
Table Of Contents

| Section | Description | Page # |
|-----------|--|------------|
| 3. | Digispense 2000 Controller Module | 3-2 |
| 3.1 | Description | 3-2 |
| 3.1.1 | Front Panel Controls & Indicators | 3-2 |
| 3.1.2 | Rear Panel Detail | 3-3 |
| 3.2 | Operation | 3-4 |
| 3.2.1 | Display Screen | 3-4 |
| 3.2.2 | Operating Modes | 3-6 |
| 3.2.3 | Initialization | 3-6 |
| 3.2.4 | Faults | 3-8 |
| 3.3 | Installation | 3-8 |
| 3.4 | Options | 3-8 |
| 3.4.1 | Voltage Trigger | 3-8 |
| 3.4.2 | PLC Interface (without load) | 3-8 |
| 3.4.3 | PLC Interface (with load) | 3-9 |
| 3.4.4 | Serial Interface | 3-9 |
| 3.4.5 | Motion System Control Interface Type A | 3-12 |
| 3.4.6 | Steps | 3-13 |
| 3.5 | Maintenance | 3-13 |
| 3.5.1 | Assembly/Disassembly Procedures | 3-13 |
| 3.6 | Problem Guide | 3-14 |
| 3.7 | Specifications | 3-14 |
| 3.8 | Model Number | 3-14 |
| 3.9 | Illustrated Parts Breakdown | 3-15 |

3. DIGISPENSE 2000 CONTROLLER MODULE

3.1 DESCRIPTION

The Digispense 2000 Controller Module, hereafter referred to as the Controller Module, contains all the control, monitoring, and interface components for the dispensing operations. The Controller Module measures 14 3/4" (380mm) wide, 11 3/4" (300mm) deep, 5 1/4" (165mm) high (feet included) and weighs approximately 17 pounds (7.7 kilograms). The operator controls and interface connections are located on the front and rear panels.

3.1.1 Front Panel Controls & Indicators (Figure 3.1)

The front panel contains the operator interface for controlling the system. The following items are located on the front panel.

- | | |
|----------------------|--------------------------|
| 1. Display | 5. 1/0 (On/Off) Switch |
| 2. START Push-button | 6. Function Push-buttons |
| 3. STOP Push-button | 7. Mode Push-button |
| 4. Dial | |

3.1.1.1 Display (Figure 3.1 Item 1)

This alphanumeric liquid crystal display is four lines of forty characters each. The Controller Module status is shown on the display.

3.1.1.2 START Push-button (Figure 3.1 Item 2)

This push-button begins the pumping operation. The button illuminates green when the pump is operating.

3.1.1.3 STOP Push-button (Figure 3.1 Item 3)

This push-button stops the pumping operation. The button illuminates red when the pump is stopped.

3.1.1.4 Dial (Figure 3.1 Item 4)

The dial is used to change values for parameters while in Setup mode.

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).

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

3.1.1.6 Function Push-buttons (Figure 3.1 Item 6)

These push-buttons change the value or initiate the operation for the item displayed directly above the push-button.

3.1.1.7 Mode Push-button (Figure 3.1 Item 7)

This push-button changes the Controller Module mode. The current mode is displayed just above the push-button.

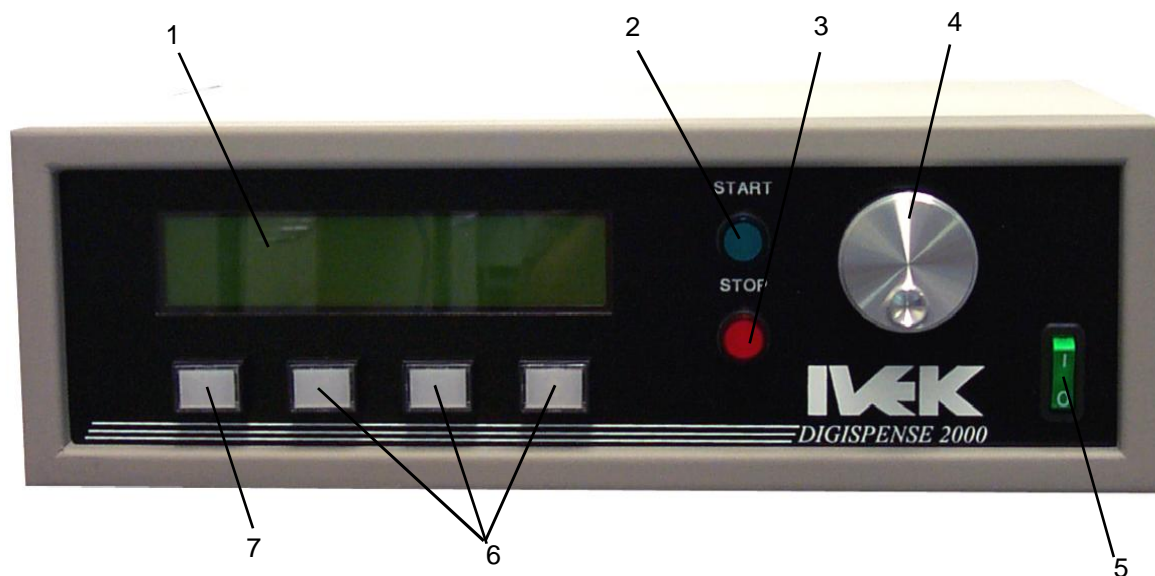


Figure 3.1 Digispense 2000 Controller Module Front Panel

3.1.2 Rear Panel Detail (Figure 3.2)

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

1. Power Entry Module
2. TRIGGER IN Terminal Strip
3. Actuator 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.

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 TRIGGER IN Terminal Strip (Figure 3.2 Item 2)

The Trigger In terminal strip has two screw terminals (+/-) used for triggering operation in Dispense or Meter mode. Prime and Bubble Clear operations can not be initiated with this signal. Operation is initiated at the rising edge of this signal (dry contact or solid state). In Dispense mode, further activity of the input signal is ignored until the dispense is completed. In Meter mode, motion continues until either the signal is removed or the pump chamber is emptied. The signal rating is 20mA at 5VDC.

