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3. DIGISPENSE 3020 CONTROLLER MODULE

3.1 DESCRIPTION

The Digispense 3020 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 210mm (8 1/4") wide, 292mm (11 1/2") deep, 146mm (5 3/4") high (feet included) and weighs approximately 4.3 kilograms (9.5 pounds). The operator controls and interface connections are located on the front and rear panels.

3.1.1 Front Panel Controls And 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. Function Push-buttons
2. Display
3. Start Push-button
4. Active Indicator
5. Stop Push-button
6. Idle Indicator
7. Arrow Push-buttons
8. Enter Push-button

3.1.1.1 Function Push-buttons (Figure 3.1 Item 1)

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

3.1.1.2 Display (Figure 3.1 Item 2)

This alphanumeric liquid crystal display is sixteen lines of forty characters each. The Controller Module status is shown on upper right hand corner of the display.

3.1.1.3 Start Push-button (Figure 3.1 Item 3)

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

Figure 3.1 Digispense 3020 Controller Module Front Panel

3.1.1.4 Active/Start LED (Figure 3.1 Item 4)

The Active/Start LED illuminates when the pump is operating and blinks when a fault occurs.

3.1.1.5 Stop Push-button (Figure 3.1 Item 5)

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

3.1.1.6 Idle/Stop LED (Figure 3.1 Item 6)

The Idle/Stop LED illuminates when the pump is stopped or idle.

3.1.1.7 Arrow Push-buttons (Figure 3.1 Item 7)

The Arrow Push-buttons move the cursor on the display and are used to change values.

3.1.1.8 Enter Push-button (Figure 3.1 Item 8)

The Enter Push-button has two functions; the first function selects a value to change that has been highlighted using the arrow push-buttons, the second function stores the changed value in the Controller Module.

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. Fan
2. AUX OUT Terminal Strip
3. CC TRIG Terminal Strip
4. RS232 Connector
5. AUX COMM Connector
6. LOGIC I/O Connector
7. MOTOR Connector
8. Power Entry Module

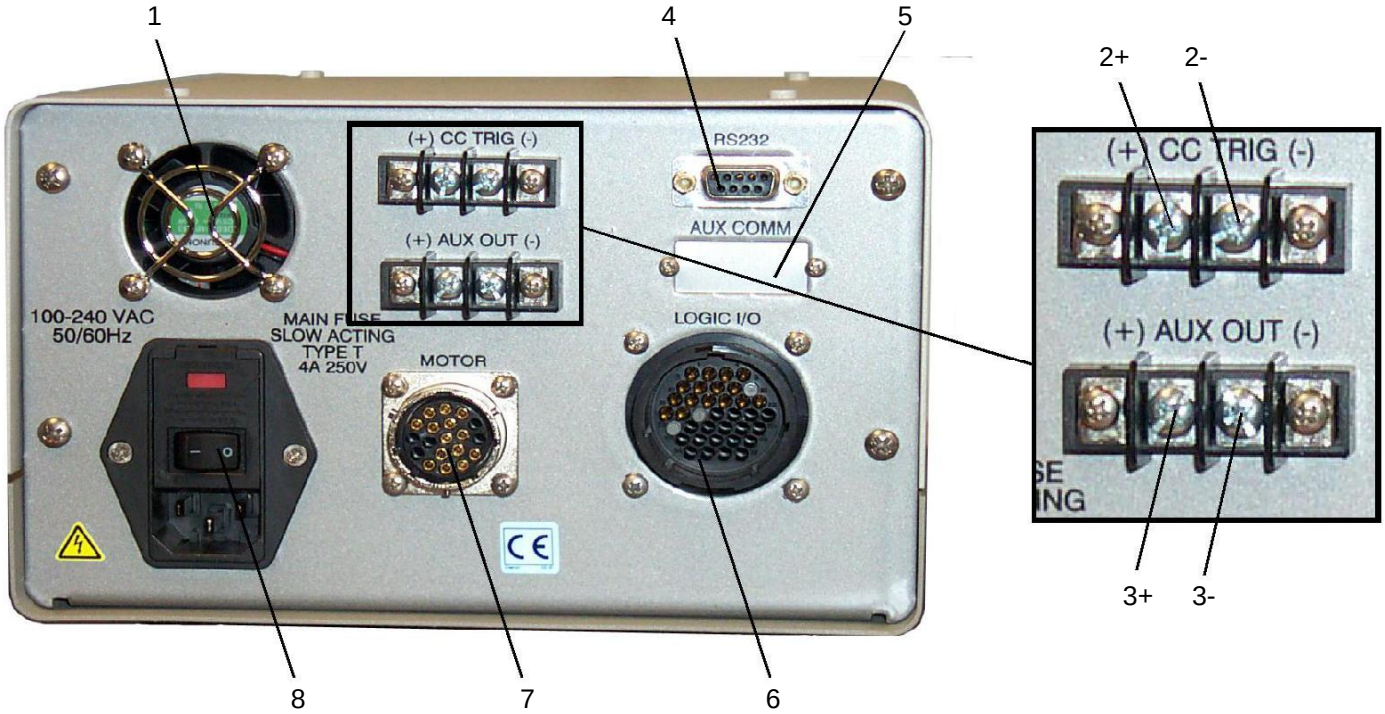


Figure 3.2 Digispense 3020 Controller Module Rear Panel

3.1.2.1 Fan (Figure 3.2 Item 1)

The fan keeps the devices in the Controller Module from getting too hot. Make sure the area around the fan is clear of obstructions.

3.1.2.2 AUX OUT Terminal Strip (Figure 3.2 Item 2)

The AUX OUT (Auxiliary Output) terminal strip has two screw terminals (+/-) used to enable auxiliary equipment. Refer to section 3.3.10.2.

3.1.2.3 CC TRIG Terminal Strip (Figure 3.2 Item 3)

The CC TRIG (Contact Closure Trigger In) terminal strip has two screw terminals (+/-) used for triggering operation in Production Modes. Fluidic Setup Mode operations can not be initiated with this signal. Refer to section 3.3.10.1.

3.1.2.4 RS232 Connector (Figure 3.2 Item 4)

The RS232 interface provides control of all available functions. The hardware is configured as Data Communications Equipment (DCE) standard. Refer to section 3.3.11.

3.1.2.5 AUX COMM Connector (Figure 3.2 Item 5)

The AUX COMM (Auxiliary Communication) connector will be used for a future enhancement.

3.1.2.6 LOGIC I/O Connector (Figure 3.2 Item 6)

The Logic I/O connector is used for making the electrical connection to the LOGIC I/O Interface Device. Refer to section 3.3.10.3.

3.1.2.7 MOTOR Connector (Figure 3.2 Item 7)

The Motor connector is used for making the electrical connections to the Actuator Module.

CAUTION

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

3.1.2.8 Power Entry Module (Figure 3.2 Item 8)

The power entry module contains a receptacle for a standard IEC power cord, an On (1) Off (0) switch, fuse holder and fuse.

The design of the power entry module requires the line cord be disconnected before the line fuse is removed. Refer to the Title Page section for fuse information.

3.1.3 Fluid Movement

Fluid movement in the system is achieved by the displacement actions of the pump. A piston moves forward and reverse in the pump chamber moving fluid in and out of ports. The piston rotates to move a flat on the piston between the two ports (Port A and Port B) to achieve the desired fluid movement through the system. The movement of the piston is initiated by an Actuator Module driven by a motor. The Controller Module provides the control and power to the Actuator Module's motor to achieve the desired fluid movement.

The movement of the piston is either forward (dispense) or reverse (load). A dispense is typically a settable volume of fluid movement while a load is an attempt to prepare the chamber for the next dispense (dependent on mode of operation). A dispense, depending on mode, allows for configurations based on rate, drawback, volume, etc. A load can only be configured for rate.

Fluid movement is controllable from two different contexts: Production Mode and Fluidic Setup Mode. Production Mode is intended for normal controlled fluidic movement operations and Fluidic Setup Modes are intended for preparing the entire fluidic system for those controlled operations.

3.1.4 Dispense/Load Rate

The optimum value of the Dispense or Load Rate needs to balance decreasing cycle times with an increasing risk of cavitations of the fluid reducing repeatability. Also, since motor torque decreases with increasing speeds, the probability of stalling the motor in the Actuator Module increases, especially when the viscosity of the fluid is high.

Often, a larger diameter tubing is used between the supply reservoir and the pump so the chamber may be prepared for the dispense more quickly. This often allows for the use of a much faster load rate to reduce the overall cycle time of the operation.

Since a precisely controlled dispense is often the goal of the system, the fluidic system attached to the active port is often carefully selected based on desired volume, fluidic characteristics, etc. This means the dispense rate is often lower than the load rate to increase repeatability and reduce the probability of fluid cavitations.

	Advantages	**Disadvantages**
Decreased Rates	Lower probability of stalls & fluid cavitations	Longer cycle time
Increased Rates	Shorter cycle time	Higher probability of stalls & fluid cavitations

3.1.5 Direction

In some modes of operation (all Production Modes and Prime Mode), a direction selection of either forward or reverse is available. This selection determines the direction of fluid movement through the Pump Module.

When the direction is forward, fluid moves into the inactive port (Intake) and out the active port (Discharge). When the direction is reverse, fluid moves into the active port and out of the inactive port.

3.1.6 Active Port

The Pump Module contains two ports, Port A and Port B, for connection to the fluidic system. One port is always designated as the active port and the active port is always the discharge port. It is only necessary to change the active port if doing so eases the location of the tubing and other elements of the fluidic system.

Active port configuration is provided in the Setup C screen to allow initial fluidic system setup/location. Changing the active port in effect reverses the fluidic movement direction, the controlled Dispense portion of the operation will now occur at the opposite port location with the opposite rates. Following is a chart illustrating the nature of fluidic movement based on active port selection and direction.

Active Port	**- Port B (Default)**	
Direction	**Port A**	**Port B**
Forward	Inlet	Outlet
Reverse	Outlet	Inlet
Active Port	**– Port A**	
Direction	**Port A**	**Port B**
Forward	Outlet	Inlet
Reverse	Inlet	Outlet

3.1.7 Pump 90 Degree Offset

Enabling the pump 90 degree offset allows the pump to be offset from the actuator by 90 degrees. This eliminates the need to mechanically modify the actuator when changing port orientation.

The following table lists the Pump 90 Degree Offset and Active Port settings to change your output from what you have to what you want. The first table is for the IVEK standard Actuator Module and the second table is for the optional Actuator Modules. The diagrams at the bottom of the page show the output port locations for the four outlet positions.

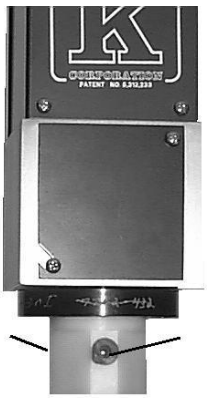
In Forward, Port A is always the input and Port B is the output. In Reverse, Port B is always the input and Port A is the output.

You Have	You Want	Controller Settings:	
		Pump 90 Degree Offset	Active Port
-03X (std)	-03X	Disabled	Port B
	-06X*	Enabled	Port B
	-09X	Disabled	Port A
	-12X*	Enabled	Port A

You Have	You Want	Controller Settings:	
		Pump 90 Degree Offset	Active Port
-06X	-06X	Disabled	Port B
-09X*		Enabled	Port A
-12X		Disabled	Port A
-06X*	-09X	Enabled	Port B
-09X		Disabled	Port B
-12X*		Enabled	Port A
-06X	-12X	Disabled	Port A
-09X*		Enabled	Port B
-12X		Disabled	Port B

* Rotate the Pump Module 90 Degrees clockwise.

Actuator Model # Tab	Outlet Port
-03X	3 O'clock
-06X	6 O'clock
-09X	9 O'clock
-12X	12 O'clock



3.1.8 Acceleration

The Acceleration setting determines how quickly the pump piston reaches the dispense/load rate from a stopped position. It is also used to determine deceleration; how quickly the piston slows down when heading towards stop. Increasing the acceleration may help increase the shearing of certain fluids from the tip improving repeatability. However, with higher accelerations, high viscosity fluids may be more susceptible to causing the Actuator Module motor to stall.

	Advantages	Disadvantages
Decreased Acceleration	Lower probability of stalls Lower probability of fluid cavitations	Less shear at tip Slightly longer cycle time
Increased Acceleration	More shear at tip Slightly shorter cycle time	Higher probability of stalls Higher probability of fluid cavitations

3.1.9 Drawback

Drawback is provided in some operating modes (Dispense, Dispense MCV, Meter) to allow the fluid to move in the opposite direction after a dispense to better separate the fluid at the tip. Often, high viscosity or “stringy” fluids are susceptible to poor separation at the end of a dispense. Drawback provides a snapping motion in the fluid to attempt to shear it off at the tip. There are three parameters available for configuration of Drawback: Drawback Volume, Drawback Rate, and Drawback Dwell.

The Drawback Volume determines the amount of fluid to move backwards after a dispense. Typically, this is configured for a small fraction of the dispense volume.

The Drawback Rate determines the rate of fluid movement during the backwards drawback.

The Drawback Dwell determines the amount of time the fluid movement pauses between the end of the cycle and the beginning of the next cycle. Typically, this is left at the default value, but may be increased if it benefits the application.

3.1.10 Torque

The torque setting determines the peak current available to the motor. Increasing the torque decreases the probability of stalling with high viscosity fluids. Decreasing the torque increases efficiency by decreasing steady state heat loss in the motor when using low viscosity fluids.

	Advantages	Disadvantages
Decreased Torque	Reduced heat loss in the motor	Higher probability of stalls
Increased Torque	Lower probability of stalls	Increased heat loss in the motor

3.2 STANDARD OPERATION

This Standard Operation section provides the information and instructions for the most common operation of the system. Most of the screens and the less common information have been removed. If you are an advanced user or need additional information please refer to Section 3.3 - Advanced Operation.

The Controller Module provides the controls for producing fluid flow 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, high reliability, and low maintenance.

Volume commands for the Controller Module use microliters. Rate commands are in microliters per second. Pumping is started using the Start push-button  based on the screen being viewed. Push the Stop push-button  to stop the operation before the respective volume setting is reached.

3.2.1 Dispense Mode

Dispense Mode is the typical operating mode to use when dispensing fixed amounts of fluids. The amount of fluid to dispense is configured by the Dispense Volume parameter. The range of the Dispense Volume is dependent on the pump size and Actuator Module, but is normally a minimum of 0.01% of the pump chamber volume up to a maximum of the full chamber volume. The repeatability of the dispense volume is dependent on many factors including: tubing setup, selected tip, fluid characteristics, Actuator Module and pump characteristics, and fluidic movement profile. Parameters such as Dispense Rate, Drawback, Drawback Rate, Drawback Dwell, and Acceleration, provide configuration of the fluidic movement profile to provide the flexibility to meet the needs of various applications.

If the Dispense Volume setting is less than a half chamber, then multiple dispenses may be initiated before requiring a reload. A reload will be required as soon as the volume remaining in the pump chamber is less than the amount required for the next dispense or the volume dispensed has reached the Load Threshold.

3.2.2 Meter Mode

Meter Mode allows for variable fluid movement. The beginning and ending of the fluid movement may be initiated by either the front panel start-stop buttons, RS232 commands or Logic I/O signals. However, the most precise control of the start and stop of metering is via the Logic I/O signals.

Once initiated, fluid will Meter until stopped. If Drawback is enabled, it will be performed upon the stopping of the Dispense.

If the Metering is not stopped, and the end of the chamber is reached, the operation will terminate and drawback will occur if enabled. This means that a metered dispense may only occur up to volumes of a pump chamber volume minus the drawback volume.

If the Metering is stopped before the end of the chamber is reached, another operation may be initiated, as long as the volume displaced has not reached the Load Threshold.

3.2.3 Prime Mode

Prime Mode is the most typically used Fluidic Setup Mode and is used to prime the fluidic tubing and components from the reservoir through to the tip before Production Mode operation. Having Prime as a separate mode from production permits selection of optimum values for priming, which may be different than optimum values for production. It is also often used in the Reverse Direction to remove the fluid from the fluidic system after Production Mode operations are completed.

The amount of fluid moved is configured by the Prime Volume parameter. The range of the Prime Volume is dependent on the pump size and Actuator Module, but is typically 0.01% to 1000 times the pump chamber volume. Once initiated, the Prime operation will move the desired amount of fluid through the system unless stopped early.

NOTE

It is recommended to perform a Dispense in the desired Production Mode after a Prime operation in order to properly setup the fluid for repeatable dispenses.

3.2.4 Display

The display provides an operator interface to all operating parameters in the Controller Module. New values can be entered and current values displayed for all the functions of the system. The current operating mode and system status are shown on the display. The display contains multiple interface screens each providing information to the operator.

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

NOTE

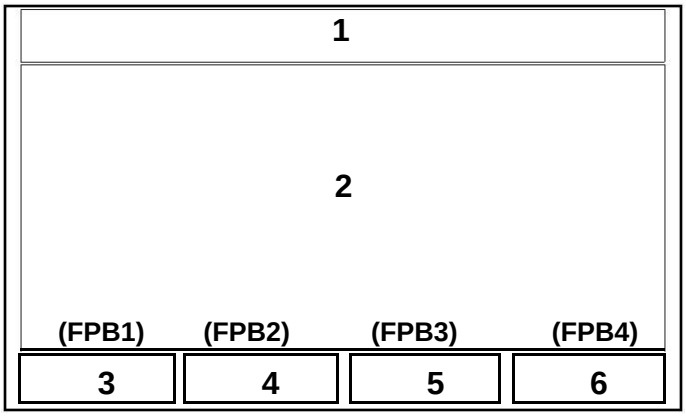
References to push-buttons for fields 3 through 6 refer to the push-button located below a word on the display. For example, the push-button located under 'REFERENCE' will be called the Reference push-button. These are referred to as Function Push-Buttons 1 through 4 (FPB1 - FPB4).

Field 1 - This field displays screen name and status information.

The status indicates the operational state of the system. The status is displayed in the upper right hand corner of the display. Refer to section 3.3.9 for additional information.

Field 2 - This field displays all the operating parameters.

Fields 3 through 6 (Function Push-Buttons 1 - 4) - These fields provide function legends for the four function push-buttons directly below the screen.



NOTE

A legend does not appear if the function is not permitted due to permission levels (section 3.2.6) or the value of the Serial Interface "k1" command (Table 3.3).

3.2.5 Help

Help is available when selecting or entering new values by pressing the FPB1 push-button. Information pertaining to the selected value will be displayed. Press the FPB1 key again to clear the help information from the screen.

3.2.6 Permission Levels

There are three levels of permission; Operator, I/O Test and Supervisor. Each level allows access to selected items on the display. The permission level can be changed in the Change Permission screen (Section 3.2.7.8).

