maximum motor speed (based on the slope multiplier settings). The output is linear across the 4 -20mA range. The OVERRANGE indicator turns on when an input signal in excess of 20 mA is applied to the Controller Module or when in Manual mode. The metering rate will not exceed the maximum value.

The operation of the controller is divided into four sections; Motor Control, Slope Multiplier, Auto mode, and Manual mode.

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 Slope Multiplier

The slope multiplier pushwheel determines the motor RPM's as a percentage of the maximum RPM. The RPM of the motor determines the rate of flow. The percentage is calculated by placing a decimal point in front of the right most digit. A pushwheel setting of "500" would be 50% of the maximum RPM. The maximum value of the slope multiplier is “999”.

The following steps are a guide to determine the Slope multiplier setting. In step 1, a displacement of 75% was used as a general starting point, your application may require a different displacement and slope multiplier setting. If cavitation occurs refer to Chapter 2 for possible solutions.

A higher pump displacement will increase the amount of liquid added with each revolution of the motor.

Fluidic pulsations can be reduced with a lower displacement and higher slope multiplier. This decreases the amount of liquid added with each revolution of the motor.

NOTE

The maximum rate required should be known.

	Example Results
1. Set the pump displacement at approximately 75% of maximum. (Refer to Chapter 7 for more information)	Max Required = 50ml/min
2. Set the slope multiplier to "999", select Manual mode and run a measured test to determine the pump output in ml/min.	75ml/min
3. If this number is larger than the maximum rate required, go to step 5.	yes
4. Increase the pump displacement and repeat steps 2 and 3.	
5. Divide the maximum rate required by the measured pump output. (make sure the values used are expressed in the same units ie. ml / ml)	50ml/min ÷ 75ml/min
6. Multiply this number by 1000.	.67 x 1000
7. Set the multiplier pushwheel to this number.	= 670

3.2.3 Auto Mode

In Auto mode, the 4 - 20mA input signal controls the system operation. The system is idle if no signal is present or if the signal is less than 4mA. When the input signal goes above 4mA, the pump will start metering. In Auto mode, the START/STOP switch is inactive. The following sections describe operating in Auto mode.

3.2.3.1 Controller Setup

Set the switches on the front panel to the following settings:

- The 1/0 power switch to "0".
- The AUTO/MANUAL switch to "AUTO".
- The SLOPE MULTIPLIER pushwheel to the required setting.
- The START/STOP is inactive.

3.2.3.2 Auto Mode Operation

Switch the 1/0 power switch to "1"

Start metering by applying a 4 - 20mA input signal at the terminal strip. The system will continue to operate and stop when the signal is no longer present or drops below 4mA.

3.2.4 Manual Mode

In Manual mode, the START/STOP switch is active and controls the activation of the system and the OVERRANGE indicator illuminates. The following sections describe operating in Manual mode.

3.2.4.1 Controller Setup

Set the switches on the front panel to the following settings:

- The 1/0 power switch to "0".
- The AUTO/MANUAL switch to "MANUAL".
- The SLOPE MULTIPLIER pushwheel to the required setting.
- The START/STOP switch to "STOP".

3.2.4.2 Manual Mode Operation

Switch the 1/0 power switch to "1"

Start pumping by switching the START/STOP switch to "START".

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.

3.3 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 starts flashing and a fault output is generated.

The RESET switch starts flashing when a fault has occurred. Pressing the switch stops it from flashing and resets the system. If the system immediately faults again, refer to Table 3 'Common Operation Problems and Solutions' in Chapter 2 'Operation'.

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.

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 Feedback

A feedback signal terminal block is supplied on the rear of the Controller Module. In Auto mode this signal provides a feedback signal based on the input signal. In Manual mode the feedback signal is the maximum.

The Controller Module's efforts to restart the motor by stopping and ramping up to target speed will be reflected in this output signal. The output will drop to the minimum value and ramp up to either the level determined by the process signal input (Auto mode) or the maximum (Manual mode). If the restart attempts are not successful and the Controller Module faults, the output will indicate 0 speed.

3.4.4 Rate Multiplier

A 3-position rate multiplier rotary switch provides a reduction for the rate multiplier pushwheel. With the switch in the 1.0 position, the system will operate normally. If the switch is in the 0.1 position, the motor speed is reduced by one-tenth. If the switch is in the .01 position, the motor speed is reduced by one-hundreth.

3.4.5 Digital Display

A 3-1/2 digit LCD panel meter is located on the front of the Controller Module. The meter displays the input signal level.

3.4.6 Motor Speed

The motor speed is set at the factory depending on the application. The optional motor speeds are 660 and 1155 RPM.

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 AUTO/MAN and 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)

1

2

3

4

Figure 3.3 LED Disassembly/Assembly

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.

