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3. DIGIFEEDER® 2002 CONTROLLER MODULE

3.1 DESCRIPTION

The DIGIFEEDER® 2002 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 1/4" wide, 15" deep, 6" high (feet included) and weighs approximately 19 pounds. The operator controls and interface connections are located on the front and rear panels. The DIGIFEEDER 2002 Controller Module is distinguished from the Multispense 2000 and the Digispense 2000 by it's ability to provide a continuous flow of liquid with minimal pulsations.

3.1.1 Front Panel Controls & Indicators (Figure 3.1)

The front panel of the Controller Module is largely made up of the individual front panels of the Digifeeder 2002 Master Plug-In PCB (printed circuit board), hereafter referred to as the Master Plug-In and the Multispense 2000 Channel Plug-In PCB, hereafter referred to as the Channel Plug-In. The main power switch is located on the front panel.

3.1.1.1 Master Plug-In Front Panel (Figure 3.1 Item 3)

Serial Interface Connector (Figure 3.1 Item 2) **-** 25 pin "D" subminiature connector wired as described in Table 3.6.

Serial Interface Data Indicators (Figure 3.1 Item 1) **-** A red LED indicates data being received by the Master Plug-In, a green LED indicates data being transmitted by the Master Plug-In. (Looking through the opening in the panel, two additional indicators show activity on the control signals. The 'buried' red LED will show the control signal being received by the Master Plug-In while the green LED will show the control signal generated by the Master Plug-In.)

3.1.1.2 Channel Plug-In Front Panel (Figure 3.1 Item 4)

Enabled Indicator (green) (Figure 3.1 Item 5) **-** This indicator illuminates while this channel is enabled for operation.

Disabled Indicator (red) (Figure 3.1 Item 6) **-** This indicator illuminates while this channel is NOT enabled for operation.

Enable Switch (Figure 3.1 Item 7) **-** This switch allows this channel to be enabled or disabled without using the serial interface. The normal position will be the middle (maintained) position where the channel can be enabled or disabled via the serial interface. Moving the switch to the top (SELECT momentary) position will toggle the state between ENABLE and DISABLE. The bottom (LOCKOUT maintained) position will disable the channel and will not allow the serial interface

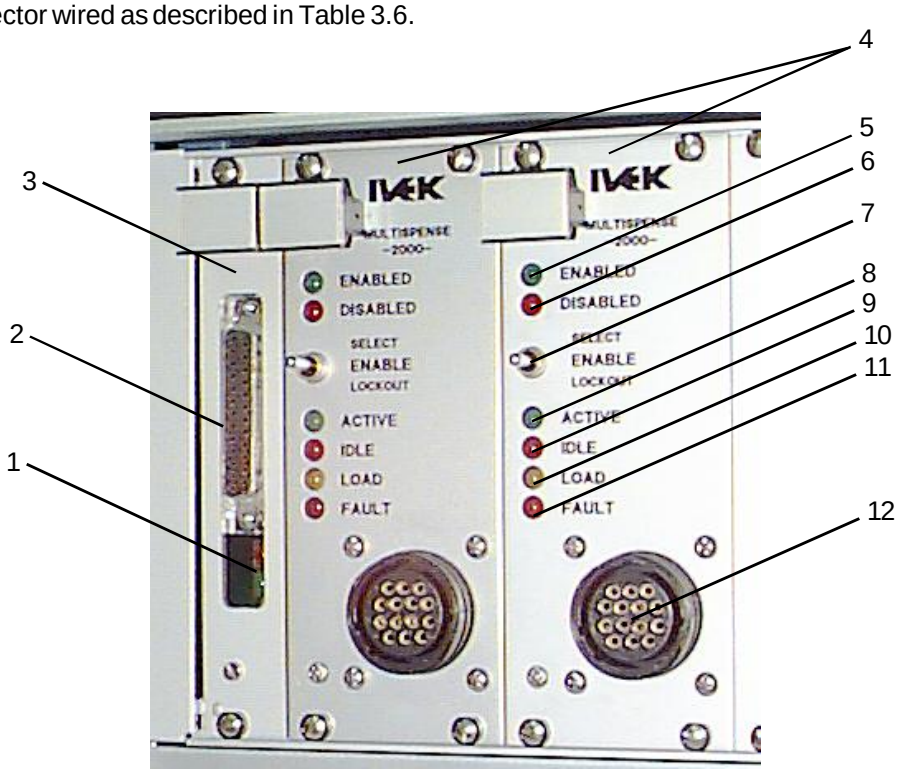

Figure 3.1 Digifeeder 2002 Controller Module Front Panel

to enable the channel. The lockout position is used to insure a particular Actuator Module will not be operated. If the channel is attempted to be enabled using the serial interface, a warning message will indicate the lockout condition.

Active Indicator (green) (Figure 3.1 Item 8) **-** This indicator illuminates while the pump is operating.

Idle Indicator (red) (Figure 3.1 Item 9) **-** This indicator illuminates while the pump is not operating.

Load Indicator (yellow) (Figure 3.1 Item 10) **-** This indicator illuminates while the pump requires a load cycle or while the pump is loading.

Fault Indicator (red) (Figure 3.1 Item 11) **-** This indicator illuminates when either the linear or rotary sensors detect a fault.

Actuator Module Connector (Figure 3.1 Item 12) **-** A Channel Plug-In for an Actuator Module will have a 14 pin female connector. A Channel Plug-In for an Actuator Module with the encoder option will have a 16 pin male connector. (Refer to the Title section of this manual to see if the encoder option was purchased.)

3.1.2 Rear Panel Detail (Figure 3.2)

The rear panel contains the power entry module and the PLC connector. The power entry module provides an entry point for power coming into the Controller Module and the PLC connector provides connections to the customer's PLC.

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.

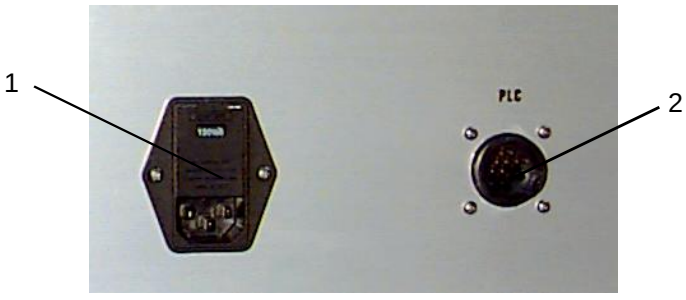

Figure 3.2 Digifeeder 2002 Controller Module Rear Panel

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 PLC Connector (Figure 3.2 Item 2)

The PLC connector contains the input and output location for the PLC signals. These signals provide communications between the PLC and the Controller Module. (Refer to section 3.2.2)

3.2 OPERATION

The Controller Module provides the controls for continuous liquid flow to the nozzle via a positive displacement pumping mechanism. The systems utilize solid-state electronics, stepping motor drives, and precision machined ceramic pump heads. These components combine to provide exceptional accuracy and precision (0.1% or less is achievable), high reliability, and low maintenance.