The highest level is **Supervisor**. This level allows access to all items on all screens. The **I/O Test** level allows access to the same items as the Operator except it also allows access to the I/O Test screen. The **Operator** level does not allow changing system parameters and is the typical use setting. Recipes can be selected and loaded, but not changed. See serial interface 'k1' command for additional restrictions.

3.2.7 Screens

Sections 3.2.7.1 through 3.2.7.11 provide an image of each screen, the permission level access and a brief description of each parameter. All screens are described in Section 3.3 - Advanced Operation. For ease of use, the screen will always be on the left and the description will always be on the right when the two pages are viewed together.

The following alphabetical list provides a brief description of each screen and figure 3.3 shows the screens and provides a map of how to navigate to each screen. Transition between screens is limited by permission level, operating mode and interface signals.

Screen	Description
Change Permission	Allows changing the Permission level.
Dispense	Displays total volume, total cycles, recipe # and pump size. Allows changing direction, dispense volume, dispense rate, load rate. load threashold and draw-back settings.
Drawback	Allows changing drawback volume, drawback rate and drawback dwell.
Enter New Value	Used for entering a numerical value.
Fault	Displays the current fault.
Meter	Displays total volume, total cycles, recipe # and pump size. Allows changing direction, dispense/meter rate, load rate, load threshold and drawback settings.
Prime	Displays volume primed, recipe # and pump size. Allows changing direction, volume, discharge rate and intake rate.
Power up	Displays the current recipe number and pump size.
Recipe	Used for saving a new recipe or retrieving an existing recipe.
Select New Value	Used for selecting a new value from a list.
Setup A	Displays recipe # and pump size. Allows changing production mode, fluidic setup mode, load mode, auto retrigger, production dwells, power-up permission and current permission.
Warning Recipe Exists	Appears when you try to save a recipe using a previously used number.

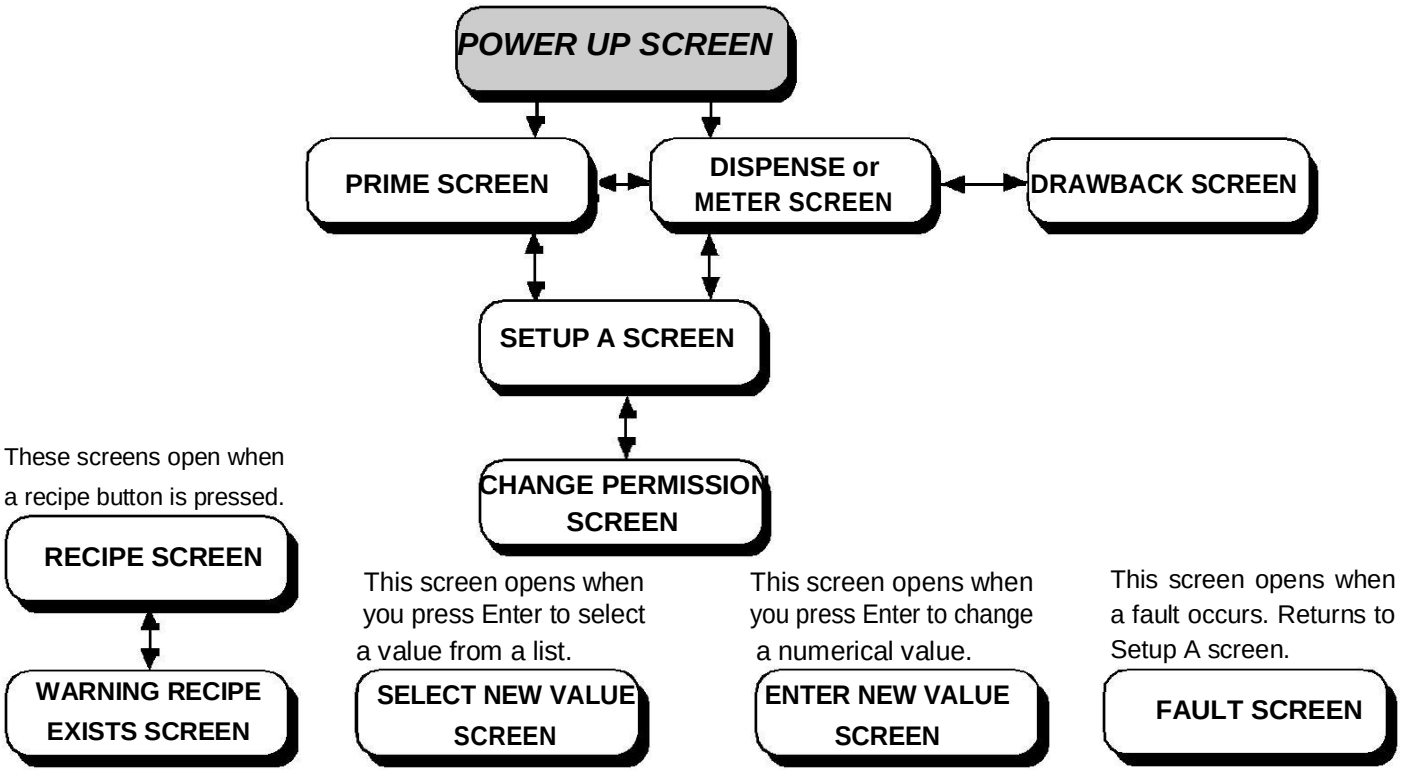


Figure 3.3 Standard Use Screen Navigation

3.2.7.1 Power Up Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

	Supervisor	I/O Test	Operator
----- Displays the Controller Module Status.....	D	D	D
----- Displays the current recipe.....	D	D	D
----- Displays the pump size	D	D	D
The following screens are accessible from this screen based on the system status.			
Agitate.....	P	P	P
Bubble Clr.....	P	P	P
Contrast Adjust	P	P	P
Dispense	P	P	P
Fault.....	P	P	P
Meter.....	P	P	P
Prime.....	P	P	P
Setup A	P	P	P
Setup C	P	P	P

```
0 DIGISPENSE 3020                    <— status —>

2
3
4                  IVEK CORPORATION
5                  http://www.ivek.com
6
7              RECIPE   =   ##
8                PUMP   =   ####
9
10
11
12  Press function button below to proceed
13
if prime mode and dispense mode
14        PRIME        DISPENSE                    CONTRAST
15       SCREEN        SCREEN                      ADJUST

OR if agitate mode and dispense mode
14       AGITATE       DISPENSE                    CONTRAST
15       SCREEN        SCREEN                      ADJUST

OR if bubble clear mode and dispense mode
14     BUBBLE CLR      DISPENSE                    CONTRAST
15       SCREEN        SCREEN                      ADJUST

OR if disabled fluidic setup mode and dispense mode
14                     DISPENSE                    CONTRAST
15                     SCREEN                      ADJUST

OR if prime mode and meter mode
14        PRIME         METER                      CONTRAST
15       SCREEN        SCREEN                      ADJUST

OR if prime mode and disabled production mode
14        PRIME                                    CONTRAST
15       SCREEN                                    ADJUST

OR if disabled fluidic setup mode and disabled production
mode
14       SETUP A                                  CONTRAST
15       SCREEN                                    ADJUST

OR if NO actuator/pump selected
14        PRIME        DISPENSE      SETUP C      CONTRAST
15       SCREEN        SCREEN        SCREEN       ADJUST

OR if actuator/pump selected and reference required
14        PRIME        DISPENSE     REFERENCE     CONTRAST
15       SCREEN        SCREEN       REQUIRED      ADJUST

if-faulted
14                                    FAULT       CONTRAST
15                                    SCREEN      ADJUST
```

Power Up Screen Description - The Power Up screen displays the recipe and pump information. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

3.2.7.2 Prime Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

```
0 PRIME                                  <— status —>

2
3          VOLUME PRIMED  =  ############ uL
4
5                            ------------------------------
6                   RECIPE  =  ##    PUMP ####
7           PRIME DIRECTION  =  #######
8             PRIME VOLUME  =  ############ uL
9          DISCHARGE RATE  =  ######### uL/s
10             INTAKE RATE  =  ######### uL/s
11
12
13
if dispense mode
14      DISPENSE      SETUP A       CHANGE        GET
15       SCREEN        SCREEN     DIRECTION     RECIPE

OR if meter mode
14        METER       SETUP A       CHANGE        GET
15       SCREEN        SCREEN     DIRECTION     RECIPE

OR if disabled production mode
14                     SETUP A       CHANGE        GET
15                      SCREEN     DIRECTION     RECIPE

OR NO actutator/pump selected
14      DISPENSE      SETUP A       SETUP C       GET
15       SCREEN        SCREEN        SCREEN     RECIPE

OR if reference required
14      DISPENSE      SETUP A     REFERENCE       GET
15       SCREEN        SCREEN      REQUIRED     RECIPE

OR if direction change disabled
14      DISPENSE      SETUP A                     GET
15       SCREEN        SCREEN                  RECIPE

OR if get recipe disabled
14      DISPENSE      SETUP A       CHANGE
15       SCREEN        SCREEN     DIRECTION

OR if direction change and get recipe disabled
14      DISPENSE      SETUP A
15       SCREEN        SCREEN
```

	Supervisor	I/O Test	Operator
----- Displays the Controller Module Status.....	D	D	D
----- Displays the current or last prime volume...	D	D	D
----- Displays the current recipe.....	D	D	D
----- Displays the pump size	D	D	D
----- Display/change fluid direction.....	D	D	C
----- Display/change the prime volume.....	D	D	C
----- Display/change the discharge rate	D	D	C
----- Display/change the Intake rate.....	D	D	C
The following screens are accessible from this screen based on the system status.			
Dispense	P	P	P
Setup A	P	P	P
Change Direction.....	P	P	P
Get Recipe	P	P	P
Meter.....	P	P	P
Setup C	P	P	P

Prime Screen Description - The Prime screen displays the current Priming parameters and allows control of priming operations. A user with Supervisor permission is able to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Priming operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Volume Primed - The Volume Primed line shows the total volume dispensed during the current or last priming operation. This resets to zero at the start of a Priming operation.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Prime Direction - The Prime Direction is the direction of fluid flow through the Pump Module in Prime mode. The direction is either Forward or Reverse. Forward is typically used to fill the tubing and pump with fluid. Reverse is typically used to remove fluid from the tubing and pump.

Prime Volume - The Prime Volume is the amount of fluid to move through the pump and tubing during a prime cycle. Typically, this should be set to a volume greater than or equal to the volume of the pump and tubing. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the minimum volume for the selected pump size. Priming may be terminated early by pressing the Stop push-button.

Discharge Rate - The Discharge Rate is the rate of the fluid movement in micro liters per second during the dispense portion of a prime cycle. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Intake Rate - The Intake Rate is the rate of the fluid movement during the load portion of the prime cycle in micro liters per second. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum pushbuttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

	Prime Mode	Minimum/Maximum Chart		
Pump Size	**Minimum Volume µl**	**Maximum Volume µl**	**Minimum Rate µl/Sec**	**Maximum Rate µl/Sec**
4A	0.002	20,000	0.010	40
3A	0.005	50,000	0.025	100
2A	0.01	100,000	0.05	200
1A	0.02	200,000	0.10	400
B	0.04	400,000	0.20	800
C	0.10	1,000,000	0.50	2000
D	0.20	2,000,000	1.00	4000

3.2.7.3 Dispense Screen

D = Display C = Display/Change P = Push-button Accessible N = Not Accessible/Viewable

```
0 DISPENSE                                  <— status —>

2
3          TOTAL VOLUME = ################ uL
43         TOTAL CYCLES = ##########
5                         ------------------------------
6                RECIPE = ##   PUMP ####
7             DIRECTION = #######
8      DISPENSE VOLUME = ############ uL
9  DISPENSE/METER RATE = ######### uL/s
10           LOAD RATE = ######### uL /s
11   LOAD THREASHOLD = ######### uL
12            DRAWBACK = DISABLED
13
if prime mode and chamber full
14      PRIME       SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if agitate mode and chamber full
14      AGITATE     SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if bubble clear mode and chamber full
14    BUBBLE CLR    SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if disabled fluidic setup mode and chamber full
14                  SETUP A       PARK          GET
15                  SCREEN        PORT          RECIPE

OR if NO actuator/pump selected
14      PRIME       SETUP A       SETUP C       GET
15      SCREEN      SCREEN        SCREEN        RECIPE

OR if reference required
14      PRIME       SETUP A     REFERENCE       GET
15      SCREEN      SCREEN      REQUIRED        RECIPE

OR if load required
14      PRIME       SETUP A       LOAD          GET
15      SCREEN      SCREEN      REQUIRED        RECIPE

OR if chamber not full and load possible
14      PRIME       SETUP A       LOAD          GET
15      SCREEN      SCREEN                      RECIPE

OR if get recipe disabled and chamber full
14      PRIME       SETUP A       PARK
15      SCREEN      SCREEN        PORT
```

		Supervisor	I/O Test	Operator
-----	Displays the Controller Module Status	D	D	D
-----	Displays the total volume dispensed	D	D	D
-----	Displays the total number of cycles	D	D	D
-----	Displays the current recipe	D	D	D
-----	Displays the pump size	D	D	D
-----	Display/change fluid direction	D	D	C
-----	Display/change the dispense volume	D	D	C
-----	Display/change the dispense/meter rate	D	D	C
-----	Display/change the load rate	D	D	C
-----	Display/change the load threashold	D	D	C
-----	Switches to the drawback screen	P	P	P
	The following screens are accessible from this screen based on the system status.			
	Prime	P	P	P
	Setup A	P	P	P
	Get Recipe	P	P	P
	Agitate	P	P	P
	Bubble Clr	P	P	P
	Setup C	P	P	P

Dispense Screen Description - The Dispense screen displays the current Dispense parameters and provides control of the dispense operations. A user with Supervisor permission is able to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Dispensing operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Total Volume - Total Volume is the total amount of liquid dispensed in Dispense and Meter Modes. The total volume counter will roll over after the maximum value is reached. The counter can be reset to 0 using the Clear Totalizer screen.

Total Cycles - Total Cycles is the total number of dispenses in Dispense and Meter modes. The total cycles counter will go up to a maximum of 3,999,999,999 before restarting at 0. The counter can be reset to 0 using the Clear Totalizer screen.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Direction - The Direction is the direction of liquid flow through the Pump Module for Dispense and Meter modes. The direction is either Forward or Reverse.

Dispense Volume - The Dispense Volume is the amount of liquid dispensed in micro liters during a dispense cycle. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the minimum volume for the selected pump size.

Dispense/Meter Rate - The Dispense/Meter Rate is the rate of the pump in micro liters per second during the dispense operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Rate - The Load Rate is the rate the pump will operate during a load operation in micro liters per second. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Threshold - A load will be required/initiated when the volume dispensed is greater than or equal to this volume.

Drawback - Refer to Section 3.3.8.13.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

Dispense Mode Minimum/Maximum Chart

Pump Size	Minimum Volume µl	Maximum Volume µl	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.002	20	0.010	40
3A	0.005	50	0.025	100
2A	0.01	100	0.05	200
1A	0.02	200	0.10	400
B	0.04	400	0.20	800
C	0.10	1000	0.50	2000
D	0.20	2000	1.00	4000

3.2.7.4 Meter Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

```
0 METER                                  <— status —>

2
3          TOTAL VOLUME  = ################ uL
4          TOTAL CYCLES  = ##########
5                          ------------------------------
6                RECIPE  = ##    PUMP ####
7             DIRECTION  = #######
8
9  DISPENSE/METER RATE  = ######### uL/s
10             LOAD RATE  = ######### uL /s
11     LOAD THREASHOLD  = ######### uL
12             DRAWBACK  = DISABLED
13
if prime mode and chamber full
14       PRIME       SETUP A        PARK          GET
15       SCREEN      SCREEN         PORT          RECIPE

OR if agitate mode and chamber full
14       AGITATE     SETUP A        PARK          GET
15       SCREEN      SCREEN         PORT          RECIPE

OR if bubble clear mode and chamber full
14    BUBBLE CLR     SETUP A        PARK          GET
15       SCREEN      SCREEN         PORT          RECIPE

OR if disabled fluidic setup mode and chamber full
14                   SETUP A        PARK          GET
15                   SCREEN         PORT          RECIPE

OR if NO actuator/pump selected
14       PRIME       SETUP A        SETUP C       GET
15       SCREEN      SCREEN         SCREEN        RECIPE

OR if reference required
14       PRIME       SETUP A      REFERENCE       GET
15       SCREEN      SCREEN       REQUIRED        RECIPE

OR if load required
14       PRIME       SETUP A        LOAD          GET
15       SCREEN      SCREEN       REQUIRED        RECIPE

OR if chamber not full and load possible
14       PRIME       SETUP A        LOAD          GET
15       SCREEN      SCREEN                       RECIPE

OR if get recipe disabled and chamber full
14       PRIME       SETUP A        PARK
15       SCREEN      SCREEN         PORT
```

		Supervisor	I/O Test	Operator
-----	Displays the Controller Module Status	D	D	D
-----	Displays the total volume dispensed	D	D	D
-----	Displays the total number of cycles	D	D	C
-----	Displays the current recipe	D	D	D
-----	Displays the pump size	D	D	D
-----	Display/change fluid direction	D	D	C
-----	Display/change the dispense/meter rate	D	D	C
-----	Display/change the load rate	D	D	C
-----	Display/change the load threashold	D	D	C
-----	Switches to the drawback screen	P	P	P
	The following screens are accessible from this screen based on the system status.			
	Prime	P	P	P
	Setup A	P	P	P
	Get Recipe	P	P	P
	Agitate	P	P	P
	Bubble Clr	P	P	P

Meter Screen Description - The Meter screen displays the current Metering parameters and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Metering operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Total Volume - Total Volume is the total amount of liquid dispensed in Dispense and Meter Modes. The total volume counter will roll over after the maximum value is reached. The counter can be reset to 0 using the Clear Totalizer screen.

Total Cycles - Total Cycles is the total number of dispenses in Dispense and Meter modes. The total cycles counter will go up to a maximum of 3,999,999,999 before restarting at 0. The counter can be reset to 0 using the Clear Totalizer screen.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Direction - The Direction is the direction of liquid flow through the Pump Module for Dispense and Meter modes. The direction is either Forward or Reverse.

Dispense/Meter Rate - The Dispense/Meter Rate is the rate of the piston in micro liters per second during the meter operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Rate - The Load Rate is the rate the pump will operate during a load operation in micro liters per second. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Threshold - A load will be required/initiated when the volume dispensed is greater than or equal to this volume.