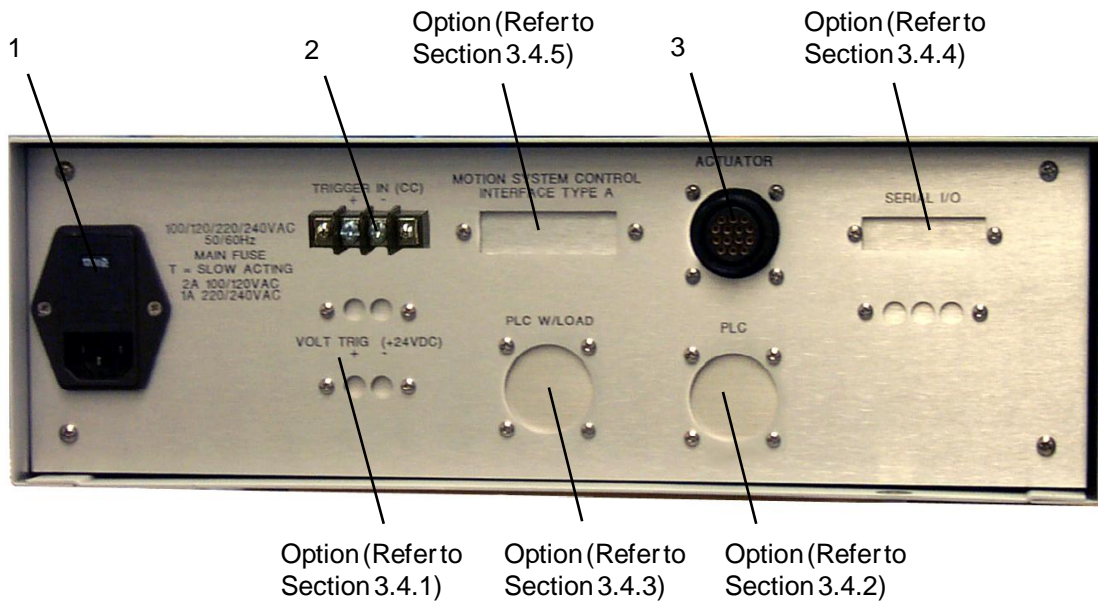


Figure 3.2 Digispense 2000 Controller Module Rear Panel

NOTE

The front panel mounted START switch or a contact closure wired through the rear panel terminal strip will activate the pump.

3.1.2.3 Actuator Connector (Figure 3.2 Item 3)

The Actuator 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 computer controlled liquid flow to the nozzle. The systems utilize solid-state electronics, stepping motor drives, ceramics, and positive displacement dispensing heads. These components combine to provide exceptional accuracy (0.1%), high reliability, and low maintenance.

3.2.1 Display Screen

This alphanumeric liquid crystal display is four lines of forty characters each. The current operating mode and system status are shown on the display.

NOTE

The following display examples are for a standard system. Your display may differ depending on your pump size and options.

The display shows system status, settings and general information. The display is divided into ten fields as shown in Figure 3.3. Following is a description of what will be displayed in each field.

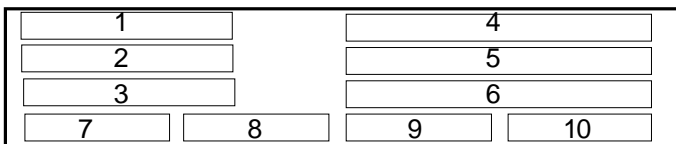


Figure 3.3 Display Screen Field Locations

NOTE

All references to push-buttons in this section refer to the push-button located below a word on the display. For example, the push-button located under 'REFERENCE' will be called the Reference push-button.

Field 1 - This field displays the software version in start-up mode and the total fluid pumped while in the Meter and Dispense modes.

In Start-up mode, the current Controller Module software version is displayed. This number is useful when calling IVEK with questions.

In Setup, Prime, Meter, and Dispense modes, this field displays the total volume dispensed during meter and dispense operations. To reset the totalizer, change to the Setup mode, move the '*' to Field 1, press the Clear push-button and while holding the CLEAR push-button press the Enter push-button. The highest count available on totalizer before it must be reset is dependent on the pump size. Refer to Table 3.1 for the maximum number for each pump size.

Field 2 - This field displays the Controller Module type in start-up mode and the volume setting used in the Prime and Dispense modes.

In Start-up mode, the current Controller Module type is displayed. This number is Digispense 2000 for this Controller Module.

In Setup, Prime, Meter, and Dispense modes, this field displays the volume dispensed during dispense operations. Refer to Section 3.2.3.2 for instructions on changing this setting.

Field 3 - This field displays the minimum and maximum volume settings for the system in the Start-up mode and the load setting in Setup, Prime, Dispense and Meter modes.

In Start-up mode, the minimum and maximum volume settings for the pump supplied are displayed. Refer to Table 3.1 for a listing of these numbers for each size Pump Module. Refer to the Title Section of this manual for the correct pump size.

Table 3.1 Volumetric Output Of Linear Pump Modules

| Size | Minimum Increment (μ l) | Maximum Increment (μ l) | Maximum Totalizer Value |
|---------|------------------------------|------------------------------|-------------------------|
| 4A | 0.010 | 20 | 65X.XX |
| 3A | 0.025 | 50 | 163X.XXX |
| 2A | 0.050 | 100 | 32XX.XX |
| 1A | 0.100 | 200 | 65XX.X |
| B | 0.200 | 400 | 13XXX.X |
| C | 0.500 | 1000 | 32XXX.X |
| D | 1.000 | 2000 | 65XXX. |
| Options | | | |
| 2A20* | 0.100 | 100 | 65XX.X |
| A20* | 0.200 | 200 | 13XXX.X |
| ** | | | 65XXX. |

*Standard Pumps Modules with optional 20-pitch Actuator modules.