IVEK units have custom designed stepping motors and pumps sized to the specific dispensing application to provide the proper torque and speed.

3.2.1 Drive System

All operational parameters on the Controller Module are programmed through an RS232 interface. Total electronic control allows for effortless, exacting calibration and full accountability of cumulative volumes dispensed. Software contained in the Controller Module's Master Plug-In coordinates the operation of two linear dispensing channels to produce a precisely alternating dispense operation which will result in continuous fluid flow with minimal pulsations.

All volume and rate commands for the Controller Module use steps or steps per second where one step is equal to the displacement resolution of the pump head size in use.

3.2.2 PLC Interface

The PLC interface provides communications between the Controller Module and the customer's PLC. Trigger input, ready out, fault out and load required signals are communicated to and from the PLC.

3.2.2.1 Signal Functions

System Trigger In - The system trigger in signal initiates a cycle. The trigger signal has no effect in Prime or Bubble Clear modes.

Continuous Meter Mode - When the Controller Module is properly configured for 'Continuous Meter' mode, a signal applied to this input will initiate the metering operation. Continuous meter operation will continue as long as the signal is present. (see section 3.2.3.5)

Dispense Mode - When the Controller Module is properly configured for Dispense mode, both channels are triggered at the transition when a signal is applied to the system trigger. If a channel is disabled, faulted, requires a reference, or requires a load, that channel is not triggered. (see section 3.2.3.2)

Meter Mode - When the Controller Module is properly configured for Meter mode, both channels are triggered as long as a signal is applied to the system trigger (until the pump chamber empties). If a channel is disabled, faulted, requires a reference, or requires a load, that channel is not triggered. (see section 3.2.3.2)

System Ready Out - The ready output signal indicates the active/idle state of the Controller Module. All channels must be 'ready' for this output to indicate 'ready'. The 'h' command is used to define 'ready' for both the 'system ready' and 'channel ready' outputs.

System Fault Out - The fault output signal indicates that a fault has been detected in the operation of an Actuator Module. This output is complemented, i.e., the output is true when no fault exists on any channel, and is false when one or both channels are faulted.

Load Required - The load required output indicates if any channel requires a load cycle. This output is 'true' when any enabled channel requires a load. This output is 'false' when no enabled channel requires a load (A channel in the process of loading does not change this output to 'true'.)

3.2.2.2 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 do not 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.

3.2.2.3 Connections

All connections are through a 9-pin circular plastic connector, with the mating connector (AMP # 206708-1), backshell (AMP # 206966-1), pins (AMP # 66105-4), and key (AMP # 200821-1) supplied with the unit. The connector has the pin layout as shown in Table 3.1.

Table 3.1 PLC Interface

PIN	SIGNAL	PIN	SIGNAL
1	TRIGGER IN +	6	FAULT OUT -
2	TRIGGER IN -	7	(reserved)
3	READY OUT +	8	(reserved)
4	READY OUT -	9	not used
5	FAULT OUT +		

3.2.3 Operating Modes (Refer to Tables 3.2 and 3.3 for a listing of commands)

There are several different modes of operation which provide the Controller Module with its vast functional flexibility. The operational mode is selected using the 'm' command through the serial interface.

3.2.3.1 Prime

Prime mode produces a continuous cycle to pump fluid in one direction. Prime mode fills the system with fluid in preparation

for actual operation, empties the system of fluid, and flushes the system for cleaning.

The current settings for the fluid direction ('d' command) and pumping port ('p' command) combine to determine the direction of fluid flow. Pumping cannot be started in this mode using the PLC inputs, only using the begin command ('b') through the serial interface. The pumping will continue until the end command ('e') is issued up to a maximum time set with the 't' command. The time-out insures a communications problem won't result in the pumps operating indefinitely.

The flow rate for Prime mode is set with the 'u' command. The flow rate for Prime mode is also used in Bubble Clear mode and during load cycles.

Volume pumped during prime operation does not accumulate on the totalizer (viewed with the 'g' command).

3.2.3.2 Dispense (For calibration use only)

Dispense mode is used to deliver a specific volume of fluid at a specific rate. The current settings for the fluid direction ('d' command) and pumping port ('p' command) combine to determine the direction of fluid flow. Pumping can be started with the begin command ('b') using the serial interface, or with PLC inputs.

The dispense cycle will continue until the volume set using the 'v' command has been delivered, unless the *end* command ('e') is issued.

The flow rate for Dispense mode is set with the 'r' command.

The volume for Dispense mode is set with the 'v' command.

Volume pumped during dispense operation accumulates on the totalizer which is viewed with the 'g' command.

3.2.3.3 Meter (For calibration use only)

Meter mode is used to deliver fluid at a specific rate for a period of time determined by PLC input signals or commands through the serial interface. The most accurate and repeatable method to control metering operation uses the PLC inputs. Pumping will start when the trigger signal is present and will stop when the trigger signal is removed or the pump chamber empties. Pumping will also start with the *begin* command ('b') using the serial interface and stop with the *end* command ('e'). The current settings for the fluid direction ('d' command) and pumping port ('p' command) combine to determine the direction of fluid flow.

The flow rate for metering is set with the 'r' command as in dispense.

Volume pumped during dispense operation accumulates on the totalizer which is viewed with the 'g' command.

3.2.3.4 Continuous Meter

The normal operating mode for the Controller Module is Continuous Meter.

Continuous Meter mode uses both pump channels to deliver fluid at a specific rate for a period of time determined by the PLC input signals (but not through the serial interface). Pumping will start when the trigger signal is present and will stop when the trigger signal is removed.

The current settings for the fluid direction ('d' command) and pumping port 'p' command) combine to determine the direction of fluid flow.

The flow rate for Meter mode is set with the 'r' command as in Dispense mode.

Volume pumped during dispense operation accumulates on both totalizers which are viewed with the 'g' command.

Necessary Commands - In order to configure the system to operate in the continuous Meter mode, the following commands are required.

Fluid flow rate during Meter mode: Use the '0r###' command to set the metering rate of all channels.

If necessary, select the proper port ('p' command), load flow rate ('u' command), or valving speed ('y' command) for both channels.

Configure the Master Plug-In for Continuous Meter mode with the command '99m5'.

NOTE

When the mode of the master changes from 0 to 5, the master then changes several parameters in both channels. Therefore, if other commands are issued to the channels after the master is configured to 'continuous meter', it is necessary to change the master to normal mode (99m0), then back to continuous Meter mode (99m5) to insure the parameters in the channels contain the correct values. The parameters affected include, but are not limited to: mode, autoload, drawback, and hardwired signal configuration (system ready only).

NOTE

The metering rate ('r' command) should be limited to a maximum of 500 when using Continuous Meter mode. This is required so the pumping operation is slow enough to avoid acceleration and deceleration which causes discontinuity in an otherwise constant flow rate.

The load rate ('u' command) should be sufficiently greater than the metering rate ('r' command) in order for the "Load" cycle to be completed in less time than a full discharge stroke. For example, the 'u' command should be set at 1000 or greater with the 'r' command at 500 for continuous metering.