Drawback - Refer to Section 3.3.8.13.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

Meter Mode Minimum/Maximum Chart

Pump Size	Minimum Volume µl	Maximum Volume µl	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.002	20	0.010	40
3A	0.005	50	0.025	100
2A	0.01	100	0.05	200
1A	0.02	200	0.10	400
B	0.04	400	0.20	800
C	0.10	1000	0.50	2000
D	0.20	2000	1.00	4000

3.2.7.5 Setup A Screen

D = Display **P = Push-button Accessible**
C = Display/Change **N = Not Accessible/Viewable**

```
0  SETUP A                                   <— status —>

2                               -------------------------------
3                    RECIPE  =  ##    PUMP ####
4
5         PRODUCTION MODE  =  ########
6       FLUIDIC SETUP MODE  =  ######
7                LOAD MODE  =  ######
8           AUTO RETRIGGER  =  #######
9       PRODUCTION DWELLS  =  #######
10
11POWER-UP PERMISSION  =  #################
12 CURRENT PERMISSION  =  ##########
13
if prime mode
14       PRIME        SETUP B                         SAVE
15       SCREEN       SCREEN                         RECIPE

OR if agitate mode
14      AGITATE       SETUP B                         SAVE
15       SCREEN       SCREEN                         RECIPE

OR if bubble clear mode
14    BUBBLE CLR      SETUP B                         SAVE
15       SCREEN       SCREEN                         RECIPE

OR if dispense mode and disabled fluidic setup mode
14      DISPENSE      SETUP B                         SAVE
15       SCREEN       SCREEN                         RECIPE

OR if meter mode and disabled fluidic setup mode
14       METER        SETUP B                         SAVE
15       SCREEN       SCREEN                         RECIPE

OR if disabled production mode and disabled fluidic setup
 mode
14        GET         SETUP B                         SAVE
15       RECIPE       SCREEN                         RECIPE

OR if prime mode and faulted
14       PRIME        SETUP B        FAULT            SAVE
15       SCREEN       SCREEN        SCREEN           RECIPE

OR if prime mode and save recipe disabled
14       PRIME        SETUP B
15       SCREEN       SCREEN
```

	Operator	I/O Test	Supervisor
----- Displays the Controller Module Status	D	D	D
----- Displays the current recipe	D	D	D
----- Displays the pump size	D	D	D
----- Display/change the production mode	D	D	C
----- Display/change the fluidic setup mode	D	D	C
----- Display/change the load mode	D	D	C
----- Switches to the auto trig screen	P	P	P
----- Switches to the prod dwells screen	P	P	P
----- Display/change the power up permission	D	D	C
----- Display/change the current permission	D	D	C

The following screens are accessible from this screen based on the system status.

	Operator	I/O Test	Supervisor
Agitate	P	P	P
Bubble Clr	P	P	P
Get Recipe	P	P	P
Prime	P	P	P
Setup A	P	P	P
Setup C	P	P	P

Setup A Screen Description - The Setup A screen displays some of the higher level settings for the Controller Module and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Production Mode - The Production Mode configures the current mode of operation. The mode can either be Disabled, Dispense, Meter, Dispense MCV (Minimum Chamber Volume), Dispense Mult (Multichamber) or Meter Mult (Multichamber). Refer to section 3.3.1 for description of advanced modes.

Fluidic Setup Mode - The Fluidic Setup Mode configures the current mode of operation during setup. The mode can either be Disabled, Prime, Bubble Clr (Clear) or Agitate. Refer to section 3.3.2 for description of Bubble Clear and Agitate.

Load Mode - The Load Mode configures the current mode for refilling the pump chamber with fluid. The mode can be either Manual, Empty or Every.

Auto Retrigger - Refer to Section 3.3.8.14.

Production Dwells - Refer to Section 3.3.8.15.

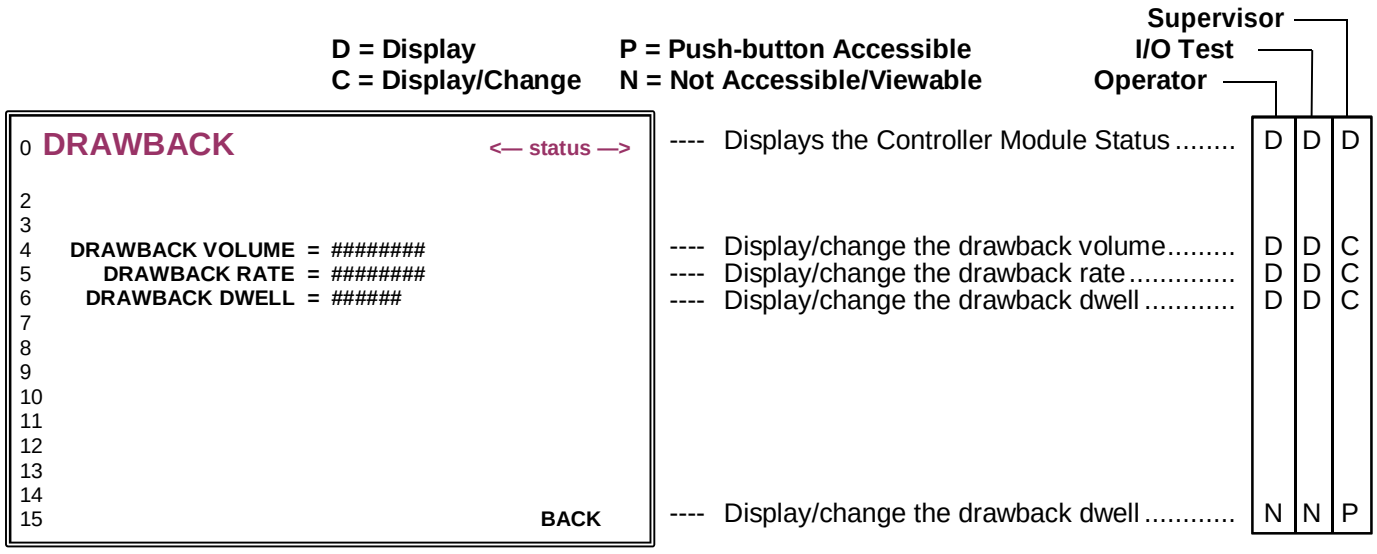
Power-Up Permission - The Power-Up Permission configures the current setting for the permission when the Controller Module is powered on. The mode can be either Operator or Last At Power Off.

Current-Permission - Refer to Section 3.3.8.19.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

3.2.7.6 Drawback Screen



Drawback Screen Description - The Drawback screen displays the current Drawback parameters and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown. Refer to section 3.1.9 for description of Drawback.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Drawback Volume - The Drawback Volume is the amount of liquid drawn back during a drawback cycle. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the minimum volume for the selected pump size. Drawback volume is limited to the full chamber volume minus dispense volume. A drawback volume of zero disables drawback while a drawback volume greater than zero enables drawback.

NOTE

It is reset to 0 when the dispense volume is increased such that the dispense volume plus drawback volume exceeds the full chamber volume.

Drawback Rate - The Drawback Rate is the rate of the pump in micro liters per second during a drawback operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the 20% of the minimum rate.

Drawback Dwell - The Drawback Dwell is the time between the end of a dispense and the beginning of the drawback cycle in seconds. The range is 0.00 sec to 2.55 sec with an increment value of 0.01. The recommend minimum is 0.05.

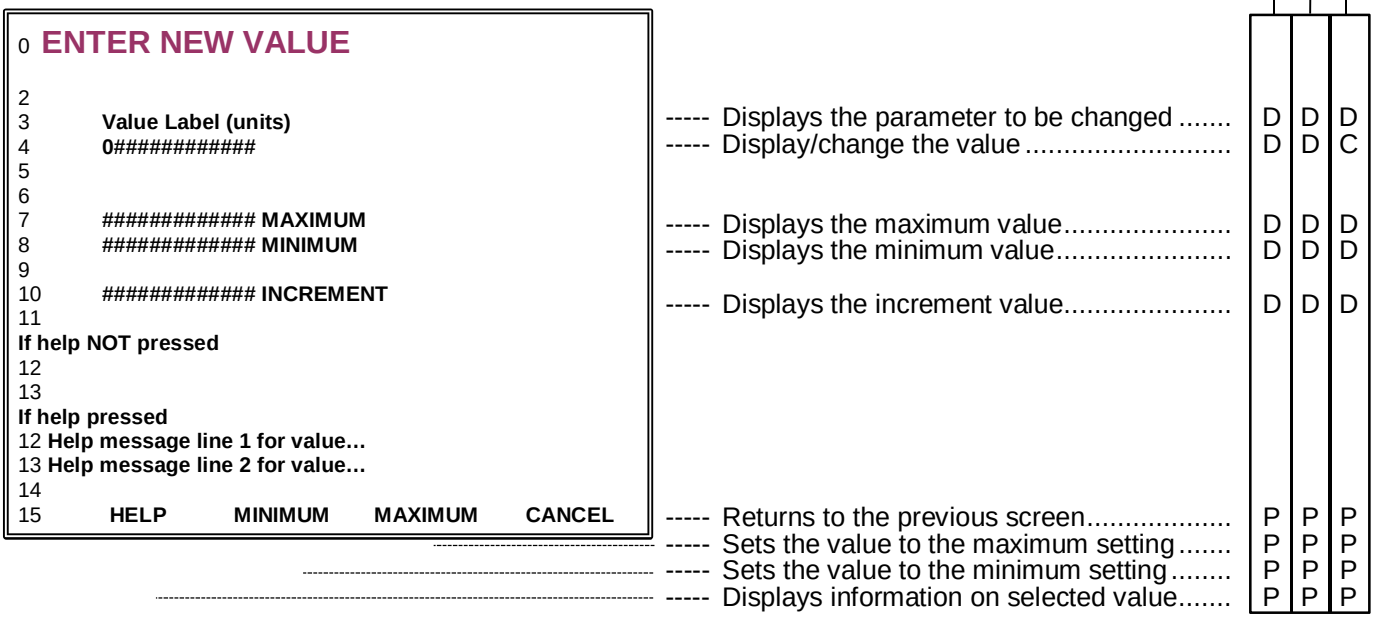
To change a value;

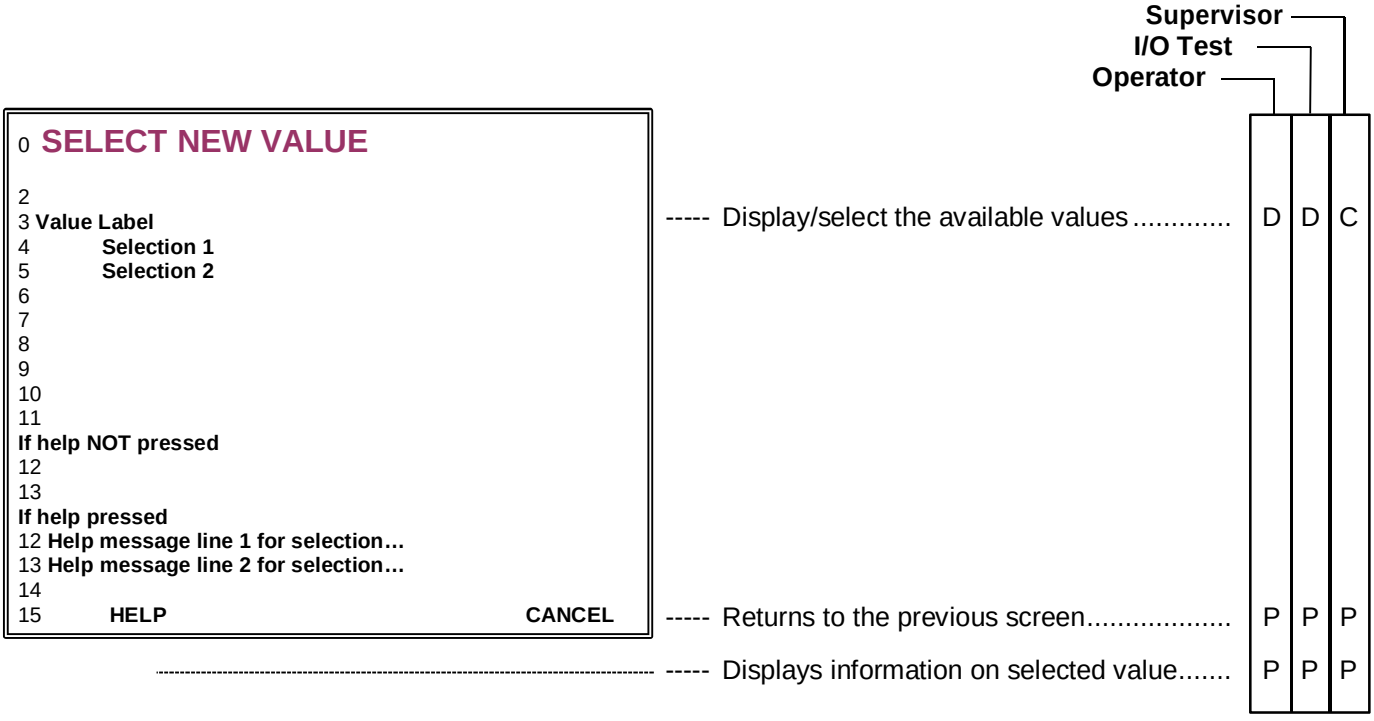
1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

Drawback Minimum/Maximum Chart				
Pump Size	**Minimum Volume µl**	**Maximum Volume µl**	**Minimum Rate µl/Sec**	**Maximum Rate µl/Sec**
4A	0.0	< 20	0.010	40
3A	0.0	< 50	0.025	100
2A	0.0	< 100	0.05	200
1A	0.0	< 200	0.10	400
B	0.0	< 400	0.20	800
C	0.0	< 1000	0.50	2000
D	0.0	< 2000	1.00	4000

3.2.7.7 Select New Value and Enter New Value Screens

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable





Enter New Value Description - The Enter New Value screen allows entry of a numerical value within the indicated range. This screen is only accessible with Supervisor permission.

Upon reaching the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value. Press the Enter push-button to store the new value and return to the previous screen or press cancel to ignore the change.

Parameter - The first two lines of this screen display the parameter to be changed and the current value.

Maximum - Displays the maximum value for the parameter.

Minimum - Displays the minimum value for the parameter.

Increment - Displays the incremental value for the parameter.

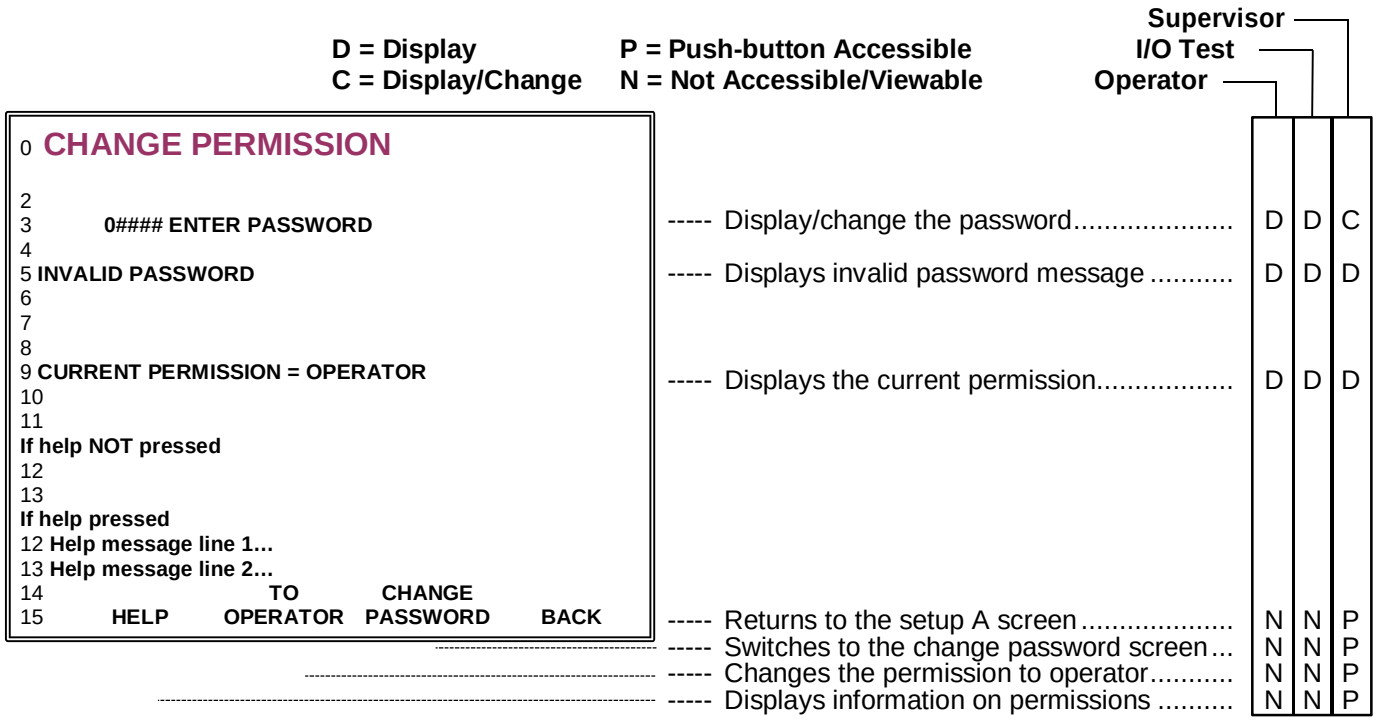
Select New Value Screen Description - The Select New Value screen selects a value from a list of values. The Enter New Value screen allows entry of a numerical value within the indicated range. This screen is only accessible with Supervisor permission.

Upon reaching the Select New Value screen use the up and down arrow push-buttons to select the value. Press the Enter push-button to store the new value and return to the previous screen.

Parameter - The first line of this screen displays the parameter to be changed. The available choices start at the second line.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

3.2.7.8 Change Permission Screen



Change Permission Screen Description - The Change Permission screen is used to change the permission to a lower or higher level. This allows additional or more restrictive access to parameters and screens. The current permission level determines which push-buttons are available as shown.