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 3.3 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

Process Signal:
- 4 - 20mA, Input Impedance; 50 Ohms (Standard)
- 0 - 5 V (Option)
- 0 - 10 V (Option)

Feedback Signal:
- 4 - 20mA, Input Impedance; 50 Ohms (Standard)
- 0 - 5 V (Option)

Fault Out (CC Option):

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
+24 VDC @ 20mA max	(OI Option)

3.8 MODEL NUMBER

The model number provides important information about the specifics of your Controller Module at time of order. 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 and on the rear of the Controller Module.

Figure 3.4 Power Entry Module

520094 - # # # # # # #

Motor/Base
- **A** - Microspense AP Single End
- **B** - Microspense AP Dual End
- **C** - Microspense AP Rare Earth
- **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

Interface A
- **A** - Process Signal In 4-20mA
- **B** - Process Signal In 0-5V
- **C** - Process Signal In 0-10V
- **D** - A & Feedback Output 4-20mA
- **E** - B & Feedback Output 0-5V
- **F** - C & Feedback Output 0-5V
- **G** - Process Signal In 4-20mA, 34 3 Stk
- **H** - Process Signal In 0-5V, 34 3 Stk
- **J** - Process Signal In 0-10V, 34 3 Stk
- **K** - A & Feedback Output 4-20mA, 34 3 Stk
- **L** - B & Feedback Output 0-5V, 34 3 Stk
- **M** - C & Feedback Output 0-5V, 34 3 Stk

Interface B
- **A** - None
- **B** - Fault Out (CC)
- **C** - Fault Out (OI)

Front Panel
- **A** - No Front Panel Options
- **B** - Fwd / Rev Switch
- **C** - Fwd / Rev Switch & Rate Multiplier
- **D** - Process Signal Display
- **E** - RPM Display
- **F** - C & D
- **G** - C & E
- **H** - B & D
- **J** - B & E

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

Table 3.3 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.
	Bad input signal.	Switch to Manual mode. If the system operates properly, check the input connections and source.
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.**

NOTE

A 'Z' in the model number or a model number not listed indicates a custom option and will be described in either the Title Page or Chapter 4.

3.9 ILLUSTRATED PARTS BREAKDOWN

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

INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
		Digifeeder Controller Module	**1**
1	662039-03	Switch Lens, Rocker, 662041 Legend; Fwd/Rev	1
2	662029-005SY	LED, Wedge Based, Multichip, 5 VDC, Std Yellow	4
3	662039-08	Pushbutton Lens, For 662027, Legend, Auto/Man	1
4	662039-01	Switch Lens, Rocker, 662041 Legend; Start/Stop	1
5	662029-005SG	LED, Wedge Based, Multichip, 5 VDC, Std Green	1
6	662029-005SR	LED, Wedge Based, Multichip, 5 VDC, Std Red	2
7	662025-01	Pushbutton Lens, For 662027, Legend, Reset	1

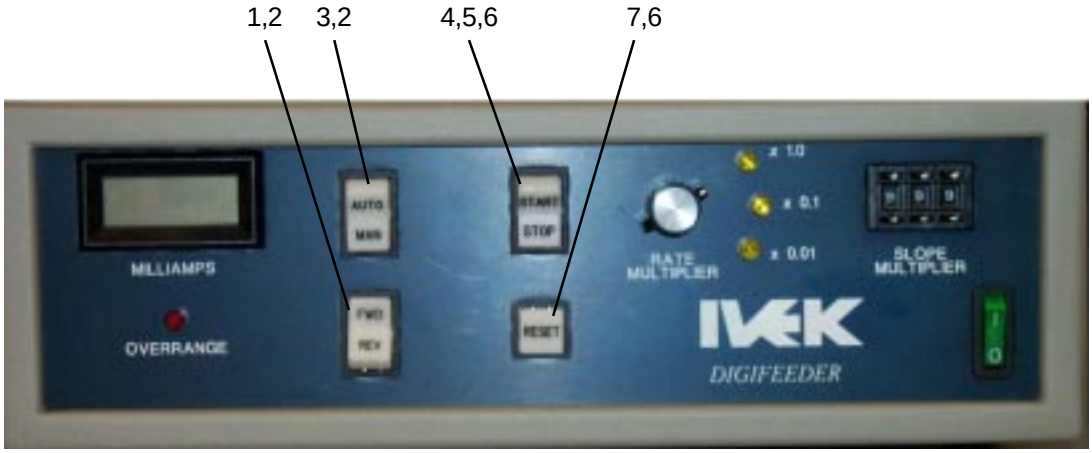

Figure 3.5 Digifeeder Controller Module (Sheet 1 of 1)