3.2.3.5 Other Operating Sequences

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. Loading can be initiated 'manually' by using the *load* command ('l') or automatically. The system can be configured to automatically start a load cycle on either of two conditions; *empty* and *every,* using the 'a' command.

When the system is configured for 'load empty', a load cycle will start when the pump is idle and the remaining volume in the pump chamber is less than the volume indicated by the 'v' parameter (dispense volume). The 'v' parameter is used for this function during both dispense and meter operation even though the 'v' parameter is not otherwise used during meter operation.

When the system is configured for 'load every', a load cycle will start at the completion of every dispense or meter operation.

The 'a' command is used to configure automatic loading for *manual* (no automatic loading), *empty*, or *every*.

Reference - The controller must complete a reference cycle when power is first applied or when a fault occurs because there are no sensors in the Actuator Module which send the absolute linear and rotary locations of the piston at all positions. 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 (initiated with the 'f' command) is required after faults or after power is first applied and before any command resulting in motion of the Actuator Module is accepted (b, l, p).

NOTE

The system will not operate if a reference command has not been initiated. The system will only return warnings.

3.2.4 Operating Parameters

Parameters are divided into a number of categories. This section provides a description of each command in the parameter that best fits its description.

3.2.4.1 Pump control

The following parameters control the specific operation of the Actuator Module. All of the following parameters are set in the individual channel for each Actuator Module. The channels can have the same or different values for each parameter.

Rate For Dispense And Meter Operation - One parameter is used to control the fluid flow rate for both Dispense and Meter mode. ('r' command)

Dispense Volume - While this parameter is used to specify the volume of fluid dispensed during dispense operation, it is also used to determine if a load cycle is required before another dispense or metering cycle can be initiated. ('v' command)

Rate For Prime, Load, And Bubble Clear Operation - This parameter is used to control the fluid flow rate for Prime, Load and Bubble Clear mode. ('u' command)

NOTE

The volume is set in steps and the rates are set in steps per second. Use the chart in Chapter 7 to convert to volume by multiplying the resolution per step for the Pump Module provided (refer to the Title Page section) times the number of steps.

Direction - The direction of the fluid flow is normally forward, but can be reversed to empty fluid back into the supply. Forward or reverse direction is defined at the selected port. ('d' command)

Port - The selected port (normally considered the discharge port) can be changed to allow desired fluid flow direction for different mounting orientations of the Actuator Module. ('p' command)

Auto Load - The pump can be set to automatically begin a load cycle when either the pump is 'empty' or after every

dispensing or metering operation. Refer to 'Load' in section 3.2.3.6. (‘a’ command)

Keylock - This parameter is used to enable or disable a channel. This parameter can also be controlled using the ENABLE switch on the front panel of the channel card. If the ENABLE switch is in the LOCKOUT position, the serial interface command will not be allowed to enable the channel. (‘k’ command)

Time Limit For Prime - In order to prevent a problem if the communications are interrupted during a prime operation, priming is limited to a duration specified by a parameter. (‘t’ command)

Valving Speed - The rotational speed of the piston during valving can be lowered if required to pump highly viscous fluids. (‘y’ command)

3.2.4.2 Interface Control

The following parameters control the interfaces (serial and PLC) to the Controller Module.

Terse/Verbose - The response to commands can be shortened if a high throughput or low overhead is required. In terse mode, the response consists of only the carriage return character, unless a fault or warning exists which then generates the full response. In verbose mode, the full response is always returned. This parameter (‘h’ command) is located at the Master Plug-In and accessed using channel number 99.

Hardwired Ready Signal - Both the hardwired (PLC) system ready output and the optional channel ready outputs can be configured by the customer. In all cases the output indicates ‘busy’ during a dispense, but may be configured to be either ‘busy’ or ‘ready’ when other conditions exist, such as during a load cycle or if a fault is detected. This parameter is set in the individual channel for each Actuator Module. (‘h’ command)

NOTE

The hardwired ‘system ready’ signal cannot be configured by the user when operating in ‘Continuous Meter’ mode.

3.2.5 Status Information

3.2.5.1 General information

Additional information is available which may be used to confirm proper operation of the system.

Totalizer - A totalizer for each channel, which accumulates steps during Dispense and Meter modes, can be read or reset to zero. The totalizer stops at a maximum value of 65,535. The value does not wrap around to 0 so it must be reset. (‘g’ command)

Ready/Busy - The active or inactive state of each channel can be read. (‘q’ command)

Volume Remaining - The remaining capacity of the pump chamber (in steps) for each channel can be read. (‘s’ command)

Software Version - The (somewhat encoded) software version on both the Master Plug-In and each Channel Plug-In can be read. (z command)

3.2.5.2 Faults

The response to all commands to a particular channel will respond with fault or warning information if applicable. The fault will be indicated until faults are cleared on that particular channel. Warnings will be indicated as long as they apply. A fault present on a channel other than the one addressed by the current command will be indicated, but neither the faulted channel address nor the exact type of fault will be indicated.

A fault is the result of improper operation of the Actuator Module being detected.

Warnings indicate an error in the command, or a condition which requires attention before operation can be initiated.

Clear Faults - The clear faults command must be issued prior to any commands which would cause motion in the Actuator Module. This command responds with the identity of the fault being cleared and additional information for certain faults. (c command)

3.2.6 Optically Isolated Serial Interface

The optically isolated serial interface provides control of all functions available with electrical isolation between the RS-232 input signals and the internal control electronics. The hardware is configured as RS-232 Data Communications Equipment (DCE) standard with the pin configuration shown in Table 3.2.

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.

CAUTION

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.

Table 3.2 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.)

The parameters of the communications interface must be set as follows.

- 9600 BAUD
- 8 BIT
- NO PARITY
- ONE STOP BIT

3.2.6.1 Command Structure

The command is a string of ASCII characters. The use of the ASCII backspace or rub out characters as a means of entry correction is not supported.

Commands are not directly echoed as they are received. The terminal being utilized to send commands should be setup for half duplex mode.

After dispense or metering operation is triggered, the values for that operation are fixed. This allows new parameter values for the following 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.

<name>	Represents an argument
[ ]	Represents an optional argument
,	Field delimiter character for numerical arguments.
<CR>	End of command represented by ASCII carriage return character (no line feed).

The complete command form is:

[<chan>]<cmd>[<value1>[,<value2>[,<value3>]]]<CR>

<chan> Channel number.
All numerical characters beginning a command are evaluated as the channel number.
If omitted, previous value of channel remains in effect.
Value of zero will broadcast command to both channels. (see section 3.2.6.3)
All values greater than 99 will be evaluated as 99.
Master Plug-In is channel number 99.
Channel Plug-Ins have channel numbers 1 and 2.

<cmd> Command
First non-numerical character seen in the command string will be evaluated as the command character.
All subsequent alphabetic characters will be ignored.
Command characters **ARE** case sensitive.
If no command is included (command string only consists of numerical characters), response will only be <CR> indicating unit is ready to accept new command string.