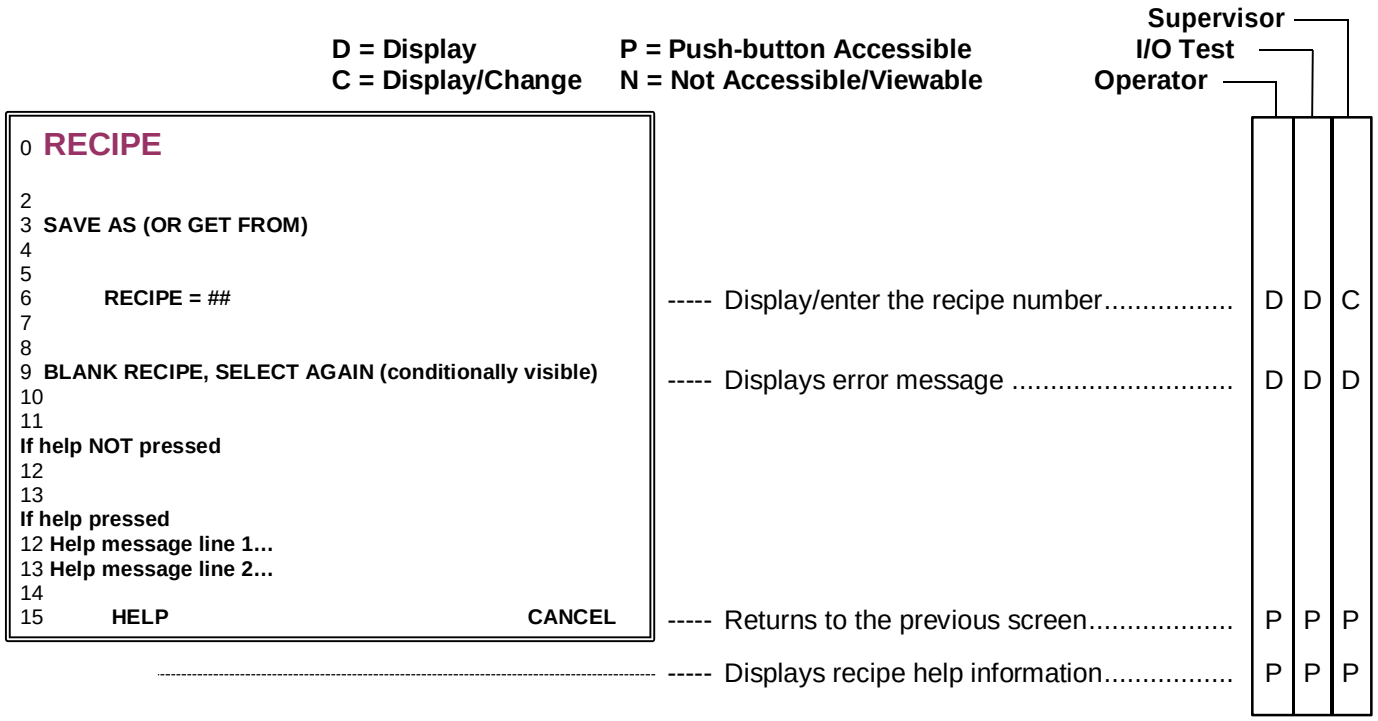
The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Enter Password - This field is used to enter the password for the desired permission level. Each permission level has a unique password to prevent unauthorized access to certain parameters. The permission level can either be Operator, I/O Test or Supervisor. Use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value. The minimum value for a password is '10'.

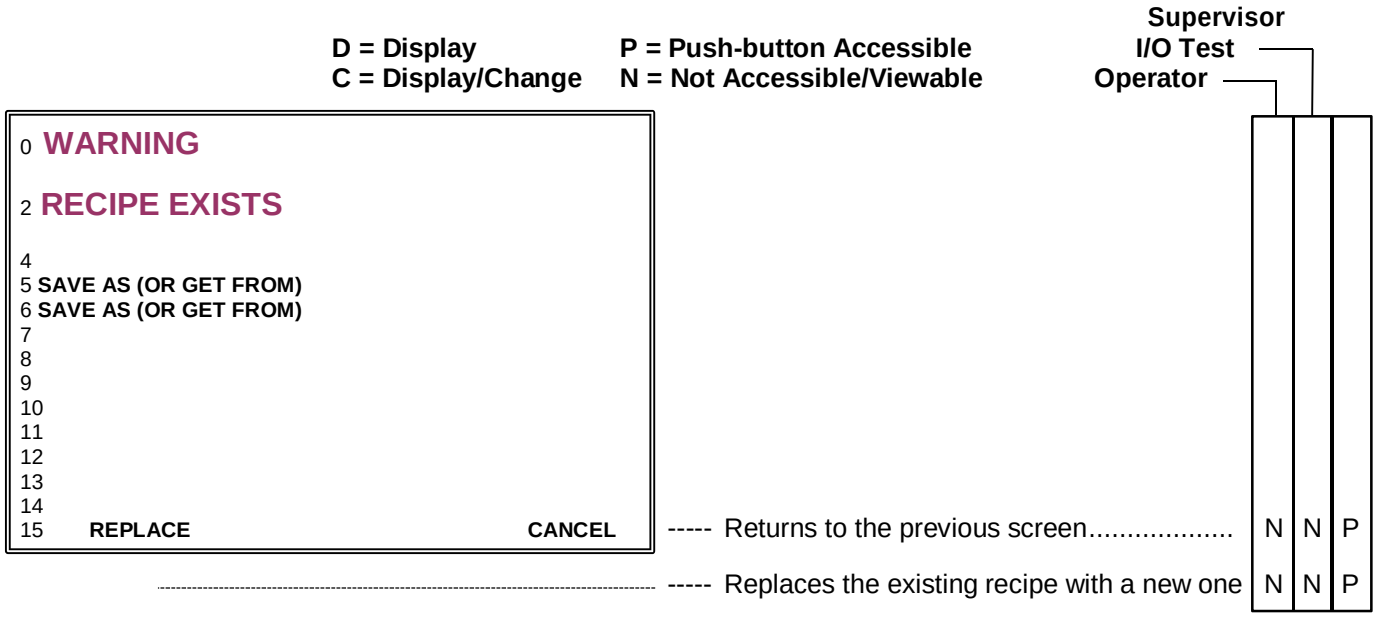
NOTE

Entering a password causes the password field to reset to the minimum value.

3.2.7.9 Recipe Screen



3.2.7.10 Warning Recipe Exists Screen



Recipe Screen Description - The Recipe screen is used to select an existing recipe to load into the Controller Module, save a changed recipe to the same number or a new number, or save a new recipe to an existing number or a new number. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Warning Recipe Exists Screen Description - The Warning Recipe Exists screen is intended to prevent accidently overwriting an existing recipe. This screen will appear and offer a choice of either replacing the existing recipe or canceling and not replacing the existing recipe. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

3.2.7.11 Fault Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

	Supervisor	I/O Test	Operator
0 **FAULT** <— status —> ----- Displays the Controller Module status	D	D	D
2			
3 **Piston Home Fault** ----- Displays the fault description.....	D	D	D
4 **Error Code: ##########** ----- Displays the fault error code.....	D	D	D
5			
6			
7			
8			
9			
10			
11 **"CLEAR FAULT" = CLEAR FAULT & REFERENCE**			
12 **"SETUP A SCREEN" = CHANGE VALUES FIRST**			
13			
If NOT port home fault			
14 **SETUP A CLEAR**			
15 **SCREEN FAULT**			
If port home fault			
14 **SETUP A CLEAR MOVE**			
15 **SCREEN FAULT PISTON**			
----- Tests the movement of the piston.....	P	P	P
----- Clears the displayed fault.....	P	P	P
----- Switches to the Setup A screen.....	P	P	P

If "MOVE PISTON" selected from above

0 **FAULT** <— status —> ----- Displays the Controller Module status	D	D	D
2			
3 **WARNING – trying to move a seized piston**			
4 **may break actuator coupling. Please**			
5 **remove pump before initiating move.**			
6			
7			
8			
9			
10 **"MOVE PISTON" = MOVE PISTON & REFERENCE**			
11 **"CLEAR FAULT" = CLEAR FAULT & REFERENCE**			
12 **"SETUP A SCREEN" = CHANGE VALUES FIRST**			
13			
14 **SETUP A CLEAR MOVE**			
15 **SCREEN FAULT PISTON**			
----- Tests the movement of the piston.....	P	P	P
----- Clears the displayed fault.....	P	P	P
----- Switches to the setup A screen	P	P	P

Fault Screen Description - The Fault screen displays faults which cause the system to stop operating. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

The Fault description lists the operational fault. The error code is a numerical value and is to be used by IVEK Technical Service personnel. Normal operational faults will cause an error code of '0'.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

3.2.8 Setup (Figure 3.4)

The following steps will guide you through a basic setup for turning your system on for the first time:

1. On the rear of the Controller Module

a. Make sure the 1/0 (On/Off) (1a) switch is set to 0 (Off).
b. Connect the power cord to the Controller Module (1b) and the power source.
c. Connect the Actuator Cable, the larger connector connects to the Controller Module (1c).

2. On the Actuator Module

a. Connect the other end of the Actuator Cable (2a).
b. Make sure the Actuator is secure.

3. On the Pump Module

NOTE

Make sure the inlet tubing is larger than, or the same size as, the outlet tubing. Start with the reservoir even with or slightly higher than the Pump Module and the Pump Module even with or slightly higher than the dispense tip. Adjust as necessary to fit your application.

a. Connect the inlet fitting and tubing (3a)
b. Connect the gland inlet fitting and tubing (3b) (*****optional)
c. Connect the outlet fitting and tubing (3c)
d. Connect the gland outlet fitting and tubing (3d) (*****optional)

3.2.9 Start-up

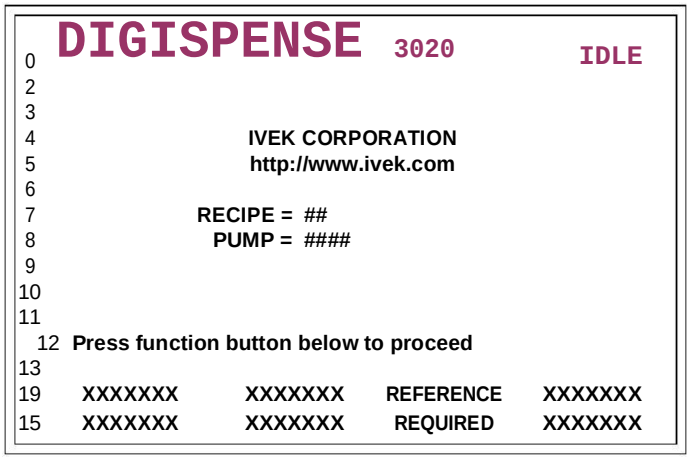
a. Switch the 1/0 power switch to the "1" position.

b. The display will illuminate and show the following information. The status will change from Initializing to Idle and the information for **your** system will be displayed including the current recipe and pump size and there may be additional push-button selections depending on your system settings.

Refer to Section 3.2.4 in your manual for field descriptions.

REFERENCE REQUIRED may be flashing indicating the system needs to be referenced.

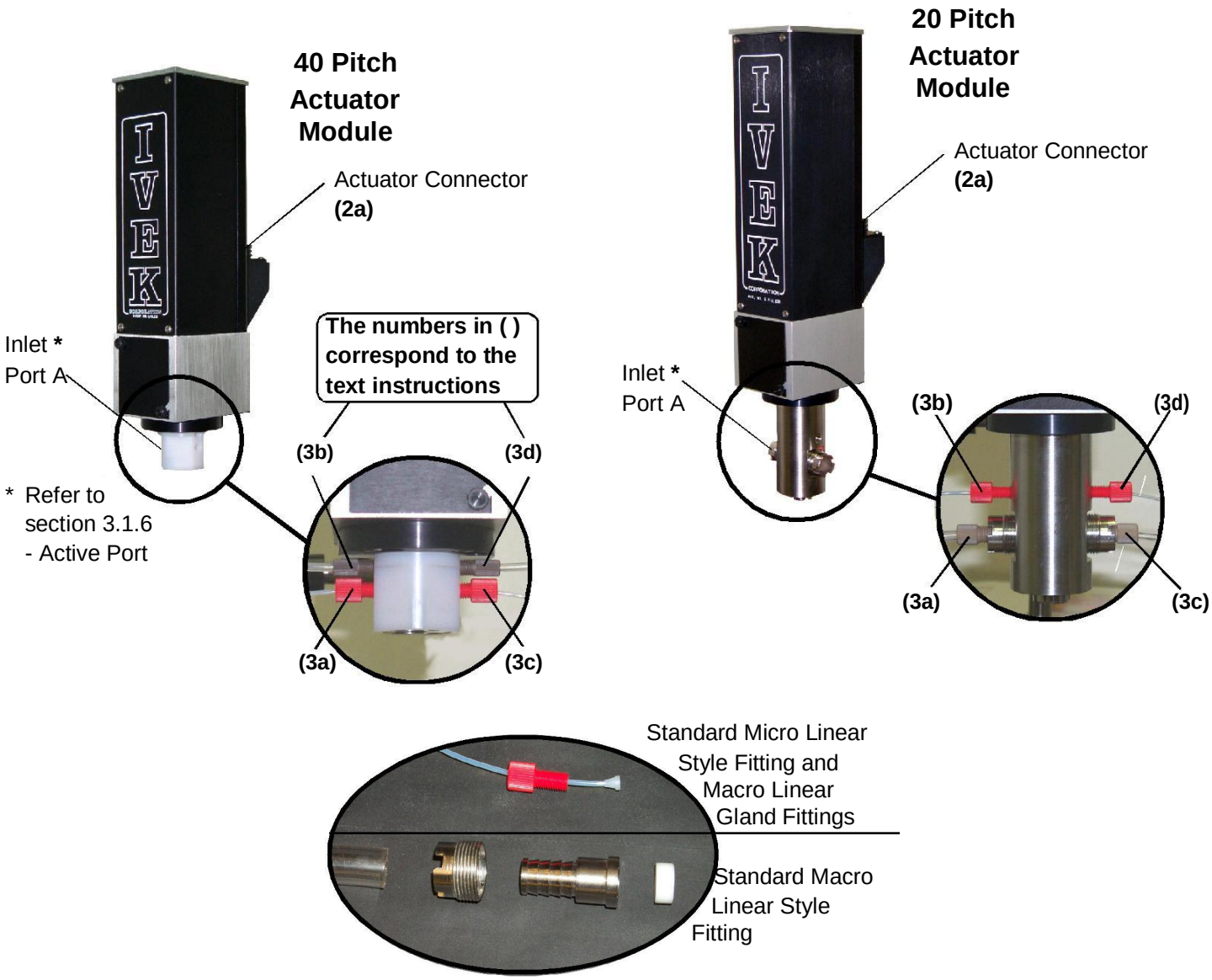
c. Press the Reference push-button to reference the system and the Actuator Module will reference.



Go to the Dispense section (3.2.9.2) or Meter section (3.2.9.3) if the system has previously been primed. If not, follow the instructions in the following section.

NOTE

All Controller Modules are shipped from the factory with a permission level of Supervisor.



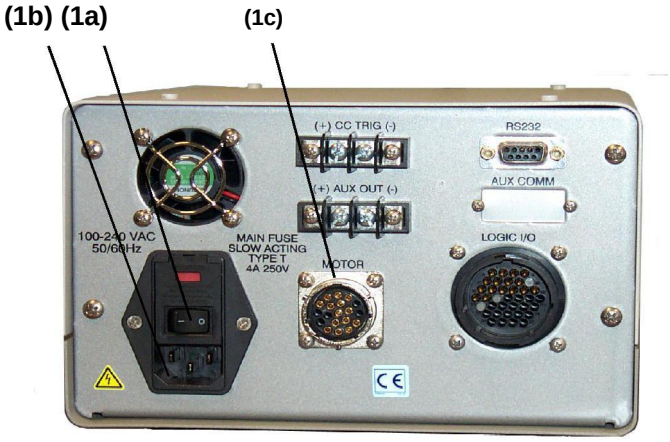


Figure 3.4 Setup

3.2.9.1 Prime

Press the PRIME SCREEN push-button to enter Prime Mode.

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 push-button to begin priming. The system cannot be initiated using the rear panel "CC TRIG" signal. The system will prime based on the Direction, Volume and Rate settings. Pressing the STOP push-button can stop the priming at any time.

3.2.9.2 Dispense

Press the DISPENSE SCREEN push-button to enter Dispense Mode. If the DISPENSE SCREEN is not shown go to SETUP A screen and change Production Mode to DISPENSE.

To start dispensing press the START button or supply a trigger to the rear panel. The system will dispense based on the Direction, Volume, Rate, Load Rate, Load Threshold and Drawback settings. Pressing the STOP push-button can stop the dispensing at any time.

When drawback is enabled, the Volume setting specifies the net fluid displaced, the actual forward motion is the sum of the specified dispense volume and the drawback volume. The Drawback Rate during drawback and the Drawback Dwell (time between the forward and reverse portions of the cycle) settings are shown on the Drawback screen.

3.2.9.3 Meter

Press the METER SCREEN push-button to enter Meter Mode. If the METER SCREEN is not shown go to SETUP A screen and change Production Mode to METER.

To start metering press the START button or supply a trigger to the rear panel. The system will meter based on the Direction, Load Threshold, Rate, Load Rate and Drawback settings. Pressing the STOP push-button can stop the metering at any time.

When drawback is enabled, the Drawback Rate during drawback and the Drawback Dwell (time between the forward and reverse portions of the cycle) settings are shown on the Drawback screen.

3.2.10 Faults

Faults cause the Fault screen (section 3.2.7.11) to appear. If a fault occurs, the type of fault will be displayed on the screen. Once the problem is corrected, press the Reference push-button. Refer to section 3.3.13 for a list and description of each fault.

3.3 ADVANCEDOPERATION

The Controller Module provides the controls for producing fluid flow 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, high reliability, and low maintenance.

Volume commands for the Controller Module use microliters. Rate commands are in microliters per second. Pumping is started using the Start push-button  based on the screen being viewed. Push the Stop push-button  to stop the operation before the respective volume setting is reached.

3.3.1 Production Mode

Production Mode provides precision dispensing and metering operations. Three Dispense Modes (Dispense, Dispense Minimum Chamber Volume, Dispense Multichamber) and two Meter Modes (Meter, Meter Multichamber)

provide means of dispensing fluid with either fixed or variable volumes. While only one Production Mode is active at a time, recipes can be used to quickly change between modes of operation when necessary.

3.3.1.1 Dispense Mode

Dispense Mode is the typical operating mode to use when dispensing fixed amounts of fluids. The amount of fluid to dispense is configured by the Dispense Volume parameter. The range of the Dispense Volume is dependent on the pump size and Actuator Module, but is normally a minimum of 0.01% of the pump chamber volume up to a maximum of the full chamber volume. The repeatability of the dispense volume is dependent on many factors including: tubing setup, selected tip, fluid characteristics, Actuator Module and pump characteristics, and fluidic movement profile. Parameters such as Dispense Rate, Drawback, Drawback Rate, Drawback Dwell, and Acceleration, provide configuration of the fluidic movement profile to provide the flexibility to meet the needs of various applications.

If the Dispense Volume setting is less than a half chamber, then multiple dispenses may be initiated before requiring a reload. A reload will be required as soon as the volume remaining in the pump chamber is less than the amount required for the next dispense or the total amount dispensed of this chamber is greater than or equal to the Load Threshold.