** Optional count in steps for all Pump Module sizes.

In Setup, Prime, Meter and Dispense modes, this field displays the load setting. The load setting indicates which type of load will be used; Manual, Empty, or Every. Refer to Section 3.2.3.2 for instructions on changing this setting.

In MANUAL, the system can be triggered in Dispense mode if the volume of fluid remaining in the pump chamber is greater than the dispense volume. The system will stop and the operator must manually initiate LOAD command by pressing the Load push-button.

In EMPTY, the system will dispense until the volume of fluid remaining in the pump chamber is less than the required volume of liquid to dispense. When the current operation stops, the system will automatically initiate a load cycle to fill the chamber with liquid. The operator may manually initiate Load at any time.

In EVERY, after every dispense or metering operation is completed, the system will automatically initiate a load cycle to fill the chamber with liquid. The operator may manually initiate Load at any time.

Field 4 - This field is used for displaying fault information. If a fault occurs, this field will indicate either a rotary or linear fault has occurred.

Field 5 - This field displays the Dispense and Meter Mode rate in Setup, Prime, Dispense and Meter modes.

The rate setting determines the pumping rate used during dispense and meter operations. Refer to Section 3.2.3.2 for instructions on changing this setting.

Field 6 - This field displays the Prime and Load Mode rate in Setup, Prime, Dispense and Meter modes.

The rate setting determines the pumping rate used during prime and load operations. Refer to Section 3.2.3.2 for instructions on changing this setting.

Field 7 - This field displays the current operating mode.

This field will display either Setup, Prime, Dispense, Meter or Bubble Clear. Refer to Section 3.2.3.2 for instructions on changing this setting.

Field 8 - This field displays SELECT in the Setup mode and indicates the liquid direction in Prime, Dispense and Meter modes.

In Setup mode, the push-button below this field will move the "*" indicating which parameter is selected and may be changed.

In Prime, Meter, and Dispense modes, this field displays either FORWARD or REVERSE indicating the fluid direction. Pressing the push-button below this field will toggle the direction between forward and reverse. The direction defines flow at the selected port.

Field 9 - This field displays ENTER in the Setup mode and indicates the selected port in Prime, Bubble Clear, Dispense and Meter modes.

In Setup mode, the ENTER push-button will load the new setting into the Controller Module. A new setting will not be saved if the ENTER push-button is not pressed.

In Prime, Bubble Clear, Meter and Dispense modes, this field displays either PORT A or PORT B indicating the selected port. Pressing the push-button below this field will toggle the selected port between A and B.

Field 10 - This field displays REFERENCE in the Start-up mode, CLEAR in Setup mode, and LOAD in Prime, Dispense and Meter modes.

In Start-up mode, the Reference push-button will reference the piston. This must be done each time the Controller is turned on or after a fault has been cleared.

In Setup mode, the Clear push-button will reset the selected field to the minimum setting.

In Prime, Meter and Dispense modes, the Load push-button will initiate a load cycle. The button will steadily illuminate during a load cycle. The button will blink when a load is required.

3.2.2 Operating Modes

The system provides different operating modes for performing unique operations. Each mode provides a unique function as described in the following paragraphs.

3.2.2.1 Prime

Prime mode produces a continuous cycle to pump fluid in one direction. Prime is used to fill the system with fluid in preparation for actual operation, empty the system of fluid, and flush the system for cleaning.

3.2.2.2 Dispense

Dispense mode is used to deliver a specific volume of fluid at a specific rate. The current settings for the fluid direction determine the direction of fluid flow.

3.2.2.3 Meter

Meter mode is used to deliver fluid at a specific rate for a period of time determined by input signals. The most accurate and repeatable method to control metering operation uses the hardwired inputs. Pumping will start when the hardwired signal is present and will stop when the hardwired signal stops or the pump chamber empties.

3.2.2.4 Bubble Clear

Bubble clear is a sequence of volume displacement and valving used to dislodge air bubbles in the pump chamber and move them out through the discharge port. This is used when initially priming the system to aid in eliminating air bubbles which have a detrimental effect on accuracy and repeatability. Bubble Clear uses the rate selected for Prime and Load.

3.2.2.5 Load

The load cycle is used to refill the pumping chamber with fluid after dispensing or metering. The piston will valve to the inlet port, fill the pump chamber with fluid, and valve back to the discharge port. The system can be configured to start a load cycle on either of three conditions; empty, every or manual.

3.2.2.6 Reference

The controller must complete a reference cycle when power is first applied or when a fault occurs. There are no sensors in the actuator which send the absolute linear and rotary locations of the piston at all positions, there are only 'home' position sensors. The piston will first turn to find the rotary home (pump chamber open to port A), then move linearly to find the linear home.

A reference cycle is required after faults or after power is first applied and before any command resulting in motion of the actuator is accepted.

NOTE

The system will not operate if a reference command has not been initiated. The setup screen will be displayed and the Reference push-button will blink when a reference is required.

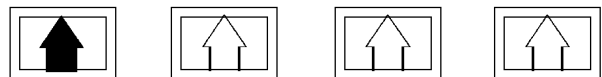
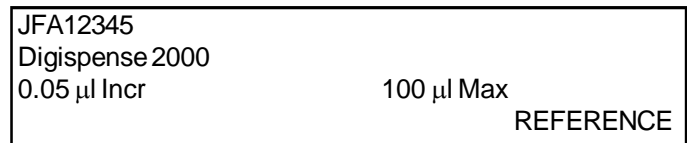
3.2.3 Initialization

There are several different modes of operation which provides the Controller Module with its vast functional flexibility. On initial power-up these modes must each be sequenced in the proper order to assure proper operation.