<value1> First numerical parameter
The first numerical character received after the command character begins evaluation of the first numerical parameter.
All non-numeric values with the exception of the field delimiter character will be ignored.
A field delimiter character after the command character and before the first numerical character will be ignored and will not delimit the first parameter to a value of zero. This means a zero character must be used to indicate an argument with value of zero for the first numerical parameter.

<value2> Second numerical parameter
All non-numerical values with the exception of the field delimiter character will be ignored.
A null argument will be evaluated as a value of zero (no numerical characters between the field delimiter for the first parameter and a following field delimiter or end of command character).

<value3> Third numerical parameter
All non-numerical values with the exception of the field delimiter character will be ignored.
A null argument will be evaluated as a value of zero (no numerical characters between the field delimiter for the second parameter and a following field delimiter or end of command character).

All values in the command string which are not required by the command specified will be ignored. Following are some examples of command strings.

2v89<CR> Channel 2, command v, one value of 89

0r400<CR> Both channels, command r, one value of 400

e1<CR> Same channel as previous command, command e, one value of 1

1q<CR> Channel 1, command q, no values

Transmission should stop when an ASCII carriage return character is sent and can resume when the ASCII carriage return of the response is received.

3.2.6.2 Response String

The response from the Controller Module has a format which is very similar to the command with the addition of an additional 'flag' and value if a fault or warning is active.

<name> Represents an argument
[ ] Represents an optional argument
, Field delimiter character for numerical arguments.
* Field delimiter character which precedes fault or warning value
<CR> End of command represented by ASCII carriage return character (no line feed).

<chan><cmd>[<value1>[,<value2>[,<value3>]]]<CR>

The description for the response string above follows the structure of the command string previously described.

If a fault or warning exists, the normal value(s) are returned for the command, followed by the fault delimiter (in place of the normal field delimiter) and the fault number to indicate the problem. The fault delimiter and fault number will appear in all responses from that channel until the command to clear faults is sent to the faulted channel. If a command normally returns three values, the fault number will replace the third value. Following are some examples of command strings.

2c<CR>
Command: Channel 2, command c
2c<CR>
Response: Channel 2, command c, no values other than warnings are returned by command c.

1m1<CR>
Command: Channel 1, command m, one value of 1
1m1<CR>
Response: Channel 1, command m, one value of 1

u<CR>
Command: Same channel as previous command (1), command u, no new value
1u2000<CR>
Response: Channel 1, command u, one value of 2000

u3500<CR>
Command: Same channel as previous command (1), command u, 1 value of 3500
1u3500<CR>
Response: Channel 1, command u, one value of 3500

r0<CR>
Command: Same channel as previous command (1), command r, 1 value of 0
1r1000*2
Response: Channel 1, command r, current value is 1000 (unchanged), warning 2 = value no good

3.2.6.3 Broadcasting

A command with a channel address of 0 will send that command to both channels if installed. A subsequent command which does not indicate a new channel number will also be broadcast to both channels (previous channel number is retained as in single channel commands). The response from each channel will be sent by the Controller Module, with a semicolon separating the responses of the channels. An ASCII carriage return is sent by the Controller Module at the end of the response from the last channel.

1<cmd><value>;2<cmd><value><CR>

EXAMPLES

0m2<CR>
Command: sets all channels to Dispense mode
1m2;2m2<CR>
Response: for a 2 channel system

0v54<CR>
Command: sets all channels to a volume of 54
1v54;2v54<CR>
Response: for a 2 channel system

0l<CR>
Command: loads all channels
1l;2l<CR>
Response: for a 2 channel system

3.2.6.4 Verbose/Terse Response

Responses from the Controller Module can be selected as 'verbose', with information from the command sent, or as

'terse', with only warning and fault information sent. Verbose or terse mode is selected using the 'h' command to the Master Plug-In (channel 99). This feature is included to improve communication throughput if many channels and parameters are being changed. The responses illustrated above show the verbose mode which is the default at power up. If current values are only being queried, not changed (i.e. no new value sent), verbose response must be used to receive the information.

EXAMPLES OF TERSE MODE

2c<CR>
Command: Channel 2, command c
<CR>
Response:

1m1<CR>
Command: Channel 1, command m, one value of 1
<CR>
Response:

u<CR>
Command: Same channel as previous command (1), command u, no new value
<CR>
Response: (verbose mode must be used)

u3500<CR>
Command: Same channel as previous command (1), command u, 1 value of 3500
<CR>
Response:

r0<CR>
Command: Same channel as previous command (1), command r, 1 value of 0

1r1000*2
Response: Channel 1, command r, current value is 1000 (unchanged), warning 2 = value no good

0m2<CR>
Command: sets all channels to Dispense mode
<CR>
Response: for a multi channel system

0v54<CR>
Command: sets all channels to a volume of 54
<CR>
Response: for a multi channel system

0l<CR>
Command: loads all channels
<CR>
Response: for a multi channel system

3.2.6.5 Commands

There are two types of commands; master and channel. The master commands are sent to the Master Plug-In and control the overall settings of the system. The channel commands are sent to the Channel Plug-Ins and can either control one Channel Plug-In or both Channel Plug-Ins depending on the code sent. If a 0 is sent as the channel number, all Channel Plug-Ins will be affected. If the Channel Plug-In number is sent, (i.e. 1 for channel 1, 2 for channel 2) then only that channel will be affected. Tables 3.3 and 3.4 list the commands for the Master Plug-In and Channel Plug-Ins.

NOTE

Refer to previous description for complete command syntax ("COMMAND STRUCTURE").

Table 3.3 Master Plug-In Commands
(Precede command with 99)

Command	Response	Description
<ESC> => RESET		
<ESC>		Resets processor on Master Plug-In only. Any time an escape character is received, the Master Plug-In processor will be restarted without changing any setup parameters for the Master Plug-In. Neither a preceding channel number, nor a following carriage return is required for this command to be recognized and executed. As this is a software controlled reset, it is not guaranteed to work in all cases.

h => HARDWARE CONFIGURATION

h	h<value1>	Returns the current configuration for the hardware.
h<value1>	h<value1> <value1>:	Sets the hardware configuration. 0 = Terse 1 = Verbose (default) Any nonzero number results in Verbose.

m => MODE

m	m<value1>	Returns the current mode.
m<value1>	m<value1> <value1>:	Sets the mode setting. 0 = Normal (default) 5 = Continuous Meter

z => SOFTWARE VERSION

z	z<value1>,<value2>,<value3>	Returns the software version. To properly decode this information, the first two values should be converted to 16 bit hexadecimal. The final 'readable' format is three uppercase letters followed by five decimal digits. value 1 high byte: first letter in ASCII value 1 low byte: second letter in ASCII value 2 high byte: third letter in ASCII value 2 low byte: fourth and fifth decimal digits as a hexadecimal value value 3: first, second, and third decimal digits as a hexadecimal value 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.