3.3.1.2 Dispense Minimum Chamber Volume

NOTE

Dispense MCV mode requires periodic referencing.

Dispense Minimum Chamber Volume allows for only a single Dispense, using an end of the pump chamber (the end of the pump chamber used is dependent on Direction). This mode is typically used when small repeatable volumes with minimum reload time are desired (regular Dispense Mode reloads, being close to the piston “home” sensor, often involve additional piston movement due to sensor hysteresis).

This mode also only fills the chamber with enough fluid to perform the dispense operation, while the regular Dispense Mode always maintains a full chamber upon loading.

The range of the Dispense Volume is dependent on pump size and Actuator Module, but is typically a minimum of 0.01% of the pump chamber volume up to a maximum of the full chamber volume.

3.3.1.3 Dispense Multichamber

Dispense Multichamber allows for dispense volumes up to ten times the pump chamber volume. When the dispense volume exceeds the pump chamber volume, reload cycle automatically occurs between the discharges of the chamber. Thus, fluid flow is not continuous when the dispense volume is greater than the chamber volume.

Due to the multichamber capability of this mode, Drawback is not available.

3.3.1.4 Meter

Meter Mode allows for variable fluid movement. The beginning and ending of the fluid movement may be initiated by either the front panel start-stop buttons, RS232 commands or Logic I/O signals. However, the most precise control of the start and stop of metering is via the Logic I/O signals.

Once initiated, fluid movement will dispense until stopped. If Drawback is enabled, it will be performed upon the stopping of the dispense.

If the dispense is not stopped, and the end of the chamber is reached, the dispense will terminate followed by drawback, if enabled. This means that a metered dispense may only occur up to volumes of a pump chamber volume

If the dispense is stopped before the end of the chamber is reached, another metered dispense may be initiated, as long as the volume dispensed is less than the Load Threshold.

3.3.1.5 Meter Multichamber

Meter Multichamber is the same as Meter without the volume being restricted to a single chamber. Once initiated, a metered dispense will occur until the end of the chamber is reached; at which time a reload will automatically occurred, followed by another dispense. This will continue until stopped.

Due to the multichamber capability of this mode, Drawback is not available. Since a Meter Multichamber operation does not use a load threshold, LOAD MODE = EMPTY behaves like Manual in this mode.

3.3.1.6 Extra Production Mode Settings

Load Mode - There are three Load Modes available: Manual, Empty, and Every. The configured Load Mode determines when a Load is required, and whether a Load automatically occurs at the end of a Production Mode operation.

NOTE

Load Mode does not affect the load portion of a multichamber operation.

Manual mode disables all automatic loading of the pump chamber. If there is not enough fluid in the pump chamber to perform the next Production Mode operation, or the Load Threshold is met, a manual initiation of a Load will be required before the next Production Mode operation may begin. This may be through the front panel, Logic I/O or serial interfaces.

Empty mode causes an automatic loading of the pump chamber when there is not enough fluid in the pump chamber to perform the next Production Mode operation or the Load Threshold is met. The loading will only automatically initiate at the end of a Production Mode operation. If any other condition results in an insufficient pump chamber volume (for example, Fluidic Setup Mode operation, or a changing of the Dispense Volume), a Load will be required before the next Production Mode operation, but will not be automatically initiated. In this case, a manual initiation is required.

Every mode causes an automatic loading of the pump chamber after every Production Mode operation. The loading will only automatically initiate at the end of a Production Mode operation (i.e., it will not initiate at the end of a Fluidic Setup Mode operation, or if a parameter changes). In Every mode, the pump must have a full chamber before a Production Mode operation is allowed. If any other condition results in a non-full pump chamber volume (for example, Fluidic Setup Mode operation, or a changing of the Dispense Volume), a Load will be required before the next Production Mode operation, but will not be automatically initiated. In this case, a manual initiation is required.

Auto Retrigger - Auto Retrigger provides the capability to have the Controller Module automatically repeat the initiation of one of the three Dispense Mode operations (ignored by Meter Modes or Fluidic Setup Modes). This is useful for applications such as filling X by Y matrix wells manually.

There are two Auto Retrigger modes available: Count and Infinite. Count provides the ability to auto retrigger a fixed number of dispense operations as determined by the Auto Retrigger Count parameter. The Auto Retrigger Count variable should be set to the desired number of total Dispense operations. The first Dispense operation must be manually triggered. At the end of the first Dispense operation, a configurable Auto Retrigger Dwell time will cause the unit to remain in idle until the period expires. Upon the expiration of the Auto Retrigger Dwell timer, another Dispense operation will be automatically initiated. This process will repeat until the Auto Retrigger Count number of operations have occurred. If using in an X by Y matrix application, the Auto Retrigger Count should be set to the value of X times Y (i.e., the total number of wells in the matrix).

The Infinite setting provides the same feature, but the Auto Retrigger Count setting is ignored and the unit will continue the Auto Retrigger sequence until stopped.

Both Auto Retrigger Modes will stop prematurely if the unit is not configured to automatically reload either before or upon a Load being required. Configuring the Load mode to either Empty or Every will ensure a Load is generated so the Auto Retriggering may continue. Alternatively, the Autoreload Count parameter may be set to cause a Load to occur after a fixed number of dispenses. This is especially useful in X by Y matrix well applications in which the amount of fluid in the pump chamber is more than enough to fill a row of the matrix. By setting the Autoreload Count to the number of columns (Y), a reload will occur automatically at the end of each row as the tip is moving from the end of the row back to the beginning.

Operation Dwells - The Pre-op Dwell and Post-op Dwell provide a delay before and after a Production Mode operation (does not affect Fluidic Setup Mode operations). This is typically used to provide a delay between the activation/deactivation of a logic output signal and the actual pump movement. A typical application for this is when the Auxiliary Output is used to gate the power of auxiliary equipment such as an ultrasonic atomization nozzle. The delay provides enough time for the nozzle to become active before the fluid movement occurs, and enough time for the fluid movement to cease before the nozzle deactivates.

3.3.2 Fluidic Setup Mode

Fluidic Setup Modes are intended to prepare the fluidic system for Production Mode operations. There are three Fluidic Setup Modes: Prime, Bubble Clear, and Agitate. While only one mode is available at a time, quick transition between Fluidic Setup Modes may be achieved using recipes.

3.3.2.1 Prime Mode

Prime Mode is the most typically used Fluidic Setup Mode and is used to prime the fluidic tubing and components from the reservoir through to the tip before Production Mode operation. It is also often used in the Reverse Direction to remove the fluid from the fluidic system after Production Mode operations are completed.

The amount of fluid moved is configured by the Prime Volume parameter. The range of the Prime Volume is dependent on the pump size and Actuator Module, but is typically 0.01% to 1000 times the pump chamber volume. Once initiated, the Prime operation will move the desired amount of fluid through the system unless stopped early.

NOTE

It is recommended to perform a "Waste" operation in the desired Production Mode after a Prime operation in order to properly setup the fluid for repeatable Dispenses.

3.3.2.2 Bubble Clear Mode

Bubble Clear Mode is useful for attempting to clear bubbles from the pump chamber. It consists of a sequence of dispensing the fluid out of the chamber through the Active Port, followed by creating a vacuum inside the chamber, followed by a dwell at the Inactive Port, followed by a dispensing of the chamber.

The vacuum is created by moving the piston out of the pump chamber while the valve is located between the two ports. After moving back, the valve rotates to the Inactive Port, which allows fluid to flow into the port. Due to the vacuum, extra turbulence is created as the fluid moves into the port. This helps dislodge and break up air bubbles inside of the pump chamber.

NOTE

Due to the decreased pressure inside of the chamber, air will often cavitate out of the fluid resulting in an additional bubble. Therefore, it is possible to actually generate bubbles even when bubbles don't already exist. Therefore positive results are not always attained.

3.3.2.3 Agitate Mode

Agitate Mode is useful for keeping fluid moving during extended periods of idleness of the fluidic system. Fluids containing suspended particles may benefit from the constant fluid movement offered by the Agitate Mode.

The Agitate operation consists of three portions: Isolation, Agitating, Return.

Isolation provides the ability to move the fluid away from the discharge tip before Agitating the fluid. The recommended range of the Isolation Volume is >1 to 1000 times the pump chamber volume.

The Agitation portion consists of four components: Reverse, Dwell, Forward, Dwell. Agitation is a repeating of the sequence Reverse, Dwell, Forward, Dwell; until stopped. During Reverse, a volume of fluid, as configured by the Agitation Volume, is moved in the Reverse direction, followed by a dwell (relative to a Forward Dispense/Meter). The direction changes and the Agitate Volume is moved back in the Forward direction. The sequence of Reverse, Dwell, Forward, Dwell then repeats until stopped.

Once stopped, the Return portion is automatically initiated. The Return portion simply moves the fluid back to the starting position. Once the starting position is reached, the pump chamber is loaded full of fluid in preparation for the next Production Mode operation.

NOTE

It is recommended to perform one or more "Waste" operations in the desired Production Mode after an Agitate operation in order to properly setup the fluid for repeatable Dispenses.

3.3.3 Port Parking (PARK PORT)

Parking the port causes the piston to rotate to the port park position so the natural fluid flow (e.g., due to gravity) is inhibited. Also, operations other than referencing and port changes are inhibited while the port is in the Park Position.

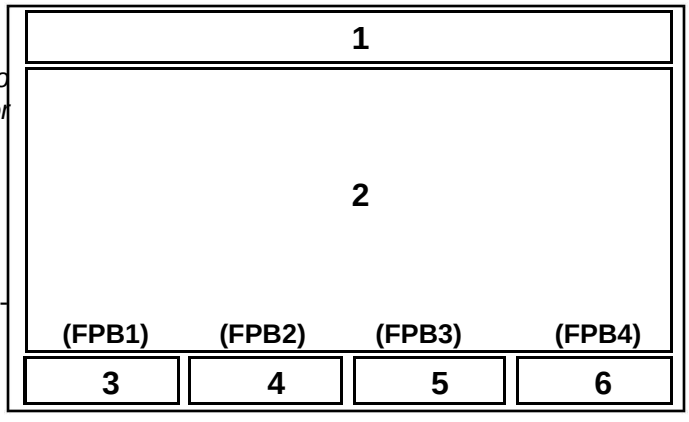
3.3.4 Display

The display provides an operator interface to all operating parameters in the Controller Module. New values can be entered and current values displayed for all the functions of the system. The current operating mode and system status are shown on the display. The display contains multiple interface screens each providing information to the operator.

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

NOTE

References to push-buttons for fields 3 through 6 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. These are referred to as Function Push-Buttons 1 through 4 (FPB1 - FPB4).



Field 1 - This field displays screen name and status information.

Field 2 - This field displays all the operating parameters.

Fields 3 through 6 (Function Push-Buttons 1 - 4) - These fields provide function legends for the four function push-buttons directly below the screen.

NOTE

A legend does not appear if the function is not permitted due to permission levels (section 3.3.6) or the value of the Serial Interface "k1" command (Table 3.3).

3.3.5 Help

Help is available when selecting or entering new values by pressing the FPB1 push-button. Information pertaining to the selected value will be displayed. Press the FPB1 key again to clear the help information from the screen.

3.3.6 Permission Levels

There are three levels of permission; Operator, I/O Test and Supervisor. Each level allows access to selected items on the display.

The permission level can be changed in the Change Permission screen (Section 3.3.8.19).

The highest level is **Supervisor**. This level allows access to all items on all screens. The **I/O Test** level allows access to the same items as the Operator except it also allows access to the I/O Test screen. The **Operator** level does not allow changing system parameters and is the typical use setting. Recipes can be selected and loaded, but not changed. See serial interface 'k1' command for additional restrictions.

3.3.7 Recipes

A recipe is a collection of the operating parameters required to operate the system. The operating parameters include volume, rate, direction and drawback. For each recipe, the parameters are stored in the recipe database.

The following is a list of configurable parameters that are NOT saved in a recipe (though they are saved at power-down). Every other configurable parameter is saved in a recipe.

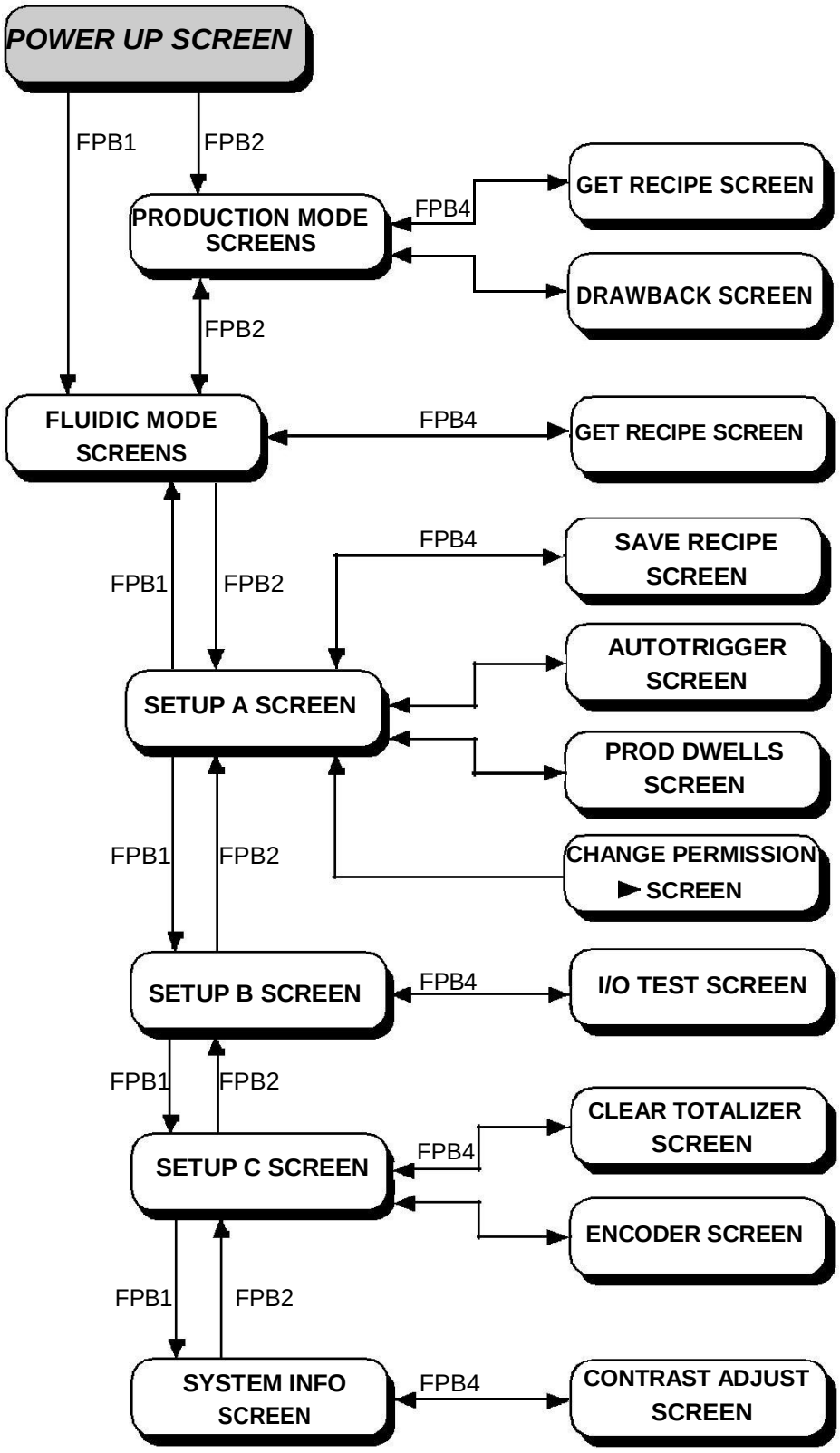
Pump	Permission at Power-up
Encoder	Passwords
Encoder Lines	Contrast
Permission	Pump 90 Degree Offset

3.3.8 Screens

There are twenty nine screens used to setup, operate and exit the system. Sections 3.3.8.1 through 3.3.8.27 provide an image of the screen, the permission level access and a brief description of each parameter. For ease of use the screen will always be on the left and the description will always be on the right when the two pages are viewed together.

The following alphabetical list provides a brief description of each screen and figure 3.5 shows the setup and overall mode screen navigation.

Screen	Description
Agitate	Displays volume agitated, recipe # and pump size. Allows changing volume, discharge rate, intake rate, agitate dwell time and isolation volume.
Auto Trig	Allows changing auto retrigger, auto dwell time, dispense count and reload count.
Bubble Clear	Displays recipe # and pump size. Allows changing the discharge rate, intake rate and intake dwell time.
Change Password	Allows changing the password.
Change Permission	Allows changing the Permission level.
Clear Totalizer	Clears the total volume and total cycles counters.
Contrast Adjust	Allows changing the screen contrast. (not available on all units)
Dispense	Displays total volume, total cycles, recipe # and pump size. Allows changing direction, dispense volume, dispense rate, load rate, load threashold and drawback settings.
Dispense MCV	Displays total volume, total cycles, recipe # and pump size. Allows changing direction, dispense volume, dispense rate, load rate, MCV conserve fluid and drawback settings.
Dispense Mult	Displays total volume, total cycles, recipe # and pump size. Allows changing direction, dispense volume, dispense rate, load rate and load threashold.
Drawback	Allows changing drawback volume, drawback rate and drawback dwell.
Encoder	Allows changing encoder and encoder lines.
Enter New Password	Used for changing an existing password.
Enter New Value	Used for entering a numerical value.
Fault	Displays the current fault.
I/O Test	Displays trigger in, input 2, CC trig in, input 3, input 4 and RS232. Allows changing ready out, fault out, config 3 out, config 4 out and auxiliary out.
Meter	Displays total volume, total cycles, recipe # and pump size. Allows changing direction, dispense rate, load rate, load threashold and drawback settings.
Meter Mult	Displays total volume, total cycles, recipe # and pump size. Allows changing direction, dispense rate and load rate.
Prime	Displays volume primed, recipe # and pump size. Allows changing direction, volume, discharge rate and intake rate.
Power Up	Displays the current recipe number and pump size.
Prod Dwells	Allows changing pre-op dwell and post-op dwell.
Recipe	Used for saving a new recipe or retrieving an existing recipe.
Reset Parameters Warnings	Erases all recipes and resets passwords.
Select New Value	Used for selecting a new value from a list.
Setup A	Displays recipe # and pump size. Allows changing production mode, fluidic setup mode, load mode, auto retrigger, production dwells, power-up permission and currentpermission.
Setup B	Displays output 2, input CC and input 1. Allows changing auxiliary output, ready output config, output 3 config, output 4 config, input 2 config, input 3 config and input 4 config.
Setup C	Displays pump chamber volume. Allows changing pump size, encoder, pump 90 degree offset, active port, valving speed, torque and acceleration.
System Info	Displays firmware version, firmware CRC, serial number, asserts SW, Assert SW code, asserts HW, asserts HW code.
Warning Recipe Exists	Appears when you try to save a recipe using a previously used number.