3.2.3.1 Start-up

Switch the 1/0 power switch to the "1" position. The switch should illuminate green when the power is on.

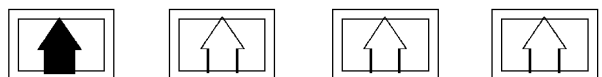
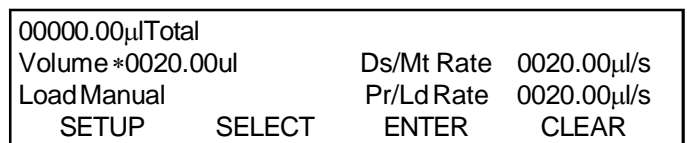
The display will illuminate and show the following information:



Refer to Section 3.2.1 for a description of each field. Your display will show the information for your system. The flashing push-button below 'REFERENCE' indicates the piston needs to be referenced. Pressing the Reference push-button will reference the piston and the display will change to the setup screen.

3.2.3.2 Setup

After the Reference push-button is pressed, the following screen will be displayed. The "*" indicates which field can be changed.



Refer to Section 3.2.1 for a description of each field. While in Setup mode, all the system operating parameters should be entered. Use the following guide to set the parameters.

Volume - Initially the '*' is next to the Volume so set this first. Turn the dial until the display shows the correct Volume for Dispense mode then press the Enter push-button. The volume can not be set outside the minimum and maximum range of the pump.

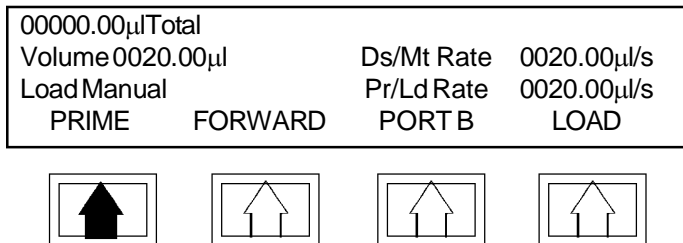
Ds/Mt Rate - The '*' will move to the rate for Ds/Mt Rate line on the display. Turn the dial until the display shows the correct rate for Dispense and Meter modes, then press the Enter push-button.

Load - The '*' will move to the Load line on the display. Turn the dial until the display shows the correct load setting then press the Enter push-button.

Pr/Ld Rate - The '*' will move to the Pr/Ld Rate line on the display. Turn the dial until the display shows the correct rate for Prime and Load modes, then press the Enter push-button.

3.2.3.3 Prime

To enter the Prime mode from the Setup mode, press the solid arrow push-button once. The following screen will be displayed. If the Controller Module is not in the SETUP mode, simply press the solid arrow push-button until PRIME appears.

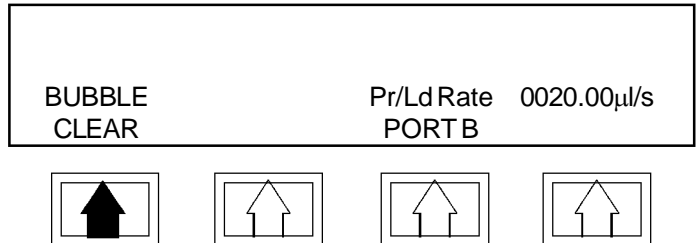


Refer to Section 3.2.1 for a description of each field. Position the pump for priming (outlet above or even with the inlet) fill all reservoirs with liquid, and make sure all liquid lines are connected and secure. Press the START button to begin priming. The system can not be initiated using the rear panel "Manual Start" signal. The system will prime for approximately two minutes then stop. Pressing the STOP button can stop the priming any time during the two minutes. After the system is primed, check for air bubbles.

Position the pump for checking for bubbles (viewing port up) and check for bubbles. If no bubbles are present, the system is ready for operation. If a bubble is present, run the bubble clear operation as follows.

3.2.3.4 Bubble Clear

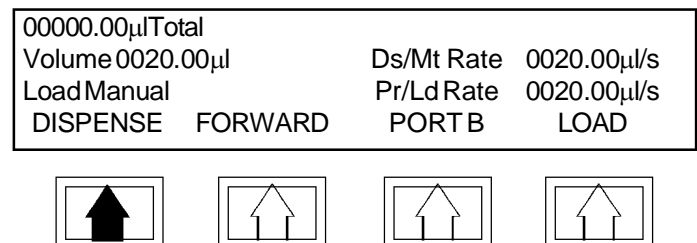
To enter the Bubble Clear mode from the Prime mode, press the solid arrow push-button three times. The following screen will be displayed. If the Controller Module is not in the PRIME mode, simply press the solid arrow push-button until BUBBLE CLEAR appears.



Refer to Section 3.2.1 for a description of each field. Press the START button to begin the bubble clear. The system will operate for one cycle. Continue to press the START push-button until no bubbles are present. Pressing the STOP button will not stop the operation. After the system is free of bubbles you can proceed to either Dispense or Meter mode.

3.2.3.5 Dispense

To enter the Dispense mode from the Bubble Clear mode, press the solid arrow push-button three times. The following screen will be displayed. If the Controller Module is not in the Bubble Clear mode, simply press the solid arrow push-button until DISPENSE appears.

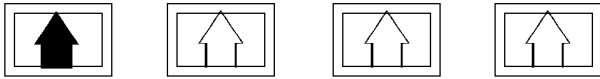


Refer to Section 3.2.1 for a description of each field. To start dispensing press the START button or supply a trigger to the rear panel. The system will dispense the liquid amount specified in the Volume setting at the rate specified in the Ds/Mt Rate setting.