Table 3.4 Channel Plug-In Commands

(Precede command with 0 for all channels or the individual channel number)

Command	Response	Description
a => AUTOLOAD		
a	a<value1>	Returns current autoload setting.
a<value1>	a<value1> <value1>:	Sets the Autoload mode. 0 = Manual (default) 1 = Empty 2 = Every
b => BEGIN		
b	b	Initiates a prime, dispense, meter, or bubble clear cycle according to the current 'mode' setting. Will not properly initiate Continuous Meter mode.

c => CLEAR FAULTS

c	c<value1>	Clears all faults. Error number returned as value1. Extended error information may be returned as value 2 and value 3 if applicable to that error number.

d => DIRECTION

d	d<value1>	Returns current fluid direction setting.
d<value1>	d<value1> <value1>:	Sets the liquid flow direction. 0 = Reverse 1 = Forward (default) Any nonzero number results in Forward.

e => END

e	e	Ends the current pumping cycle. In Prime mode, will continue until piston chamber full if direction is Forward and piston chamber empty if direction is Reverse.

f => REFERENCE

f	f	References the piston in the home position for both the rotary and linear home.

g => TOTALIZER

g	g<value1>	Returns current value, in pump rotations, of the totalizer for dispensing and metering volume. <value1> represents a 5 digit decimal value. **MAX VALUE:** The totalizer will increment to a maximum value of 65,535 and stop. The totalizer will not 'wrap around'. The pump will continue to operate without incrementing the totalizer.
g0	g0	Resets the value of the totalizer to zero. This parameter can only be reset to zero.

h => HARDWIRED READY SIGNAL OPERATION

h	h<value1>	Returns the current configuration for the hardwired ready signals.
h<value1>	h<value1>	Sets configuration for the hardwired ready signals <value1> represents a 3 digit decimal value. The hardwired ready signals (SYSTEM READY and optional CHANNEL READY) are always false while the pump is active in dispense or metering operation. In addition, the ready signals can be configured to be false during other times by setting appropriate bits in this configuration value. In all other cases, the ready output will be true. Individual configuration information can be determined using binary decoding as follows:

bit	value	if bit set, SYSTEM READY also false
0	1	Valving
1	2	Loading, Priming, Bubble Clearing
2	4	Load Required
3	8	Any fault true, Ref Required
		if bit set, CHANNEL

bit	value	READY also false
4	16	Valving
5	32	Loading, Priming, Bubble Clearing
6	64	Load Required
7	128	Any fault true, Ref Required
	136	System or Channel not ready if fault or reference required (default)

k => KEYLOCK

k	k<value1>	Returns the current setting which inhibits or allows operation of the channel.
k<value1>	k<value1> <value1>:	Enables or disables a channel. 0 = Disabled 1 = Enabled (default)

l => LOAD

l	l	Initiates a load cycle.

m => MODE

m	m<value1>	Returns the current mode.
m<value1>	m<value1> <value1>:	Sets the operating mode. 1 = Prime (default) 2 = Dispense 3 = Meter 4 = Bubble Clear (Do Not Use) 5 = Continuous Meter

p => PORT

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

q => READY/BUSY

q	q<value1>	Indicates READY/BUSY status. <value1> is 0 for READY and greater than 0 for BUSY. Individual operational information can be determined using binary decoding as follows:

bit	value	active if bit set
0	1	Any Motion
1	2	Dispense or Meter
2	4	Prime or bubble Clear
3	8	Load
4	16	Valve
5	32	Referencing

r => DISPENSE RATE

r	r<value1>	Returns the current dispense and metering flow rate in steps per second.
r<value1>	r<value1>	Sets the Dispense or Metering flow rate in steps/sec. <value1>: represents a 5 digit decimal number Maximum: 4000 **(we recommend 500 maximum in Continuous Meter mode)** Minimum: 14 Default: 1000

s => STATUS

s	s<value1>	Returns the volume remaining in the pump chamber. (units are steps)
	<value1>:	volume remaining

t => TIME LIMIT FOR PRIME

t	t<value1>	Returns current limit on prime cycle in seconds.
t<value1> for less than one second.	t<value1>	Sets the limit on prime cycles in seconds. Value of zero will allow priming <value1>: represents a 3 digit decimal number Maximum: 127 Minimum: 0 Default: 120

u => PRIME, LOAD AND BUBBLE CLEAR RATE

u	u<value1>	Returns the current prime, load, and bubble clear flow rate in steps/ second.
u<value1>	u<value1>	Sets the Prime, Load, and Bubble Clear flow rate in steps/sec. <value1>: represents a 5 digit decimal number Maximum: 4000 Minimum: 14 Default: 1000

v => DISPENSE VOLUME

v	v<value1>	Returns the current dispense volume in steps.
v<value1>	v<value1>	Sets the dispense volume in steps. A volume of zero will not allow the unit to be triggered while in Dispense mode. <value1>: represents a 5 digit decimal number Maximum: 2000 Minimum: 0 Default: 400

w => DRAWBACK Drawback should not be used with this Controller Module.

y => VALVING SPEED

y	y<value1>	Returns the current speed of the motor during valving in steps per second.
y<value1>	y<value1>	Sets the speed of the motor during valving in steps per second <value1>: represents a 5 digit decimal number Maximum: 1000 (default) Minimum: 14

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

z => SOFTWARE VERSION

z	z<value1>,<value2>,<value3>	Returns the software version. To properly decode this information, the first two values should be converted to 16 bit hexadecimal. The final 'readable' format is three uppercase letters followed by five decimal digits as seen in the lower left corner of this page. value 1 high byte: first letter in ASCII value 1 low byte: second letter in ASCII value 2 high byte: third letter in ASCII value 2 low byte: fourth and fifth decimal digits as a hexadecimal value value 3: first, second, and third decimal digits as a hexadecimal value 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.

3.2.6.6 Warnings

Warnings indicate problems in the command received, or a state of the Actuator Module which prohibits immediate operation. An asterisk (*) precedes warnings in responses. An appropriate command (other than 'clear faults') may be required to operate the pump.

1	Command Not Valid	Response to any unrecognized command
2	Value Not Valid	Response to any out of range value
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 reference position. Reference cycle, using 'f' command, this must be completed before continuing.
5	Mode Not Selected	(not used)
6	Number Format	(not used)
7	Channel Not Installed	No response from channel with that address.
8	Channel Locked Out	Switch on front panel of channel control card is in LOCKOUT position. Channel cannot be enabled via the serial interface with the 'k' command. The switch must first be moved to the middle position.
9	Channel Not Enabled	Specific channel triggered with 'begin' or 'load' commands but NOT enabled.
10	Channel Not Responding	Master Plug-In does not see response from Channel Plug-In during internal communications attempt. If condition persists, contact IVEK Technical Support for replacement.
11	Second Command Character	A second command character (alphabetic character) was seen in a single command (before <CR> character). Entire command is ignored.

3.2.6.7 Faults

Faults are a result of the system detecting improper operation of the pump actuator. All fault numbers will be greater than or equal to 1000. An asterisk (*) precedes warnings in responses. The 'clear faults' command must be used before any subsequent operation of the affected channel is performed.