FPB = Function Push-Button

FPB1 traverses up the "Screen Ladder"

FPB2 traverses down the "Screen Ladder"

FPB3 has multiple functions depending on the screen and operating state of the controller.

FPB4 goes to parallel screens.

Figure 3.5 Mode & Setup Screen Navigation

3.3.8.1 Power Up Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

	Supervisor	I/O Test	Operator
----- Displays the Controller Module Status.....	D	D	D
----- Displays the current recipe.....	D	D	D
----- Displays the pump size	D	D	D
The following screens are accessible from this screen based on the system status.			
Agitate.....	P	P	P
Bubble Clr.....	P	P	P
Contrast Adjust	P	P	P
Dispense	P	P	P
Fault.....	P	P	P
Meter.....	P	P	P
Prime.....	P	P	P
Setup A	P	P	P
Setup C	P	P	P

```
0 DIGISPENSE 3020                    <— status —>

2
3
4                  IVEK CORPORATION
5                  http://www.ivek.com
6
7            RECIPE   =   ##
8              PUMP   =   ####
9
10
11
12 Press function button below to proceed
13
if prime mode and dispense mode
14       PRIME       DISPENSE                    CONTRAST
15      SCREEN       SCREEN                      ADJUST

OR if agitate mode and dispense mode
14      AGITATE      DISPENSE                    CONTRAST
15      SCREEN       SCREEN                      ADJUST

OR if bubble clear mode and dispense mode
14   BUBBLE CLR      DISPENSE                    CONTRAST
15      SCREEN       SCREEN                      ADJUST

OR if disabled fluidic setup mode and dispense mode
14                   DISPENSE                    CONTRAST
15                   SCREEN                      ADJUST

OR if prime mode and meter mode
14       PRIME        METER                      CONTRAST
15      SCREEN       SCREEN                      ADJUST

OR if prime mode and disabled production mode
14       PRIME                                   CONTRAST
15      SCREEN                                   ADJUST

OR if disabled fluidic setup mode and disabled production
mode
14      SETUP A                                  CONTRAST
15      SCREEN                                   ADJUST

OR if NO actuator/pump selected
14       PRIME       DISPENSE      SETUP C       CONTRAST
15      SCREEN       SCREEN        SCREEN        ADJUST

OR if actuator/pump selected and reference required
14       PRIME       DISPENSE     REFERENCE      CONTRAST
15      SCREEN       SCREEN       REQUIRED       ADJUST

if-faulted
14                                  FAULT        CONTRAST
15                                  SCREEN       ADJUST
```

Power Up Screen Description - The Power Up screen displays the recipe and pump information. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional while this screen is visible.

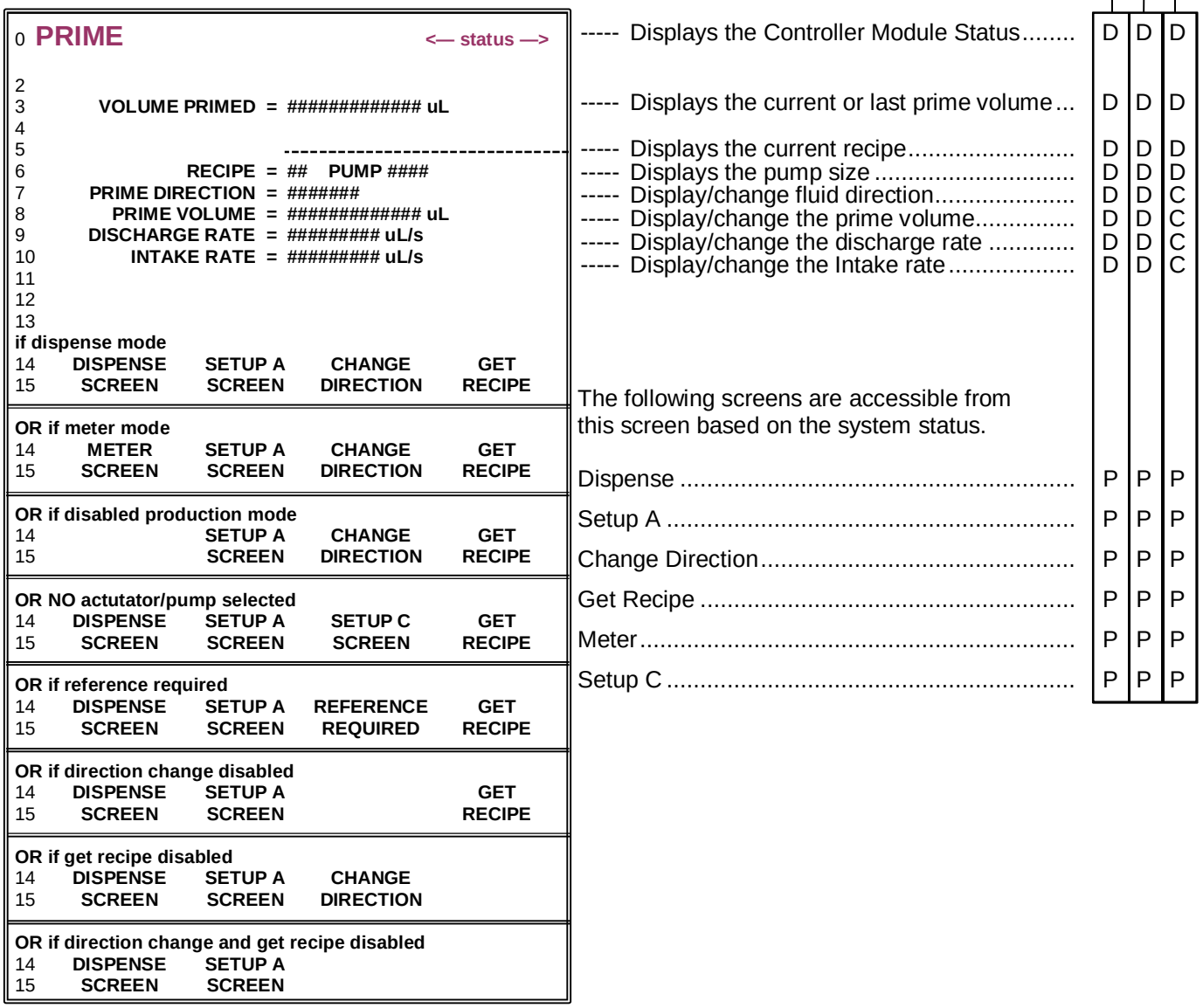
Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

3.3.8.2 Prime Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable



	Supervisor	I/O Test	Operator
----- Displays the Controller Module Status.....	D	D	D
----- Displays the current or last prime volume...	D	D	D
----- Displays the current recipe.....	D	D	D
----- Displays the pump size	D	D	D
----- Display/change fluid direction.....	D	D	C
----- Display/change the prime volume.....	D	D	C
----- Display/change the discharge rate	D	D	C
----- Display/change the Intake rate	D	D	C
The following screens are accessible from this screen based on the system status.			
Dispense	P	P	P
Setup A	P	P	P
Change Direction.....	P	P	P
Get Recipe	P	P	P
Meter.....	P	P	P
Setup C	P	P	P

Prime Screen Description - The Prime screen displays the current Priming parameters and allows control of priming operations. A user with Supervisor permission is able to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Priming operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Volume Primed - The Volume Primed line shows the total volume dispensed during the current or last priming operation. This resets to zero at the start of a Priming operation.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Prime Direction - The Prime Direction is the direction of fluid flow through the Pump Module in Prime mode. The direction is either Forward or Reverse. Forward is typically used to fill the tubing and pump with fluid. Reverse is typically used to remove fluid from the tubing and pump.

Prime Volume - The Prime Volume is the amount of fluid to move through the pump and tubing during a prime cycle. Typically, this should be set to a volume greater than or equal to the volume of the pump and tubing. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the minimum volume for the selected pump size. Priming may be terminated early by pressing the Stop push-button.

Discharge Rate - The Discharge Rate is the rate of the fluid movement in micro liters per second during the dispense portion of a prime cycle. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Intake Rate - The Intake Rate is the rate of the fluid movement during the load portion of the prime cycle in micro liters per second. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

To change a value;

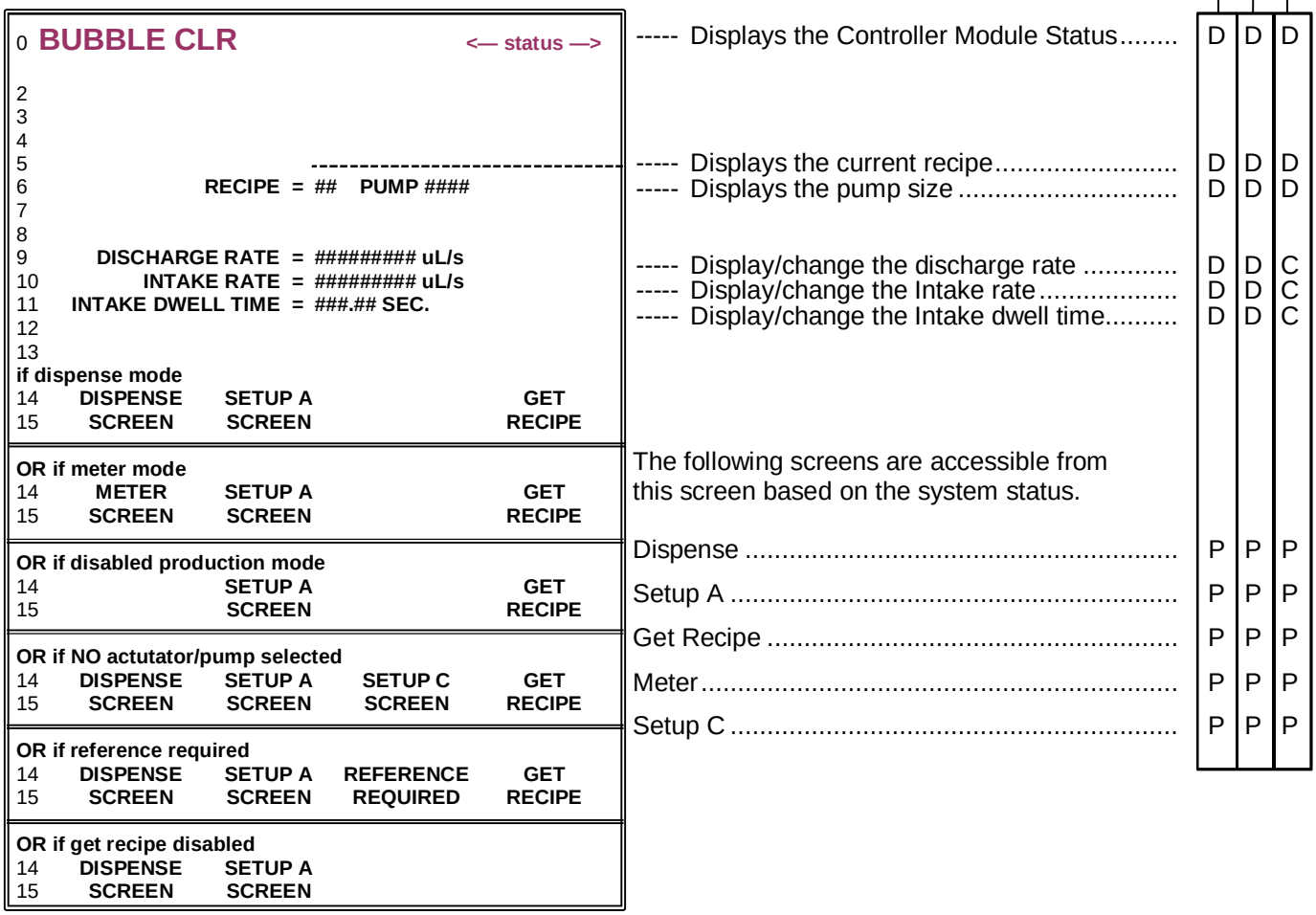
1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

Prime Mode Minimum/Maximum Chart

Pump Size	Minimum Volume µl	Maximum Volume µl	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.002	20,000	0.010	40
3A	0.005	50,000	0.025	100
2A	0.01	100,000	0.05	200
1A	0.02	200,000	0.10	400
B	0.04	400,000	0.20	800
C	0.10	1,000,000	0.50	2000
D	0.20	2,000,000	1.00	4000

3.3.8.3 Bubble Clear Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable



Bubble Clear Screen Description - The Bubble Clear screen displays the current Bubble Clear parameters and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Bubble Clear operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Discharge Rate - The Discharge Rate is the rate of the pump in micro liters per second during a bubble clear operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Intake Rate - The Intake Rate is the rate the pump will operate during the intake portion of the bubble clear operation in micro liters per second. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Intake Dwell Time - The Intake Dwell Time is the time the valve will dwell at the intake port after a vacuum is created in seconds. The range is 0.00 sec to 2.55 sec with an increment value of 0.01.

Bubble Clear Mode Minimum/ Maximum Chart

Pump Size	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.010	40
3A	0.025	100
2A	0.05	200
1A	0.10	400
B	0.20	800
C	0.50	2000
D	1.00	4000

3.3.8.4 Agitate Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

```
0 AGITATE                                  <— status —>

2
3       VOLUME AGITATED  =  ############ uL
4
5                           ------------------------------
6                  RECIPE  =  ##    PUMP ####
7
8          AGITATE VOLUME  =  ############ uL
9          DISCHARGE RATE  =  ######### uL/s
10              INTAKE RATE  =  ######### uL/s
11           AGITATE DWELL  =  ###.## SEC.
12       ISOLATION VOLUME  =  ############ uL
13
if dispense mode
14      DISPENSE      SETUP A                          GET
15       SCREEN       SCREEN                         RECIPE

OR if meter mode
14        METER       SETUP A                          GET
15       SCREEN       SCREEN                         RECIPE

OR if disabled production mode
14                     SETUP A                          GET
15                     SCREEN                         RECIPE

OR if NO actutator/pump selected
14      DISPENSE      SETUP A       SETUP C            GET
15       SCREEN       SCREEN        SCREEN           RECIPE

OR if reference required
14      DISPENSE      SETUP A     REFERENCE          GET
15       SCREEN       SCREEN      REQUIRED         RECIPE

OR if get recipe disabled
14      DISPENSE      SETUP A
15       SCREEN       SCREEN
```

	Supervisor	I/O Test	Operator
----- Displays the Controller Module Status.....	D	D	D
----- Displays the agitated volume.....	D	D	D
----- Displays the current recipe.....	D	D	D
----- Displays the pump size	D	D	D
----- Display/change the agitate volume.....	D	D	C
----- Display/change the discharge rate	D	D	C
----- Display/change the Intake rate.....	D	D	C
----- Display/change the agitate dwell	D	D	C
----- Display/change the isolation volume.....	D	D	C
The following screens are accessible from this screen based on the system status.			
Dispense	P	P	P
Setup A	P	P	P
Get Recipe	P	P	P
Meter.....	P	P	P
Setup C	P	P	P

Agitate Screen Description - The Agitate screen displays the current Agitate parameters and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Agitate operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Volume Agitated - The Volume Agitated line shows the total volume of fluid isolated and agitated during an agitation operation.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Agitate Volume - The Agitate Volume is the amount of fluid to agitate in micro liters during an agitate cycle. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the minimum volume for the selected pump size.

Discharge Rate - The Discharge Rate is the rate of the pump in micro liters per second during the dispense/aspirate portion of the agitate cycle. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Intake Rate - The Intake Rate is the rate the pump will operate during the load portion of an agitate cycle in micro liters per second. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Agitate Dwell - The Agitate Dwell is the time between the forward and reverse cycles in seconds. The range is 0.00 sec to 2.55 sec with an increment value of 0.01.

Isolation Volume - The Isolation Volume is the amount of liquid isolated prior to the agitate cycle in micro liters. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

Agitate Mode Minimum/Maximum Chart

Pump Size	Minimum Volume µl	Maximum Volume µl	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.002	20,000	0.010	40
3A	0.005	50,000	0.025	100
2A	0.01	100,000	0.05	200
1A	0.02	200,000	0.10	400
B	0.04	400,000	0.20	800
C	0.10	1,000,000	0.50	2000
D	0.20	2,000,000	1.00	4000

3.3.8.5 Dispense Screen

D = Display C = Display/Change P = Push-button Accessible N = Not Accessible/Viewable

```
0 DISPENSE                                  <— status —>

2
3          TOTAL VOLUME = ################ uL
43         TOTAL CYCLES = ##########
5                         ------------------------------
6                RECIPE = ##   PUMP ####
7             DIRECTION = #######
8      DISPENSE VOLUME = ############ uL
9  DISPENSE/METER RATE = ######### uL/s
10           LOAD RATE = ######### uL /s
11   LOAD THREASHOLD = ######### uL
12           DRAWBACK = DISABLED
13
if prime mode and chamber full
14      PRIME       SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if agitate mode and chamber full
14      AGITATE     SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if bubble clear mode and chamber full
14    BUBBLE CLR    SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if disabled fluidic setup mode and chamber full
14                  SETUP A       PARK          GET
15                  SCREEN        PORT          RECIPE

OR if NO actuator/pump selected
14      PRIME       SETUP A       SETUP C       GET
15      SCREEN      SCREEN        SCREEN        RECIPE

OR if reference required
14      PRIME       SETUP A     REFERENCE       GET
15      SCREEN      SCREEN      REQUIRED        RECIPE

OR if load required
14      PRIME       SETUP A       LOAD          GET
15      SCREEN      SCREEN      REQUIRED        RECIPE

OR if chamber not full and load possible
14      PRIME       SETUP A       LOAD          GET
15      SCREEN      SCREEN                      RECIPE

OR if get recipe disabled and chamber full
14      PRIME       SETUP A       PARK
15      SCREEN      SCREEN        PORT
```

	Supervisor	I/O Test	Operator
----- Displays the Controller Module Status.....	D	D	D
----- Displays the total volume dispensed.....	D	D	D
----- Displays the total number of cycles	D	D	D
----- Displays the current recipe.....	D	D	D
----- Displays the pump size	D	D	D
----- Display/change fluid direction.....	D	D	C
----- Display/change the dispense volume	D	D	C
----- Display/change the dispense/meter rate.....	D	D	C
----- Display/change the load rate.....	D	D	C
----- Display/change the load threashold.....	D	D	C
----- Switches to the drawback screen	P	P	P
The following screens are accessible from this screen based on the system status.			
Prime.....	P	P	P
Setup A	P	P	P
Get Recipe	P	P	P
Agitate.....	P	P	P
Bubble Clr.....	P	P	P
Setup C	P	P	P

Dispense Screen Description - The Dispense screen displays the current Dispense parameters and provides control of the dispense operations. A user with Supervisor permission is able to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Dispensing operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Total Volume - Total Volume is the total amount of liquid dispensed in Dispense and Meter Modes. The total volume counter will roll over after the maximum value is reached. The counter can be reset to 0 using the Clear Totalizer screen.