3.2.3.6 Meter

To enter the Meter mode from the Bubble Clear mode, press the solid arrow push-button four times. The following screen will be displayed. If the Controller Module is not in the Bubble Clear mode, simply press the solid arrow push-button until METER appears.

| | | | |
|-----------------|---------|------------|-------------|
| 00000.00µlTotal | | Ds/Mt Rate | 0020.00µl/s |
| Load Manual | FORWARD | Pr/Ld Rate | 0020.00µl/s |
| METER | | PORT B | LOAD |



Refer to Section 3.2.1 for a description of each field. To start metering press the START button or supply a trigger to the rear panel. The system will dispense at the rate specified in the Ds/Mt Rate setting with the volume determined by the length of time the system is active.

3.2.4 Faults

There are two types of faults associated with this system; rotary and linear. If a fault occurs, the type of fault will be displayed in the upper right hand corner. Once the problem is corrected, press the Reset push-button. Refer to Section 3.4.4.3 for a list of possible fault causes.

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 customers 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 Voltage Trigger

The voltage trigger option changes the standard external trigger signal from accepting a contact closure to accepting an external voltage signal. With this option, dispense or metering operation will be triggered when an external 24 volt DC signal is applied.

With the addition of this option, the external trigger signal becomes electrically isolated from the remainder of the internal circuitry of the Controller Module. A two position terminal strip is used for external connections.

3.4.2 PLC Interface (without load)

The PLC interface option replaces the external contact closure trigger signal with a number of signals, including the trigger.

3.4.2.1 Signal Functions

Trigger In - A signal applied to this input will trigger operation if Dispense or Meter mode is selected. No operation will result if the Controller Module is in Setup, Prime, or Bubble Clear mode. Operation is initiated at the rising edge of this signal. In Dispense mode, further activity of the input signal is ignored until the dispense is completed. In Meter mode, motion continues until either the signal is removed or the pump chamber is emptied.

Ready Out - The ready output signal indicates the active/idle state of the Controller Module. This output is true (conducts) when Ready and is false (does not conduct) when the Controller Module is not Ready.

Fault Out (Complemented fault) - The fault output signal indicates that a fault has been detected in the operation of the Actuator Module. This output is complemented, i.e. the output is true (conducts) when no fault exists, and is false (does not conduct) when the Controller Module is faulted.

3.4.2.2 Signal Levels

All signals are optically isolated. The power for all signals is provided by the customer's equipment.

All inputs accept a 24 VDC signal and require 20 mA.

All outputs conduct when the signal is 'true' and don't conduct when the signal is 'false' (see FAULT OUT). Outputs 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.

3.4.2.3 Connections

All connections are through a 9 pin circular plastic connector, with the mating connector and pins supplied with the unit. The connector on the controller is an AMP CPC series 206705-1 with the pin layout as shown in Table 3.2.

Table 3.2 PLC Interface Without Load - Pin Assignments

| PIN | SIGNAL | PIN | SIGNAL |
|-----|-------------|-------|-----------|
| 1 | TRIGGER IN+ | 5 | FAULTOUT+ |
| 2 | TRIGGER IN- | 6 | FAULTOUT- |
| 3 | READY OUT+ | 7,8,9 | Not Used |
| 4 | READY OUT- | | |

3.4.3 PLC Interface (with load)

The PLC interface option replaces the external contact closure trigger signal with a number of signals, including the trigger.

3.4.3.1 Signal Functions

Trigger In - A signal applied to this input will trigger operation if Dispense or Meter mode is selected. No operation will result if the Controller Module is in Setup, Prime, or Bubble Clear mode. Operation is initiated at the rising edge of this signal. In Dispense mode, further activity of the input signal is ignored until the dispense is completed. In Meter mode, motion continues until either the signal is removed or the pump chamber is emptied.

Ready Out - The ready output signal indicates the active/idle state of the Controller Module. This output is true (conducts) when Ready and is false (does not conduct) when the Controller Module is not Ready.

Load Start In - A signal applied to this input will initiate a load cycle. Operation is initiated at the rising edge of this signal, with any further activities on the signal ignored until the operation is completed.

Load Required Out - The load required output signal indicates that a load cycle is required before another dispensing or metering operation can take place. The volume of fluid remaining in the pump chamber is less than the current dispense volume.

Fault Out (Complemented fault) - The fault output signal indicates that a fault has been detected in the operation of the Actuator Module. This output is complemented, i.e. the output is true (conducts) when no fault exists, and is false (does not conduct) when the Controller Module is faulted.

3.4.3.2 Signal Levels

All signals are optically isolated. The power for all signals is provided by the customer's equipment.

All inputs accept a 24 VDC signal and require 20 mA.

All outputs conduct when the signal is 'true' and don't conduct when the signal is 'false' (see FAULT OUT). Outputs 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.

3.4.3.3 Connections

All connections are through a 16 pin circular plastic connector, with the mating connector and pins supplied with the unit. The connector on the Controller Module is an AMP CPC series 206036-1 with the pin layout as shown in Table 3.3.

Table 3.3 PLC Interface With Load - Pin Assignments

| PIN | SIGNAL | PIN | SIGNAL |
|-----|---------------------|-----|---------------------|
| 1 | keying lug | 9 | LOAD START IN + |
| 2 | (open for plug key) | 10 | LOAD START IN - |
| 3 | TRIGGER IN + | 11 | LOAD REQUIRED OUT + |
| 4 | TRIGGER IN - | 12 | LOAD REQUIRED OUT - |
| 5 | READY OUT + | 13 | Not Used |
| 6 | READY OUT - | 14 | Not Used |
| 7 | FAULT OUT + | 15 | Not Used |
| 8 | FAULT OUT - | 16 | Not Used |

3.4.4 Serial Interface

CAUTION

Do not issue a motion command while the actuator is busy (while the actuator is in motion). Use the 'q' Ready/Busy command to determine the actuator's Ready/Busy status.

It is suggested the actuator NOT be run in the reverse direction for extended periods. Loss of the linear home position may result. If reverse direction is required, a periodic reference or load command should be issued to allow the actuator to reacquire the linear home sensor.