1000 Fault On Other Channel	An unspecified fault has been detected on another channel. This error will not appear if a warning or fault condition exists in the channel for the command (won't replace warning or fault information from command's channel to indicate fault elsewhere). This error will not appear in a broadcast response.
1001 Linear Sensor Fault	"Home" position sensor for linear motion was not detected. Clear faults using 'c' command and re-reference using 'f' command.
1002 Rotary Sensor Fault	"Home" position sensor for rotary motion was not detected. Clear faults using 'c' command and re-reference using 'f' command.
1003 Linear Stall	Motor stall was detected during linear operation of the piston. **This requires the encoder option in the Channel Plug-In and in the pump actuator.**
1004 Rotary Stall	Motor stall was detected during rotary operation of the piston. **This requires the encoder option in the Channel Plug-In and in the pump actuator.**

3.2.6.8 Command Summary

The command summary section is almost identical to the Command section except it has been abbreviated into two pages. This allows for removal, copying and locating near the controlling terminal. Tables 3.5 and 3.6 list the abbreviated commands for the master and channel cards.

Table 3.5 Master Plug-In Commands (Precede command with 99)

Command	Response	Description
<ESC>		Resets processor on Master Plug-In only.
h<value1>	h<value1> <value1>:	Sets the hardware configuration 0 = Terse 1 = Verbose (default)
m<value1>	m<value1> <value1>:	Sets the mode setting. 0 = Normal (default) 5 = Continuous Meter
z	z<value1>,<value2>,<value3>	Returns the coded software version.

Table 3.6 Channel Plug-In Commands (Precede command with 0 for all channels or 1 or 2)

Command	Response	Description
a<value1>	a<value1>	Sets the Autoload mode. <value1>: 0 = Manual (default) 1 = Empty 2 = Every
b	b	Initiates a pumping cycle.
c	c<value1>	Clears all faults.
d<value1>	d<value1>	Sets the liquid flow direction. <value1>: 0 = Reverse 1 = Forward (default)
e	e	Ends the current pumping cycle.
f	f	Sets the piston in the reference location.
g	g<value1>	Returns the total number of motor steps of the totalizer. (send 0 to reset)
h<value1>	h<value1>	Sets configuration for the hardwired ready signals

if bit set, SYSTEM

bit	value	READY also false
0	1	Valving
1	2	Load, Prime, Bubble Clear
2	4	Load Required
3	8	Fault, Ref Required

if bit set, CHANNEL

bit	value	READY also false
4	16	Valving
5	32	Load, Prime, Bubble Clear
6	64	Load Required
7	128	Fault, Ref Required
	136	*System or Channel not ready if Fault or Reference Required*

Command	Response	Description
k<value1>	k<value1>	Enables or disables a channel. <value1>: 0 = Disabled 1 = Enabled (default)
l	l	Initiates a load cycle.
m<value1>	m<value1>	Sets the operating mode. <value1>: 1 = Prime (default) 2 = Dispense 3 = Meter 4 = Bubble Clear (Do Not Use) 5 = Continuous Meter
p<value1>	p<value1>	Sets the selected port. <value1>: 0 = Port A 1 = Port B (default)
q	q<value1>	Returns the Ready/Busy status. <value1>: 0 = Ready not 0 = Busy
r<value1>	r<value1>	Sets the Dispense or Metering flow rate in steps/sec. <value1>: represents a five digit decimal number Maximum: 4000 (we recommend 500 or less in Continuous Meter mode) Minimum: 14 Power up: 1000 (default)
s	s<value1>	Returns the volume remaining before the next load. <value1>: volume remaining
t<value1>	t<value1>	Sets the limit on prime cycles in seconds. <value1>: represents a three digit decimal number Maximum: 127 Minimum: 0 Default: 120
u<value1>	u<value1>	Sets the Prime, Load, and Bubble Clear flow rate in steps/sec. <value1>: represents a five digit decimal number Maximum: 4000 Minimum: 14 Default: 1000
v<value1>	v<value1>	Sets the dispense volume in steps. <value1>: represents a five digit decimal number Maximum: 2000 Minimum: 0 Default: 400
y<value1>	y<value1>	Sets the speed of the motor during valving in steps per second <value1>: represents a five digit decimal number Maximum: 1000 (default) Minimum: 14
z	z<value1>,<value2>,<value3>	Returns the software version.

WARNINGS

1	Command Not Valid	7	Channel Not Installed	1000	Fault On Other Channel
2	Value Not valid	8	Channel Locked Out	1001	Linear Sensor Fault
3	Load Required	9	Channel Not Enabled	1002	Rotary Sensor Fault
4	Reference Required	10	Channel Not Responding	1003	Linear Stall (Option)
5	(not used)	11	Second Command Character	1004	Rotary Stall (Option)
6	(not used)				

FAULTS

3.2.6.9 Typical Command Sequence

Following is a typical command sequence for operating the system. Your sequence may vary depending on your application.

	COMMAND	OUTCOME
1.	0f<CR>	References all actuators/pumps.

The Priming procedure fills the inlet tubing, pump head chamber, outlet tubing and nozzle with liquid.

2.	0u4000<CR>	Sets Prime/Load rate to (maximum) 4000 steps/sec.
3.	1m1<CR>	Puts channel no. 1 in Prime mode.
4.	1b<CR>	Begins Prime mode in channel no. 1.
5.	1e<CR>	Ends Prime mode in channel no. 1.

The bubble clear procedure clears the liquid path of air bubbles.

6.	1m4<CR>	Puts channel no. 1 in Bubble Clear mode.
7.	1b<CR>	Begins Bubble Clear in channel no.1.
8.	1b<CR>	The second cycle aids in eliminating air bubbles.

A second Priming procedure assures the inlet tubing, pump head chamber, outlet tubing and nozzle are filled with liquid.

9.	1m1<CR>	Puts channel no. 1 in Prime mode.
10.	1b<CR>	Begins Prime mode in channel no. 1.
11.	1e<CR>	Ends Prime mode in channel no. 1.

The procedure is complete when there are no air bubbles remaining in the inlet tubing, pump head chamber, outlet tubing and nozzle.

Prime the second channel in the same manner.

12.	2m1<CR>	Puts channel no. 2 in Prime mode.
13.	2b<CR>	Begins Prime mode in channel no. 2.
14.	2e<CR>	Ends Prime mode in channel no. 2.
15.	2m4<CR>	Puts channel no. 2 in Bubble Clear mode.
16.	2b<CR>	Begins Bubble Clear in channel no. 2.
17.	2b<CR>,	The second cycle aids in eliminating air bubbles.
18.	2m1<CR>	Puts channel no. 2 in Prime mode.
19.	2b<CR>	Begins Prime mode in channel no. 2.
20.	2e<CR>	Ends Prime mode in channel no. 2.

The following three steps set up the system for normal operation.

21.	0r250<CR>	Sets Meter rate to 250 steps/sec.
22.	99m0<CR>	Sets the Master Plug-In to Normal.
23.	99m5<CR>	Addresses the Master Plug-In for communication between channels 1 & 2. Sets the Master Plug-In to continuous meter. The Master Plug-In then automatically configures the Channel Plug-Ins.