Total Cycles - Total Cycles is the total number of dispenses in Dispense and Meter modes. The total cycles counter will go up to a maximum of 3,999,999,999 before restarting at 0. The counter can be reset to 0 using the Clear Totalizer screen.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Direction - The Direction is the direction of liquid flow through the Pump Module for Dispense and Meter modes. The direction is either Forward or Reverse.

Dispense Volume - The Dispense Volume is the amount of liquid dispensed in micro liters during a dispense cycle. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the minimum volume for the selected pump size.

Dispense/Meter Rate - The Dispense/Meter Rate is the rate of the pump in micro liters per second during the dispense operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Rate - The Load Rate is the rate the pump will operate during a load operation in micro liters per second. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Threshold - A load will be required/initiated when the volume dispensed is greater than or equal to this volume.

Drawback - Refer to Section 3.3.8.13.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

Dispense Mode Minimum/Maximum Chart

Pump Size	Minimum Volume µl	Maximum Volume µl	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.002	20	0.010	40
3A	0.005	50	0.025	100
2A	0.01	100	0.05	200
1A	0.02	200	0.10	400
B	0.04	400	0.20	800
C	0.10	1000	0.50	2000
D	0.20	2000	1.00	4000

3.3.8.6 Dispense Mult Screen

D = Display **P = Push-button Accessible**
C = Display/Change **N = Not Accessible/Viewable**

```
0  DISPENSE MULT                         <— status —>

2
3            TOTAL VOLUME  =  ################ uL
43           TOTAL CYCLES  =  ##########
5                             -------------------------------
6                  RECIPE  =  ##    PUMP ####
7               DIRECTION  =  #######
8         DISPENSE VOLUME  =  ############# uL
9   DISPENSE/METER RATE    =  ######### uL/s
10              LOAD RATE  =  ######### uL /s
11        LOAD THREASHOLD  =  ######### uL
12
13
if prime mode and chamber full
14     PRIME      SETUP A     PARK       GET
15     SCREEN     SCREEN      PORT       RECIPE
```

```
OR if agitate mode and chamber full
14     AGITATE    SETUP A     PARK       GET
15     SCREEN     SCREEN      PORT       RECIPE
```

```
OR if bubble clear mode and chamber full
14     BUBBLE CLR SETUP A     PARK       GET
15     SCREEN     SCREEN      PORT       RECIPE
```

```
OR if disabled fluidic setup mode and chamber full
14                SETUP A     PARK       GET
15                SCREEN      PORT       RECIPE
```

```
OR if NO actuator/pump selected
14     PRIME      SETUP A     SETUP C    GET
15     SCREEN     SCREEN      SCREEN     RECIPE
```

```
OR if reference required
14     PRIME      SETUP A     REFERENCE  GET
15     SCREEN     SCREEN      REQUIRED   RECIPE
```

```
OR if load required
14     PRIME      SETUP A     LOAD       GET
15     SCREEN     SCREEN      REQUIRED   RECIPE
```

```
OR if get recipe disabled and chamber full
14     PRIME      SETUP A     PARK
15     SCREEN     SCREEN      PORT
```

	Operator	I/O Test	Supervisor
----- Displays the Controller Module Status........	D	D	D
----- Displays the total volume dispensed...........	D	D	D
----- Displays the total number of cycles	D	D	D
----- Displays the current recipe........................	D	D	D
----- Displays the pump size	D	D	D
----- Display/change fluid direction.....................	D	D	C
----- Display/change the dispense volume	D	D	C
----- Display/change the dispense/meter rate.....	D	D	C
----- Display/change the load rate......................	D	D	C
----- Display/change the load threashold............	D	D	C

The following screens are accessible from this screen based on the system status.

	Operator	I/O Test	Supervisor
Prime..	P	P	P
Setup A	P	P	P
Get Recipe	P	P	P
Agitate..	P	P	P
Bubble Clr..	P	P	P
Setup C	P	P	P

Dispense Mult Screen Description - The Dispense Mult (Multichamber) screen displays the current Dispense parameters and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Dispensing operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Total Volume - Total Volume is the total amount of liquid dispensed in Dispense and Meter Modes. The total volume counter will roll over after the maximum value is reached. The counter can be reset to 0 using the Clear Totalizer screen.

Total Cycles - Total Cycles is the total number of dispenses in Dispense and Meter modes. The total cycles counter will go up to a maximum of 3,999,999,999 before restarting at 0. The counter can be reset to 0 using the Clear Totalizer screen.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Direction - The Direction is the direction of liquid flow through the Pump Module for Dispense and Meter modes. The direction is either Forward or Reverse.

Dispense Volume - The Dispense Volume is the amount of liquid dispensed in micro liters during a dispense cycle. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the minimum volume for the selected pump size.

Dispense/Meter Rate - The Dispense/Meter Rate is the rate of the pump in micro liters per second during the dispense portion of a dispense operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Rate - The Load Rate is the rate the pump will operate during the reload portion of a dispense multichamber cycle in micro liters per second as well as during load operation. The range is based on the pump size as shown in the Pump Minimum/ Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Threshold - A load will be required/initiated when the volume dispensed is greater than or equal to this volume.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

Dispense Multichamber Mode Minimum/Maximum Chart

Pump Size	Minimum Volume µl	Maximum Volume µl	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.002	200	0.010	40
3A	0.005	500	0.025	100
2A	0.01	1000	0.05	200
1A	0.02	2000	0.10	400
B	0.04	4000	0.20	800
C	0.10	10000	0.50	2000
D	0.20	20000	1.00	4000

3.3.8.7 Dispense MCV Screen

D = Display C = Display/Change P = Push-button Accessible N = Not Accessible/Viewable

```
0 DISP MCV                                  <— status —>

2
3          TOTAL VOLUME  = ################ uL
43         TOTAL CYCLES  = ##########
5                          ----------------------------
6                RECIPE  = ##    PUMP ####
7             DIRECTION  = #######
8      DISPENSE VOLUME   = ############ uL
9  DISPENSE/METER RATE   = ######### uL/s
10            LOAD RATE  = ######### uL /s
11 MCV CONSERVE FLUID    = #######
12            DRAWBACK   = ########
13
if prime mode and chamber at MCV start position
14      PRIME       SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if agitate mode and chamber at MCV start position
14      AGITATE     SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if bubble clear mode and chamber at MCV start position
14   BUBBLE CLR     SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if disabled fluidic setup mode and chamber at MCV
start position
14                  SETUP A       PARK          GET
15                  SCREEN        PORT          RECIPE

OR if NO actuator/pump selected
14      PRIME       SETUP A       SETUP C       GET
15      SCREEN      SCREEN        SCREEN        RECIPE

OR if reference required
14      PRIME       SETUP A       REFERENCE     GET
15      SCREEN      SCREEN        REQUIRED      RECIPE

OR if load required
14      PRIME       SETUP A       LOAD          GET
15      SCREEN      SCREEN        REQUIRED      RECIPE

OR if get recipe disabled and chamber full
14      PRIME       SETUP A       PARK
15      SCREEN      SCREEN        PORT
```

		Supervisor	I/O Test	Operator
-----	Displays the Controller Module Status.....	D	D	D
-----	Displays the total volume dispensed.....	D	D	D
-----	Displays the total number of cycles	D	D	D
-----	Displays the current recipe.....	D	D	D
-----	Displays the pump size	D	D	D
-----	Display/change fluid direction.....	D	D	C
-----	Display/change the Dispense volume.....	D	D	C
-----	Display/change the Dispense/meter rate	D	D	C
-----	Display/change the load rate.....	D	D	C
-----	Display/change the fluid conserve option....	D	D	C
-----	Switches to the drawback screen	P	P	P
	The following screens are accessible from this screen based on the system status.			
	Prime.....	P	P	P
	Setup A	P	P	P
	Get Recipe	P	P	P
	Agitate.....	P	P	P
	Bubble Clr.....	P	P	P

Dispense MCV Screen Description - The Dispense MCV screen displays the current dispense parameters and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Dispensing operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Total Volume - Total Volume is the total amount of liquid dispensed in Dispense and Meter Modes. The total volume counter will roll over after the maximum value is reached. The counter can be reset to 0 using the Clear Totalizer screen.

Total Cycles - Total Cycles is the total number of dispenses in Dispense and Meter modes. The total cycles counter will go up to a maximum of 3,999,999,999 before restarting at 0. The counter can be reset to 0 using the Clear Totalizer screen.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Direction - The Direction is the direction of liquid flow through the Pump Module for Dispense and Meter modes. The direction is either Forward or Reverse.

Dispense Volume - The Dispense Volume is the amount of liquid dispensed in micro liters during a dispense operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum volume for the selected pump size.

Dispense/Meter Rate - The Dispense Rate is the rate of the pump in micro liters per second during the dispense operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Rate - The Load Rate is the rate the pump will operate during a load operation in micro liters per second. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the minimum rate for the selected pump size.

MCV Conserve Fluid - MCV Conserve Fluid determines the fluid direction after a reference while moving to the MCV starting position. The selections are either Disabled (towards the tip) or Enabled (towards the reservoir).

NOTE

Setting MCV Conserve Fluid to enable conserves fluid by pushing extra fluid back to the reservoir. This may contaminate the reservoir or cause problems with a pressurized reservoir.

Dispense MCV Minimum/Maximum Chart

Pump Size	Minimum Volume µl	Maximum Volume µl	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.002	200	0.010	40
3A	0.005	500	0.025	100
2A	0.01	1000	0.05	200
1A	0.02	2000	0.10	400
B	0.04	4000	0.20	800
C	0.10	10000	0.50	2000
D	0.20	20000	1.00	4000

Drawback - Refer to section 3.3.8.13.
To change a value;
1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

3.3.8.8 Meter Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

```
0 METER                                  <— status —>

2
3          TOTAL VOLUME = ################ uL
4          TOTAL CYCLES = ##########
5                         ------------------------------
6                RECIPE = ##   PUMP ####
7             DIRECTION = #######
8
9  DISPENSE/METER RATE = ######### uL/s
10             LOAD RATE = ######### uL /s
11     LOAD THREASHOLD = ######### uL
12             DRAWBACK = DISABLED
13
if prime mode and chamber full
14      PRIME       SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if agitate mode and chamber full
14      AGITATE     SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if bubble clear mode and chamber full
14    BUBBLE CLR    SETUP A       PARK          GET
15      SCREEN      SCREEN        PORT          RECIPE

OR if disabled fluidic setup mode and chamber full
14                  SETUP A       PARK          GET
15                  SCREEN        PORT          RECIPE

OR if NO actuator/pump selected
14      PRIME       SETUP A       SETUP C       GET
15      SCREEN      SCREEN        SCREEN        RECIPE

OR if reference required
14      PRIME       SETUP A     REFERENCE       GET
15      SCREEN      SCREEN      REQUIRED        RECIPE

OR if load required
14      PRIME       SETUP A       LOAD          GET
15      SCREEN      SCREEN      REQUIRED        RECIPE

OR if chamber not full and load possible
14      PRIME       SETUP A       LOAD          GET
15      SCREEN      SCREEN                      RECIPE

OR if get recipe disabled and chamber full
14      PRIME       SETUP A       PARK
15      SCREEN      SCREEN        PORT
```

	Supervisor	I/O Test	Operator
----- Displays the Controller Module Status.....	D	D	D
----- Displays the total volume dispensed.....	D	D	D
----- Displays the total number of cycles	D	D	C
----- Displays the current recipe.....	D	D	D
----- Displays the pump size	D	D	D
----- Display/change fluid direction.....	D	D	C
----- Display/change the dispense/meter rate.....	D	D	C
----- Display/change the load rate.....	D	D	C
----- Display/change the load threashold.....	D	D	C
----- Switches to the drawback screen	P	P	P
The following screens are accessible from this screen based on the system status.			
Prime.....	P	P	P
Setup A	P	P	P
Get Recipe	P	P	P
Agitate.....	P	P	P
Bubble Clr.....	P	P	P

Meter Screen Description - The Meter screen displays the current Metering parameters and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown. The Start and Stop push-buttons control Metering operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Total Volume - Total Volume is the total amount of liquid dispensed in Dispense and Meter Modes. The total volume counter will roll over after the maximum value is reached. The counter can be reset to 0 using the Clear Totalizer screen.

Total Cycles - Total Cycles is the total number of dispenses in Dispense and Meter modes. The total cycles counter will go up to a maximum of 3,999,999,999 before restarting at 0. The counter can be reset to 0 using the Clear Totalizer screen.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Direction - The Direction is the direction of liquid flow through the Pump Module for Dispense and Meter modes. The direction is either Forward or Reverse.

Dispense/Meter Rate - The Dispense/Meter Rate is the rate of the piston in micro liters per second during the meter operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Rate - The Load Rate is the rate the pump will operate during a load operation in micro liters per second. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Threshold - A load will be required/initiated when the volume dispensed is greater than or equal to this volume.

Drawback - Refer to section 3.3.8.13.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

Meter Mode Minimum/Maximum Chart

Pump Size	Minimum Volume µl	Maximum Volume µl	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.002	20	0.010	40
3A	0.005	50	0.025	100
2A	0.01	100	0.05	200
1A	0.02	200	0.10	400
B	0.04	400	0.20	800
C	0.10	1000	0.50	2000
D	0.20	2000	1.00	4000

3.3.8.9 Meter Mult Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

```
0 METER MULT                                  <— status —>

2
3          TOTAL VOLUME  =  ################ uL
4          TOTAL CYCLES  =  ##########
5                           ----------------------------
6                  RECIPE  =  ##    PUMP ####
7               DIRECTION  =  #######
8
9  DISPENSE/METER RATE  =  ######### uL/s
10               LOAD RATE  =  ######### uL /s
11
12
13
if prime mode and chamber full
14       PRIME        SETUP A        PARK          GET
15       SCREEN       SCREEN         PORT          RECIPE

OR if agitate mode and chamber full
14       AGITATE      SETUP A        PARK          GET
15       SCREEN       SCREEN         PORT          RECIPE

OR if bubble clear mode and chamber full
14    BUBBLE CLR      SETUP A        PARK          GET
15       SCREEN       SCREEN         PORT          RECIPE

OR if disabled fluidic setup mode and chamber full
14                    SETUP A        PARK          GET
15                    SCREEN         PORT          RECIPE

OR if NO actuator/pump selected
14       PRIME        SETUP A        SETUP C       GET
15       SCREEN       SCREEN         SCREEN        RECIPE

OR if prime mode and reference required
14       PRIME        SETUP A        LOAD          GET
15       SCREEN       SCREEN         REQUIRED      RECIPE

OR if chamber not full and load possible
14       PRIME        SETUP A        LOAD          GET
15       SCREEN       SCREEN                       RECIPE

OR if prime mode and get recipe disabled
14       PRIME        SETUP A        PARK
15       SCREEN       SCREEN         PORT
```

	Supervisor	I/O Test	Operator
----- Displays the Controller Module Status.....	D	D	D
----- Displays the total volume dispensed.....	D	D	D
----- Displays the total number of cycles	D	D	C
----- Displays the current recipe.....	D	D	D
----- Displays the pump size	D	D	D
----- Display/change fluid direction.....	D	D	C
----- Display/change the dispense/meter rate.....	D	D	C
----- Display/change the load rate.....	D	D	C

The following screens are accessible from this screen based on the system status.

Agitate.....	P	P	P
Bubble Clr.....	P	P	P
Get Recipe	P	P	P
Prime.....	P	P	P
Setup A	P	P	P
Setup C	P	P	P

Meter Mult Screen Description - The Meter Mult (Multichamber) screen displays the current Metering parameters and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start and Stop push-buttons control Metering operation while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Total Volume - Total Volume is the total amount of liquid dispensed in Dispense and Meter Modes. The total volume counter will roll over after the maximum value is reached. The counter can be reset to 0 using the Clear Totalizer screen.

Total Cycles - Total Cycles is the total number of dispenses in Dispense and Meter modes. The total cycles counter will go up to a maximum of 3,999,999,999 before restarting at 0. The counter can be reset to 0 using the Clear Totalizer screen.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Direction - The Direction is the direction of liquid flow through the Pump Module for Dispense and Meter modes. The direction is either Forward or Reverse.

Dispense/Meter Rate - The Dispense/Meter Rate is the speed in micro liters per second during the dispense portion of the operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

Load Rate - The Load Rate is the rate the pump will operate during the reload portion of the multi chamber meter in micro liters per seconds well as during a load operation. The range is based on the pump size as shown in the Pump Minimum/ Maximum Chart. The increment is equal to 20% of the minimum rate for the selected pump size.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.

2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.

3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.

4. Press the Enter push-button.

Meter Multichamber Mode Pump Minimum/Maximum Chart

Pump Size	Minimum Rate µl/Sec	Maximum Rate µl/Sec
4A	0.010	40
3A	0.025	100
2A	0.05	200
1A	0.10	400
B	0.20	800
C	0.50	2000
D	1.00	4000

3.3.8.10 Setup A Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

```
0  SETUP A                                   <— status —>

2                                  -----------------------------
3                    RECIPE  =  ##    PUMP ####
4
5           PRODUCTION MODE  =  ########
6        FLUIDIC SETUP MODE  =  ######
7                 LOAD MODE  =  ######
8            AUTO RETRIGGER  =  #######
9        PRODUCTION DWELLS   =  #######
10
11POWER-UP PERMISSION  =  #################
12 CURRENT PERMISSION  =  ##########
13
if prime mode
14      PRIME        SETUP B                        SAVE
15      SCREEN       SCREEN                         RECIPE

OR if agitate mode
14      AGITATE      SETUP B                        SAVE
15      SCREEN       SCREEN                         RECIPE

OR if bubble clear mode
14      BUBBLE CLR   SETUP B                        SAVE
15      SCREEN       SCREEN                         RECIPE

OR if dispense mode and disabled fluidic setup mode
14      DISPENSE     SETUP B                        SAVE
15      SCREEN       SCREEN                         RECIPE

OR if meter mode and disabled fluidic setup mode
14      METER        SETUP B                        SAVE
15      SCREEN       SCREEN                         RECIPE

OR if disabled production mode and disabled fluidic setup
 mode
14      GET          SETUP B                        SAVE
15      RECIPE       SCREEN                         RECIPE

OR if prime mode and faulted
14      PRIME        SETUP B        FAULT           SAVE
15      SCREEN       SCREEN         SCREEN          RECIPE

OR if prime mode and save recipe disabled
14      PRIME        SETUP B
15      SCREEN       SCREEN
```

	Operator	I/O Test	Supervisor
----- Displays the Controller Module Status........	D	D	D
----- Displays the current recipe........................	D	D	D
----- Displays the pump size	D	D	D
----- Display/change the production mode..........	D	D	C
----- Display/change the fluidic setup mode	D	D	C
----- Display/change the load mode	D	D	C
----- Switches to the auto trig screen.................	P	P	P
----- Switches to the prod dwells screen............	P	P	P
----- Display/change the power up permission ...	D	D	C
----- Display/change the current permission.......	D	D	C

The following screens are accessible from this screen based on the system status.