The serial interface provides control of all functions available. The hardware is configured as Data Communications Equipment (DCE) standard with the pin configuration shown in Table 3.4.

Table 3.4 Connections (DCE, 25 pin D-sub female)

| Pin | Signal | Direction |
|-----|--------|------------------------|
| 1 | SHLD | Shield - not connected |
| 2 | TD | To Controller Module |
| 3 | RD | From Controller Module |
| 7 | GND | |

No hardware signals are currently used for handshaking. (One signal in each direction is available for future enhancements.)

To operate the system, a terminal emulator is required. A standard terminal emulator set to the following parameters will work.

- 1200 Baud
- 8 Bit
- No Parity Sent, Received Parity Ignored
- One Stop Bit

d<value1> FORWARD or REVERSE Sets the liquid flow direction.
 <value1>: 0 = Reverse
 1 = Forward
 Any nonzero number results in Forward.

3.4.4.1 Command Structure

The command is a string of ASCII characters. The use of the ASCII backspace character as a means of entry correction is supported.

Commands are echoed as they are received.

After dispense or metering operation is triggered, the values for that operation are fixed. This allows new parameter values for the next operation to be downloaded before the current operation is complete.

The Controller Module serial interface does not 'broadcast' messages, such as fault conditions, but only responds when it receives a command.

Every command is ended with a carriage return character. Every command echo and response is ended with carriage return and line feed characters.

e => END
 e END Ends the current pumping cycle. In Prime mode, will continue until piston chamber full in Forward and piston chamber empty in Reverse.

f => REFERENCE
 f REFERENCING References the piston in the home position for both the rotary and linear home.

g => TOTALIZER
 g #####.##µL TOTAL Returns current value of the totalizer for dispensing and metering volume in microliters.

MAX VALUE: The totalizer will increment to the maximum value and stop, the totalizer will not 'wrap around', the pump will continue to operate without incrementing the totalizer. (See Table 3.1 for the maximum value)

Table 3.5 Commands

| <u>Command</u> | <u>Response</u> | <u>Description</u> |
|-----------------------------|--|--|
| a => AUTOLOAD | | |
| a | Load MANUAL or Load EMPTY or Load EVERY | Returns current autoloading setting. |
| a<value1> | Load MANUAL or Load EMPTY or Load EVERY | Sets the Autoloading mode. <value1>: 0 = Manual 1 = Empty 2 = Every |
| b => BEGIN | | |
| b | BEGIN | Initiates a prime, dispense, meter, or bubble clear cycle according to the current 'mode' setting. |
| c => CLEAR FAULTS | | |
| c | FAULTS CLEARED | Clears all faults. |
| d => DIRECTION | | |
| d | FORWARD or REVERSE | Returns current fluid direction setting. |
| g0 | 0000.00µL TOTAL | Resets the value of the totalizer to zero. This parameter can only be reset to zero. |
| k => KEYLOCK | | |
| k | UNLOCKED or LOCKED | Returns the current setting which inhibits or allows operation of the front panel controls. |
| k<value1> | UNLOCKED or LOCKED | Enables or disables a channel. <value1>: 0 = Disabled 1 = Enabled |
| l => LOAD | | |
| l | LOADING | Initiates a load cycle. |
| m => MODE | | |
| m | PRIME or DISPENSE or METER or BUBBLE CLEAR | Returns the current mode. |

m<value1> PRIME or DISPENSE or METER or BUBBLE CLEAR Sets the operating mode. <value1>: 1 = Prime 2 = Dispense 3 = Meter 4 = Bubble Clear

t => TIME LIMIT FOR PRIME
 t "### S Limit For Prime" Returns current limit on prime or empty cycle in seconds. Value of 0 will allow priming for less than 1 second.

p => PORT

p PORT B or PORT A Returns the current selected port.

t<###> "### S Limit For Prime" Sets the limit on prime or empty cycle in seconds. Value of zero will allow priming for less than 1 second.

p<value1> PORT B or PORT A Determines which port is the selected port. Combines with direction (fwd rev) to determine fluid direction. In forward direction, with port B selected pumping is from A to B. <value1>: 0 = Port A 1 = Port B

Maximum: 127
 Minimum: 0
 Power up: 120

u => PRIME, LOAD AND BUBBLE CLEAR RATE

u "Pr/LdRate####.##µL/S" Returns the current prime, load, and bubble clear flow rate in microliters per second.

q => READY/BUSY

q --faults-- READY or BUSY Retransmits any current faults or indicates READY/BUSY status.

u<###.##> "Pr/LdRate####.##µL/S" Sets the Prime, Load, and Bubble Clear flow rate. Min, Max, Default values are a function of piston size.

r => DISPENSE RATE

r Ds/Mt Rate ####.##µL/S Returns the current dispense and metering flow rate.

v => DISPENSE VOLUME

v "Volume####.##µL" Returns the current dispense volume in microliters.

r<###.##> Ds/Mt Rate ####.##µL/S Sets the Dispense or Metering flow rate in microliters/sec. Min, Max Default values are a function of the piston size.

v<###.##> "Volume####.##µL" Sets the dispense volume. Min, Max, Default values are a function of piston size.

s => STATUS

s ###.##µL Remaining Returns miscellaneous status information. Volume #.###µL Incr ###µL Max remaining until a load is required. Pump size given by incremental volume and maximum volume. All volume units are in microliters.

y => VALVING SPEED

y "Porting#### st/sec" Returns the current speed of the motor during valving in steps per second.

y<###.##> "Porting#### st/sec" Sets the speed of the motor during valving in steps per second. One full revolution (i.e. Port A back to Port A) is 200 steps. Maximum: 1000 Minimum: 14

Note: While the maximum speed for valving to port B is 1000, the maximum (and default) speed for valving to port A is 580. If the parameter set with this command is greater than 580, that value will be the speed for valving to port B, and 580 will be the speed for valving to port A. If the parameter is set less than 580, then both ports will use the same value.

z=> SOFTWARE VERSION

z<cr> XXX##### Returns the software version and additional configuration information. As an aid to determining relative age of different versions, the last two digits are the year and the previous three digits are the day in the year for that version.