For initiation of continuous metering, a 24V or contact closure input trigger is necessary. Continuous metering can be terminated by shutting the trigger off.

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 PLC Interface With Independent Channel Ready

Ready output logic signals for each of the two channels are added to the PLC interface. The ready output signals for each channel permit independent monitoring of the 'ready' versus 'busy' status of an individual channel using a logic signal rather than a command through the serial interface.

3.4.1.1 Signal Functions

System Trigger In - The system trigger in signal initiates a cycle.

Dispense Or Meter Mode - A signal applied to this input will trigger all enabled channels which have Dispense or Meter mode selected. A channel will not be triggered if it is in Setup, Prime, or Bubble Clear mode, is faulted, requires a reference, or requires a load cycle.

Continuous Meter Mode - When the controller is properly configured for Continuous Meter mode, a signal applied to this input will start that mode of operation. This mode of operation provides an uninterrupted flow while the system trigger signal is present.

System Ready Out - The ready output signal indicates the active/idle state of the Controller Module. All channels must be 'ready' for this output to indicate 'ready'. The 'h' command is used to define 'ready' for both the 'system ready' and 'channel ready' outputs.

System Fault Out - The fault output signal indicates that a fault has been detected in the operation of a Actuator Module. This output is complemented, i.e., the output is true when no fault exists on any channel, and is false when one or more channels is faulted.

Channel 1 Ready Out - The ready output signal indicates the active/idle state of channel 1. The 'h' command is used to define 'ready' for both the 'system ready' and 'channel ready' outputs.

Channel 2 Ready Out - The ready output signal indicates the active/idle state of channel 2. The 'h' command is used to define 'ready' for both the 'system ready' and 'channel ready' outputs.

3.4.1.2 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 do not 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.

3.4.1.3 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 3.7.

Table 3.7 PLC Interface With Independent Channel Ready

PIN	SIGNAL
1	keying lug
2	(open for keying plug in mate)
3	SYSTEM TRIGGER IN +
4	SYSTEM TRIGGER IN -
5	SYSTEM READY OUT +
6	SYSTEM READY OUT -
7	/SYSTEM FAULT OUT +
8	/SYSTEM FAULT OUT -
9	not used
10	not used
11	not used
12	not used
13	CHANNEL 1 READY OUT +
14	CHANNEL 1 READY OUT -
15	CHANNEL 2 READY OUT +
16	CHANNEL 2 READY OUT -

3.4.2 Encoder

The encoder option must be present in both the Channel Plug-In (in Controller Module) and in its corresponding Actuator Module, and requires a different cable between the Controller Module and the Actuator Module.

This option adds an encoder to the Actuator Module allowing the Channel Plug-In to verify all motions of the actuator. Any stall during fluid displacement or valving will immediately be sensed by the encoder and generate a fault condition. Without this option, only the linear and rotary home sensors can be used to detect a stall. The rotary home sensor detects valving to port A and can only generate faults if valving has been commanded to port A with no response from this sensor. The linear home sensor detects a piston withdrawn to full chamber capacity, and can only generate a fault during a load operation (when using standard operating methods).

3.4.3 Motion System Control Interface Type A

The Motion System Control Interface Type A option allows convenient connection to a compatible Cartesian robot or an IVEK supplied X-Y-Z Table. The interface connector is mounted on the rear of the Controller Module and mates with the input/output cable. This option comes equipped with a Reset Switch/Fault Indicator.

3.4.3.1 Signal Description

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

TRIGGER IN - A signal applied to this input will trigger operation in Dispense or Prime mode. Operation is initiated at the false-to-true transition of this signal, if the Controller Module is not faulted, with any further activities on the signal ignored until the operation is completed.

READY OUT - The Ready Output signal indicates the active/idle state of the Controller Module. The Controller Module is ready to accept a trigger, if the Controller Module is not faulted, when this signal is true. The signal will remain false

during any operation or if it's faulted. The "h" command (Table 3.4) is used to define "READY".

FAULT OUT - 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 when no fault exists, and is false when the controller is faulted. Four stalls during an operation are required to activate this signal.

LOAD REQUIRED OUT - The 'Load Required' signal indicates when a channel requires a load cycle. This output is 'true' when any enabled channels require a load or are in process of loading. This output is 'false' if no enabled channel requires a load or is in the process of loading.

3.4.3.2 Signal Levels

The input accepts a contact closure signal (dry contact or solid state). The signal rating is 20mA at 5 VDC.

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 VDC and 50 mA. The output consists of the emitter and collector connections to an IC opto-isolator.

3.4.3.3 Multiple Dispensers

If multiple Controller Modules are to be used on a single Motion System Control Interface Type A unit, a custom cable assembly is used to connect the Motion System Control Interface Type A unit to all IVEK Controller Modules being used. The wiring of this cable assembly will reassign the Controller Module functions to new signals in the unit.

3.4.3.4 Connections

The signal assignments in the controller are shown in Table 3.7.

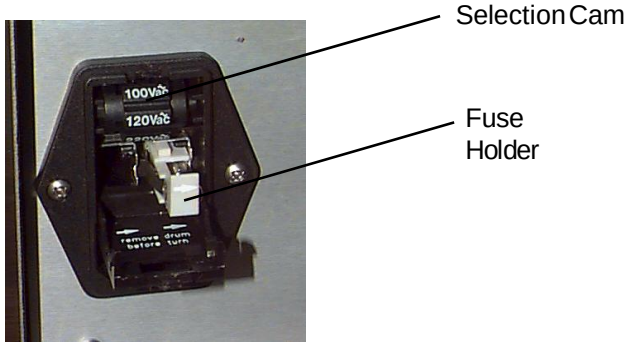

Figure 3.3 Power Entry Module

Table 3.7 Controller Module Interface - Pin Assignments

Controller Signal	Controller Pin #
LOAD REQUIRED OUT +	5
READY OUT +	6
FAULT OUT +	7
TRIG IN +	14
OUT COMMON -	18
TRIG IN -	23

3.4.4 PLC Interface With Contact Closure Trigger

The PLC interface with contact closure trigger provides a contact closure trigger signal in place of the standard optically isolated signal. The following "signal levels" section replaces section 3.2.2.2 in this chapter.

3.4.4.1 Signal Levels

All output signals are optically isolated. The power for output signals is provided by the customer's equipment. All inputs are configured for contact closure (dry contact or solid state) 5 VDC signal at 20 mA. The power for input signals is provided by the IVEK controller.

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 VDC and 50 mA. The output consists of the emitter and collector connections to an IC opto-isolator.

The input signal is true when the external contact closure is applied.

3.4.4.2 Connections

Refer to Table 3.1 in section 3.2.2.3 for connection information.

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.

- Master Plug-In
- Channel Plug-In
- Main Power Fuse

3.5.1.1 Master Plug-In (Figure 3.4 Item 1)

CAUTION

This is an electrostatic sensitive device. Electrostatic discharge can damage the board if not handled properly.