3.4.4.2 Warnings

All warning messages will begin with an asterisk followed by a nonzero digit. A space will separate the identification number from any descriptive text.

***1 WHAT?**

Response to any unrecognized command

***2 VALUE NG!**

Response to any out of range value, previous value will remain unchanged.

***3 LOAD REQUIRED**

Piston is empty or remaining volume is less than the current dispense volume.

***4 REFERENCE REQUIRED**

Pump needs to locate linear and rotary position reference positions. Reference cycle, using "f" command, must be completed before continuing.

***5 MODE NOT SELECTED**

Begin command ('b') issued without prime, dispense, meter, or bubble clear mode selected.

***6 NUM4MAT**

Internal software error, please note command issued by you and the software version (use 'z' command) and send to IVEK Corp. to help us eliminate the error.

3.4.4.3 Faults

All fault messages will begin with an asterisk and zero. A space will separate the identification number from any descriptive text.

***00 Linear Sensor Fault**

"Home" position sensor for linear motion was not detected. Clear faults using "c" command and re-reference using "f" command.

***01 Rotary Sensor Fault**

"Home" position sensor for rotary motion was not detected. Clear faults using "c" command and re-reference using "f" command.

NOTES

Examine, don't assume, decimal point position in returned values. The number of digits and decimal point position in returned values will possibly change for different pump volumes and software revisions.

The number and placement of spaces in responses will possibly change for different pump volumes and software revisions.

Minus characters (-) are ignored in input values, negative numbers are treated as positive values.

When a parameter is selected with the front panel setup and changed but not entered, these commands will return the 'temporary' value. If the 'select' button is pushed without the 'temporary' value being entered, the parameter will return to the original value and these commands will return that original value.

3.4.5 Motion System Control Interface Type A

The Motion System Control Interface Type A option allows convenient connection to a number of motion control systems. This interface is required on Controller Modules used in conjunction with an IVEK Linear Striper or some Cartesian robots IVEK utilizes. The connector for this interface is located on the rear of the Controller Module.

3.4.5.1 Signal Description

Following is a list of the signals and their associated descriptions.

Trigger In - A signal applied to this input will trigger operation if Dispense or Meter mode is selected. No operation will result if the Controller Module is in Setup, Prime, or Bubble Clear mode. Operation is initiated at the rising edge of this signal. In Dispense mode, further activity of the input signal is ignored until the dispense is completed. In Meter mode, motion continues until either the signal is removed or the pump chamber is emptied.

Ready Out - The ready output signal indicates the active/idle state of the Controller Module. This output is true (conducts) when Ready and is false (does not conduct) when the Controller Module is not Ready.

Load Start In - A signal applied to this input will initiate a load cycle. Operation is initiated at the rising edge of this signal, with any further activities on the signal ignored until the operation is completed.

Load Required Out - The load required output signal indicates that a load cycle is required before another dispensing or metering operation can take place. The volume of fluid remaining in the pump chamber is less than the current dispense volume.

Fault Out (Complemented fault) - The fault output signal indicates that a fault has been detected in the operation of the Actuator Module. This output is complemented, i.e. the output is true (conducts) when no fault exists, and is false (does not conduct) when the Controller Module is faulted.

3.4.5.2 Signal Levels

All inputs accept a contact closure or isolated transistor output. The negative side of the input signals are connected inside the Controller Module to logic supply common. The customer device connected to an input signal must be capable of switching a 5 volt DC signal of 20 milliamps with an 'off' state leakage of less than 0.5 milliamps. The Controller Module supplies the power source for the input signals.

All outputs conduct when the signal is 'true' and do not conduct when the signal is 'false' (see Fault Out). Outputs can switch a signal of up to 24 volts DC and 50 milliamps. The output consists of the emitter and collector connections to an IC opto-isolator. All outputs of opto-isolator have the emitters tied together and connected to pin 18. This configures the IVEK outputs as sinking the customer provided power source. The output signals are isolated from the input signals. The customer provides the power source for output signals.

Table 3.6 Controller Module Interface - Pin Assignments

| Controller Signal | Controller Pin # |
|-------------------|------------------|
| LOAD REQ OUT + | 5 |
| READY OUT + | 6 |
| FAULT OUT + | 7 |
| TRIGGER IN + | 14 |
| LOAD START IN + | 15 |
| OUT COM - | 18 |
| TRIGGER IN - | 23 |
| LOAD START IN - | 24 |

3.5.4.3 Use with IVEK Linear Striper

When the Controller Module is used with an IVEK Linear Striper, IVEK supplies a cable which connects the Controller Module to the Linear Striper Controller Module. Identical connectors are on both ends of this cable allowing either end to be connected to either controller. This interface not only allows the Linear Striper to trigger the Controller Module, but allows the Controller Module to prevent a stripe from being started if it is not 'ready'.

3.4.6 Steps

The Controller Module can be set to display steps instead of micro liters. This option is useful when the process requires changing Pump Module Sizes on a regular basis.

A dispense of 0.1ml would require 10 steps for a 4A Pump Module, 4 steps for a 3A Pump Module and 2 steps for a 2A Pump module. Refer to Table 3.1 for the volume per step (Minimum Increment) for each size Pump Module.

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
- Power Module

3.5.1.1 Switch LED's (Figure 3.3 Items 1,2,3)

The LED's in the START, STOP and right FUNCTION push-buttons are replaceable.

Disassembly

1. Use a small straight blade screwdriver to remove the switch cover.
2. Use needle nose pliers to grab the bulb and pull it straight out.

Assembly

1. Install the new bulb into the socket.
2. Snap the switch cover into place.

3.5.1.2 Main Power Fuse

520090-

#

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 3.7 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 the Controller Module. Any unauthorized access to the inside will void the warranty.

3.7 SPECIFICATIONS

Trigger Signal Requirements:
 Mechanical contact closure or solid state
 Held closed for 100msec typical

Voltage Trigger Requirements (option):
 +24 VDC @ 20mA max
 Held active for 100msec

Input Power Requirements:
 100/120/220/240 VAC 50/60 Hz

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.

LINEAR ACTUATOR & PUMP

- A - 40 Pitch, 4A
- B - 40 Pitch, 3A
- C - 40 Pitch, 2A
- D - 40 Pitch, A
- E - 40 Pitch, Steps
- F - 40 Pitch, Custom Default Parameters
- G - 40 Pitch, Custom Torque
- H - 20 Pitch, B
- J - 20 Pitch, C
- K - 20 Pitch, D
- L - 20 Pitch, Steps
- M - 20 Pitch, Custom Default Parameters
- N - 20 Pitch, Custom Torque

ENCLOSURE FINISH

- A - Powder Coat
- B - Stainless Steel

LOGIC INTERFACE

- A - Trigger In Contact Closure (CC)
- B - PLC, Optically Isolated (OI)
- C - PLC w/Load, Optically Isolated
- D - Motor System Control Interface Type A
- F - Voltage Trigger In (24 VDC)
- G - PLC (OI) & Trigger In (CC)
- H - PLC W/Load (OI) & Trigger In (CC)
- I - Trigger In (CC) & Digisonic Trigger Out
- J - PLC (OI) & Digisonic Trigger Out
- K - PLC W/Load & Digisonic Trigger Out
- L - PLC (OI), CC & V (24 VDC) Trig
- M - PLC W/Load, CC & V (24V) Trig

PARAMETER INTERFACE

- A - None
- B - Serial Interface, RS232

LINE CORD/CE

- A - North American
- B - International
- C - North American, CE
- D - International, CE

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.

Table 3.7 Common Operational Problems And Solutions

| PROBLEM | PROBABLE CAUSE | POSSIBLE SOLUTION |
|--|--|--|
| <p>No power, nothing works.</p> <p>Power is on, Controller Module accepts trigger, piston fails to move and Actuator Module makes a sound. * This condition does not harm the system.</p> <p>Power is on, Controller Module accepts a trigger, (START indicator illuminates, STOP indicator does not), piston fails to move, and Actuator Module is silent.</p> <p>Controller Module power on and operational, but will not activate Actuator.</p> <p>"junk" characters appear in the echo of a command when using the serial interface. Otherwise command functions properly.</p> | <p>AC power may be absent or inadequate. Unit not plugged in.</p> <p>Fuse is blown.</p> <p>A Pump Module or motor malfunction can cause this problem.</p> <p>A motor malfunction can cause this problem.</p> <p>I/O Cable</p> <p>Serial characters are being sent to the Controller Module faster than the Controller Module can process the echo.</p> | <p>Ensure AC power cord is plugged into a properly grounded three-prong outlet capable of supplying 115/120/220/240 volts, 50/60Hz, rated at 5.0 amps.</p> <p>Unplug main power cord from outlet. Remove fuse from rear panel fuse holder. Test fuse conductivity. Install good fuse in rear panel fuse holder.</p> <p>Turn off Controller Module power. Remove Pump Module from Actuator Module. Turn on Controller Module and try again.</p> <p>If the motor operates correctly, the pump may need to be cleaned or serviced.</p> <p>Turn off Controller Module power. Check to ensure Actuator Module is properly connected to controller. Turn on controller and try again. If the motor operates incorrectly, servicing may be necessary to the motor or the controller. Return complete controller, Actuator Module and Pump Modules to IVEK Corporation for repair.</p> <p>Check connection of cable between Controller Module and Actuator Module. Inspect and repair faulty cable.</p> <p>Change serial interface configuration to 2 stop bits (from 1 stop bit) in equipment connected to IVEK Controller Module. No change is required in configuration of IVEK Controller Module.</p> <p>Add delay between each character being sent from the equipment connected to the IVEK Controller Module. Start with approximately 0.2 milliseconds and increase if required. If delay of 100 milliseconds between characters does not correct the problem contact IVEK technical support for assistance.</p> |

3.9 ILLUSTRATED PARTS BREAKDOWN

The illustrated parts breakdown (Figure 3.3) contains replacement parts for the Digispense 2000 Controller Module.

| INDEX NO. | PART NUMBER | DESCRIPTION | UNITS PER ASSY |
|-----------|--------------|---|----------------|
| | | Digispense 2000 Controller Module | 1 |
| 1 | 662047-005SW | LED, Flange Based, TI-3/4 Midget, Multichip, 5V Std White | 1 |
| 1 | 662141-03 | LED, Flange Based, TI-3/4 Midget, Singlechip, 6V, White | 1 |
| 2 | 662047-005SG | LED, Flange Based, TI-3/4 Midget, Multichip, 5V Std Green | 1 |
| 2 | 662141-01 | LED, Flange Based, TI-3/4 Midget, Singlechip, 6V, Green | 1 |
| 3 | 662047-005SR | LED, Flange Based, TI-3/4 Midget, Multichip, 5V Std Red | 1 |
| 3 | 662141-02 | LED, Flange Based, TI-3/4 Midget, Singlechip, 6V, Red | 1 |

The photograph shows the front panel of the IVEK DIGISPENSE 2000 controller module. It features a central green LCD display (callout 1), a blue 'START' button (callout 2), and a red 'STOP' button (callout 3). To the right of the buttons is a large silver rotary knob. Below the display are four small square indicator lights. The IVEK logo and 'DIGISPENSE 2000' are printed on the bottom right of the panel. A green power indicator light is visible on the far right.

Figure 3.3 Digispense 2000 Controller Module (Sheet 1 of 1)