Disassembly

1. Turn power OFF.
2. Remove the serial interface cable from the connector.
3. Loosen two captive screws securing the Master Plug-In to the chassis.
4. Grab the handle and slide the Master Plug-In straight out.

Assembly

1. Slide the Master Plug-In into the chassis making sure it goes into the rear connector and secure with the two captive screws.
2. Connect the cable to the connector.

3.5.1.2 Channel Plug-In (Figure 3.4 Item 2)

CAUTION

This is an electrostatic sensitive device. Electrostatic discharge can damage the board if not handled properly.

Disassembly

1. Turn power OFF.
2. Remove the cable from the connector.
3. Loosen four captive screws securing the Channel Plug-In to the chassis.
4. Grab the handle and slide the Channel Plug-In straight out.

Assembly

1. Slide the Channel Plug-In into the chassis making sure it goes into the rear connector. Secure with the four captive screws.
2. Connect the cable to the connector.

3.5.1.3 Main Power Fuse (Figure 3.3)

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. Fuse holders are available from IVEK Corporation for conversion to 5mm by 20mm fuses.

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 3.8 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:
24 VDC @ 20mA

PLC Output Signals:
Can switch maximum 24 VDC @ 50mA

Input Power Requirements:
100/120 VAC - 3A - 50/60Hz
200/240 VAC - 1.5A - 50/60Hz

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 Module.

520148 - # ## # # #

Actuator/Encoder
- **A** - 40 Pitch No Encoder
- **B** - 40 Pitch Encoder
- **E** - 20 Pitch No Encoder
- **F** - 20 Pitch Encoder

Number of Installed Channels
- **00 - 02**

Logic Interface
- **A** - PLC
- **B** - not used
- **C** - PLC W/Independent Ready Out
- **D** - not used
- **E** - Motion System Interface Type A
- **F** - PLC (CC Trigger)
- **G** - not used
- **H** - PLC (CC Trigger) W/Ind. Ready Out

Parameter Interface
- **A** - RS232 Serial

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

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 3.4) contains replacement parts for the Controller Module

Table 3.8 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 three-prong outlet capable of supplying 115/120 volts, 60Hz, rated at 5.0 amps.
	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.
Power is on, Controller Module accepts trigger, piston fails to move and Actuator Module makes a sound. * 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 Actuator Module. Turn on Controller Module and try again. If the motor operates correctly, the pump may need to be cleaned or serviced.
Power is on, Controller Module accepts a trigger, (START indicator illuminates, STOP indicator does not), piston fails to move, and Actuator Module is silent.	A motor malfunction can cause this problem.	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.
Controller Module power on and operational, but will not activate Actuator.	I/O Cable	Check connection of cable between Controller Module and Actuator Module. Inspect and repair faulty cable.
Gap in fluid flow during continuous meter operation.	The load rate is too low.	Increase the load rate ('u' command). Look for each actuator to be idle between it's load cycle and dispense cycle.
	The dispense rate is too high.	Reduce the dispense rate ('r' command) to below 500. Dispense rates above 500 use acceleration and deceleration which may be visible in the final fluid flow. **If none of the above solves the problem, contact IVEK technical support for assistance.**

INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
	520148-######	Digifeeder 2002 Controller Module	1

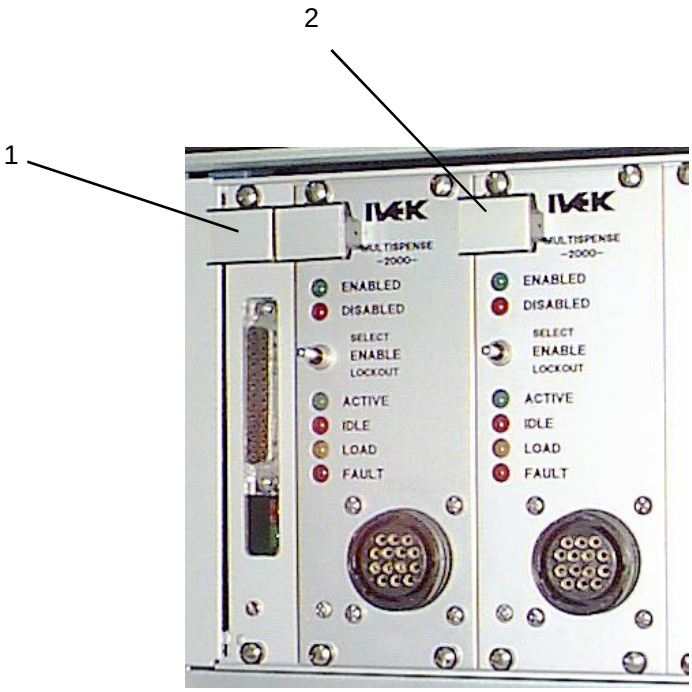

Figure 3.4 Digifeeder 2002 Controller Module (Sheet 1 of 2)

INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
	520148-######	**Digifeeder 2002 Controller Module**	**1**
1	500094-1	PCB Plug-In, DF2002, Master; Serial	1
2	500089-A	PCB Plug-In, MS2000 Channel; 40 Pitch, No Encoder **Handle Legend** A, 2A, 3A, 4A L21X/ECN OR 40 500089-A	2
2	500089-B	PCB Plug-In, MS2000 Channel; 40 Pitch, Encoder **Handle Legend** A, 2A, 3A, 4A L21X/ECA OR 40 ENC 500089-B	2
2	*	PCB Plug-In, MS2000 Channel; 40 Pitch, No Encoder, Custom Torque **Handle Legend** A, 2A, 3A, 4A L21Z/ECN OR 40 CUST TRQ 500089-C	2
2	*	PCB Plug-In, MS2000 Channel; 40 Pitch, Encoder, Custom Torque **Handle Legend** A, 2A, 3A, 4A L21Z/ECA OR 40 ENC CUST TRQ 500089-D	2
2	500089-E	PCB Plug-In, MS2000 Channel; 20 Pitch, No Encoder **Handle Legend** B, C, D L22X/ECN OR 20 500089-E	2
2	500089-F	PCB Plug-In, MS2000 Channel; 20 Pitch, Encoder **Handle Legend** B, C, D L22X/ECA OR 20 ENC 500089-F	2
2	*	PCB Plug-In, MS2000 Channel; 20 Pitch, No Encoder, Custom Torque **Handle Legend** B, C, D L22Z/ECN OR 20 CUST TRQ 500089-G	2
2	*	PCB Plug-In, MS2000 Channel; 40 Pitch, Encoder, Custom Torque **Handle Legend** B, C, D L22Z/ECA OR 20 ENC CUST TRQ 500089-H	2
2	*	PCB Plug-In, MS2000 Channel; Custom (40 or 20 Pitch) **Handle Legend** SERIES A-20 OR CUSTOM LINEAR 500089-Z	2

* Note Controller serial number and consult IVEK Technical Service Department before ordering
NOTE: The Digifeeder 2002 must be used with two identical channel types.

Figure 3.4 Digifeeder 2002 Controller Module (Sheet 2 of 2)