	Operator	I/O Test	Supervisor
Agitate..	P	P	P
Bubble Clr..	P	P	P
Get Recipe	P	P	P
Prime..	P	P	P
Setup A	P	P	P
Setup C	P	P	P

Setup A Screen Description - The Setup A screen displays some of the higher level settings for the Controller Module and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Recipe - The Recipe line shows the current recipe selected in the Recipe screen. "0" indicates values changed since last "Get Recipe".

Pump - The Pump line shows the current pump size selected in the Setup C screen. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Production Mode - The Production Mode configures the current mode of operation. The mode can either be Disabled, Dispense, Meter, Dispense MCV (Minimum Chamber Volume), Dispense Mult (Multichamber) or Meter Mult (Multichamber). Refer to section 3.3.1 for description of advanced modes.

Fluidic Setup Mode - The Fluidic Setup Mode configures the current mode of operation during setup. The mode can either be Disabled, Prime, Bubble Clr (Clear) or Agitate. Refer to section 3.3.2 for description of Bubble Clear and Agitate.

Load Mode - The Load Mode configures the current mode for refilling the pump chamber with fluid. The mode can be either Manual, Empty or Every.

Auto Retrigger - Refer to Section 3.3.8.14.

Production Dwells - Refer to Section 3.3.8.15.

Power-Up Permission - The Power-Up Permission configures the current setting for the permission when the Controller Module is powered on. The mode can be either Operator or Last At Power Off.

Current-Permission - Refer to Section 3.3.8.19.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

3.3.8.11 Setup B Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

```
0 SETUP B                                  <— status —>

2      AUXILIARY OUTPUT  = ##########
3 READY OUTPUT CONFIG  = ##############
4                OUTPUT 2  = ############
5       OUTPUT 3 CONFIG  = #############
6       OUTPUT 4 CONFIG  = ############
7
8                 INPUT CC  = ################
9                  INPUT 1  = ################
10          INPUT 2 CONFIG  = #############
11          INPUT 3 CONFIG  = ##################
12          INPUT 4 CONFIG  = ####################
13
if NOT faulted
14      SETUP A      SETUP C                    I/O TEST
15      SCREEN       SCREEN                     SCREEN

OR if faulted
14      SETUP A      SETUP C      FAULT         I/O TEST
15      SCREEN       SCREEN       SCREEN        SCREEN

OR if permission less than I/O Test
14      SETUP A      SETUP C
15      SCREEN       SCREEN
```

	Supervisor	I/O Test	Operator
----- Displays the Controller Module Status.....	D	D	D
----- Display/change the auxiliary output.....	D	D	C
----- Display/change the ready output config.....	D	D	C
----- Displays the output 2 setting	D	D	D
----- Display/change the output 3 config.....	D	D	C
----- Display/change the output 4 config.....	D	D	C
----- Displays the input CC setting	D	D	D
----- Displays the input 1 setting	D	D	D
----- Display/change the input 2 config.....	D	D	C
----- Display/change the input 3 config.....	D	D	C
----- Display/change the input 4 config.....	D	D	C
The following screens are accessible from this screen based on the system status.			
Setup A	P	P	P
Setup C	P	P	P
I/O Test	P	P	P
Fault	P	P	P

Setup B Screen Description - The Setup B screen displays some additional higher level settings for the Controller Module and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Auxiliary Output - The Auxiliary Output selects the logic for an additional output signal. The output signal can either be Disabled, Enable Fluid Ops, Enable Both or Enable Prod Ops. Refer to section 3.3.10.2 for signal functions.

Ready Output Config - The Ready Output Config sets the configuration of the Ready Output signal. The output signal can be either Disabled, Busy Discharge, Busy Prod Only, Busy Moving, Ready Idle or Ready for Prod. Refer to section 3.3.10.3 for signal functions.

Output 2 - The Output 2 displays the setting for the 2nd output signal. This field is set to Fault Output and is not changeable.

Output 3 Config - The Output 3 Config settings determines the signal type for the 3rd output. The output signal can be either Disabled, Busy Discharge, Busy Prod Only, Busy Moving, Ready Idle, Ready for Prod, Ref Required, Load Required or Port Park. Refer to section 3.3.10.3 for signal functions.

Output 4 Config - The Output 4 Config settings determines the signal type for the 4th output. The output signal can be either Disabled, Busy Discharge, Busy Prod Only, Busy Moving, Ready Idle, Ready for Prod, Ref Required, Load Required or Port Park. Refer to section 3.3.10.3 for signal functions.

Input CC - The Input CC setting determines the signal type for the CC input. This setting is preset to Prod Mode Trigger and is not changeable. Refer to section 3.3.10.1.

Input 1 - The Input 1 setting determines the signal type for the 1st input. This setting is preset to Prod Mode Trigger and is not changeable.

Input 2 Config - The Input 2 Config settings determines the signal type for the 2nd input. The input signal can be either Clear Fault & Reference, Fluid Mode trigger, Enable Motion, Load Trigger or Port Park. Refer to section 3.3.10.3 for signal functions.

Input 3 Config - The Input 3 Config settings determines the signal type for the 3rd input. The input signal can be either Clear Fault & Reference, Fluid Mode trigger, Enable Motion, Load Trigger or Port Park. Refer to section 3.3.10.3 for signal functions.

Input 4 Config - The Input 4 Config settings determines the signal type for the 4th input. The input signal can be either Clear Fault & Ref, Fluid Mode Trigger, Enable Motion, Load Trigger, EN FP RS, EN FP RS / VC, EN FP RS / VC /PD, EN FP RG&S / VC, EN FP RG&S / VC /PD, EN FP RG&S / VC/PD/S. Refer to section 3.3.10.3 for signal functions.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.

2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.

3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.

4. Press the Enter push-button.

3.3.8.12 Setup C Screen

D = Display **P = Push-button Accessible**
C = Display/Change **N = Not Accessible/Viewable**

Screen	Description	Operator	I/O Test	Supervisor
0 **SETUP C** <— status —>	----- Displays the Controller Module Status........	D	D	D
2				
3 **PUMP = ##############**	----- Display/change the pump size....................	D	D	C
4 **PUMP CHAMBER VOLUME = ############**	----- Displays the pump chamber volume...........	D	D	D
5				
6 **ENCODER = ############**	----- Switches to the encoder screen..................	D	D	C
7 **PUMP 90 DEG OFFSET = ############**	----- Display/change the pump 90 degree offset.	D	D	D
8 **ACTIVE PORT = ################**	----- Display/change the active port	D	D	D
9 **VALVING SPEED = ################**	----- Display/change the valving speed	D	D	C
10				
11 **TORQUE = #################**	----- Display/change the torque..........................	D	D	C
12 **ACCELERATION = ###################**	----- Display/change the acceleration.................	D	D	C
13				

if configured and NOT faulted and NOT reference required

14	**SETUP B**	**SYSTEM**	**REFERENCE**	**CLEAR**
15	**SCREEN**	**INFO**		**TOTALIZER**

OR if faulted

14	**SETUP B**	**SYSTEM**	**FAULT**	**CLEAR**
15	**SCREEN**	**INFO**	**SCREEN**	**TOTALIZER**

OR if NOT configured

14	**SETUP B**	**SYSTEM**		**CLEAR**
15	**SCREEN**	**INFO**		**TOTALIZER**

OR if reference required

14	**SETUP B**	**SYSTEM**	**REFERENCE**	**CLEAR**
15	**SCREEN**	**INFO**	**REQUIRED**	**TOTALIZER**

OR if permission less than supervisor

14	**SETUP B**	**SYSTEM**	**REFERENCE**
15	**SCREEN**	**INFO**	

The following screens are accessible from this screen based on the system status.

Screen	Operator	I/O Test	Supervisor
Setup B	P	P	P
System Info	P	P	P
Clear Totalizer	P	P	P
Fault	P	P	P

Setup C Screen Description - The Setup C screen displays some additional settings for the Controller Module and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Pump - The Pump setting displays the current pump size. This setting has to match the pump size on the Actuator for the system to operate properly. The pump size can be either 4A, 3A, 2A, 1A, B, C, D or NONE.

Pump 90 Deg Offset - The Pump may be offset 90 degrees relative to the actuator in order to achieve various alignments of the inlet/outlet. Refer to section 3.1.7 for further explanation.

Encoder - Selecting this value for change switches to the "Encoder" screen shown in section 3.3.8.16.

Active Port - The active port indicates which port is the outlet in forward direction operations. The setting can either be Port A or Port B. Refer to section 3.1.6 for additional information.

Valving Speed - The Valving Speed is a percentage of the rate the piston flat moves between ports. The range is 1% to 100% with an increment value of 1. Viscous fluids may require a value less than 100%.

Torque - The Torque indicates the current torque setting for the motor. The setting can either be Low, Medium or High. Refer to section 3.1.10 for additional information.

Acceleration - Acceleration determines how fast the motor gets up to full speed when first started. The acceleration can either be Slow, Medium, Standard and Fast. Standard acceleration should work for most applications and is the system default value. Faster acceleration values, if combined with larger motor sizes or high viscosity fluids / large displacement volumes, may cause nuisance faults. Refer to section 3.1.8 for additional information.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.

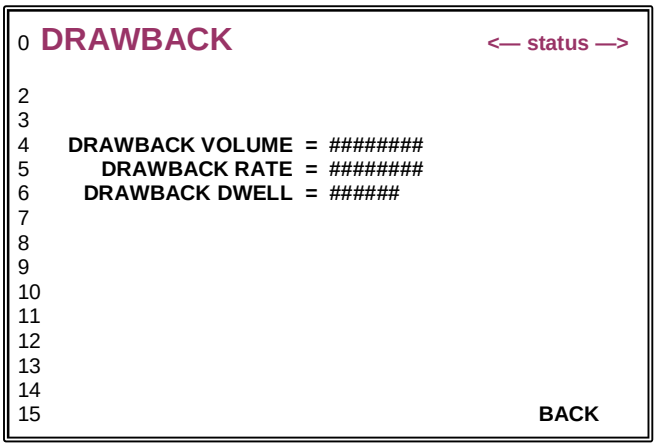
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.

3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.

4. Press the Enter push-button.

3.3.8.13 Drawback Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable



		Supervisor	I/O Test	Operator
----	Displays the Controller Module Status	D	D	D
----	Display/change the drawback volume	D	D	C
----	Display/change the drawback rate	D	D	C
----	Display/change the drawback dwell	D	D	C
----	Display/change the drawback dwell	N	N	P

Drawback Screen Description - The Drawback screen displays the current Drawback parameters and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown. Refer to section 3.1.9 for description of Drawback.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Drawback Volume - The Drawback Volume is the amount of liquid drawn back during a drawback cycle. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the minimum volume for the selected pump size. Drawback volume is limited to the full chamber volume minus dispense volume. A drawback volume of zero disables drawback while a drawback volume greater than zero enables drawback.

NOTE

It is reset to 0 when the dispense volume is increased such that the dispense volume plus drawback volume exceeds the full chamber volume.

Drawback Rate - The Drawback Rate is the rate of the pump in micro liters per second during a drawback operation. The range is based on the pump size as shown in the Pump Minimum/Maximum Chart. The increment is equal to the 20% of the minimum rate.

Drawback Dwell - The Drawback Dwell is the time between the end of a dispense and the beginning of the drawback cycle in seconds. The range is 0.00 sec to 2.55 sec with an increment value of 0.01. The recommend minimum is 0.05.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.

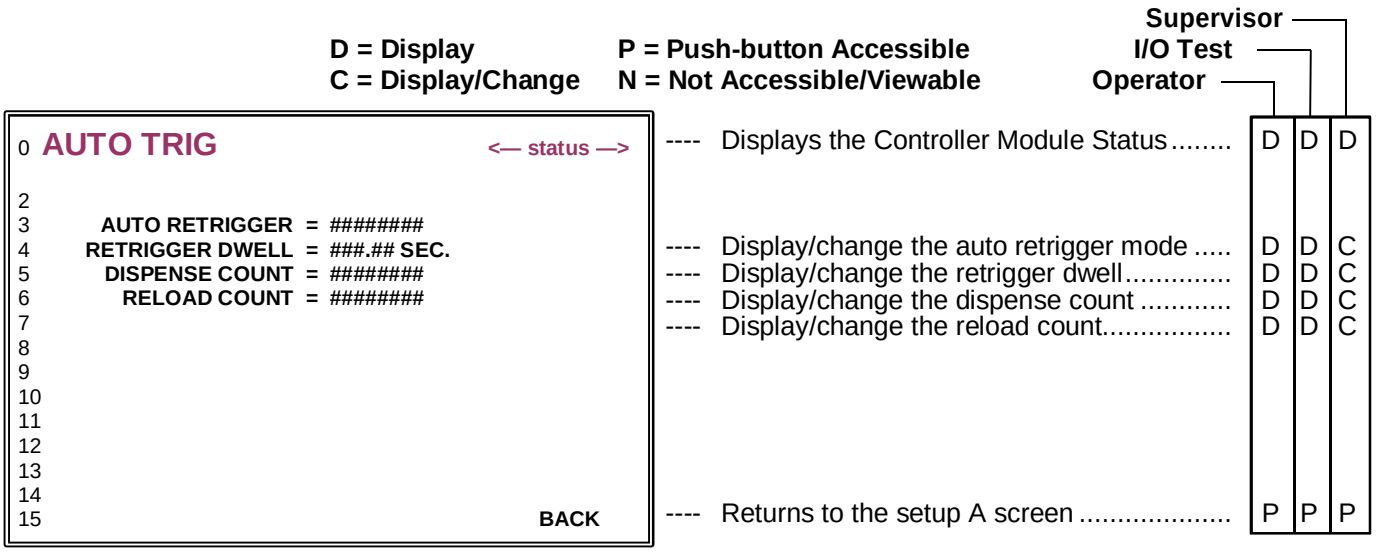
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.

3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.

4. Press the Enter push-button.

Drawback Minimum/Maximum Chart				
Pump Size	**Minimum Volume µl**	**Maximum Volume µl**	**Minimum Rate µl/Sec**	**Maximum Rate µl/Sec**
4A	0.0	< 20	0.010	40
3A	0.0	< 50	0.025	100
2A	0.0	< 100	0.05	200
1A	0.0	< 200	0.10	400
B	0.0	< 400	0.20	800
C	0.0	< 1000	0.50	2000
D	0.0	< 2000	1.00	4000

3.3.8.14 Auto Trig Screen



Auto Trig Screen Description - The Auto Trig screen displays the information for Auto Trigger and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown. Refer to section 3.3.1.6 for a description of Auto Trig.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Auto Retrigger - The Auto Retrigger setting indicates the current mode of the trigger. The mode can either be Disabled, Count or Infinite. (Refer to section 3.3.1.6)

Retrigger Dwell - The Retrigger Dwell indicates the amount of time in seconds between a dispense and the next auto retrigger. The range is 0.0 seconds to 300.0 seconds with an increment value of 0.01. (Refer to section 3.3.1.6)

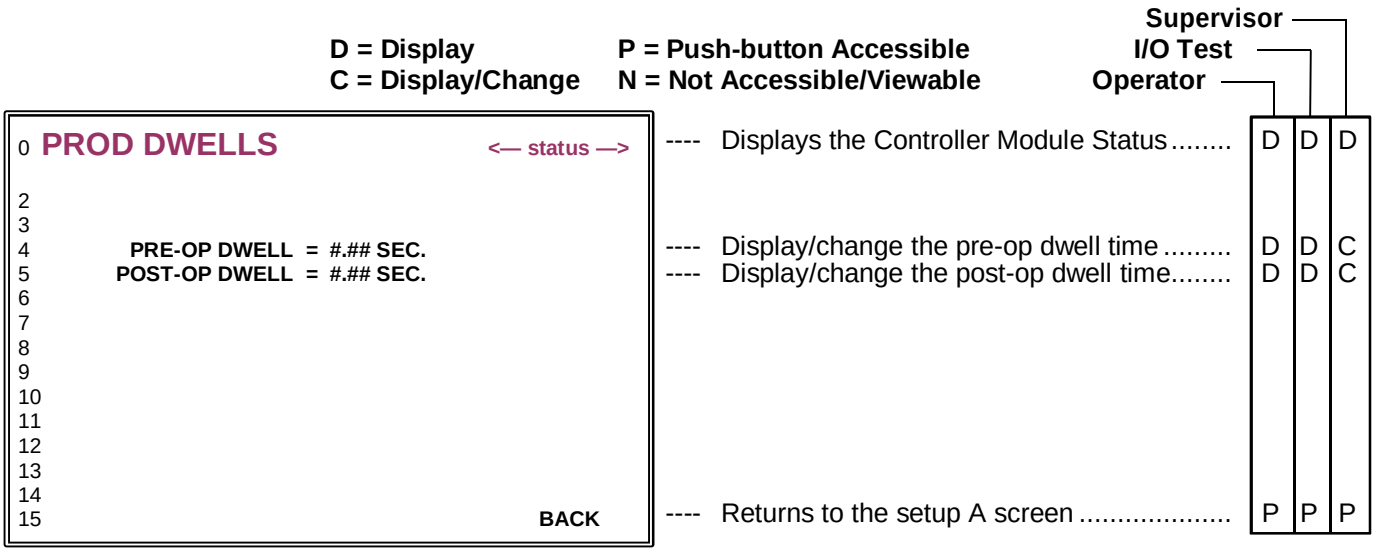
Dispense Count - The Dispense Count indicates the total number of dispenses to be triggered. The range is 2 to 65535 with an increment value of 1. (Refer to section 3.3.1.6)

Reload Count - The Reload Count indicates the number of dispenses between each reload. The range is 0 to 65535 with an increment value of 1. (Refer to section 3.3.1.6)

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

3.3.8.15 Prod Dwells Screen



Prod Dwells Screen Description - The Prod Dwells screen displays the production dwell time information and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

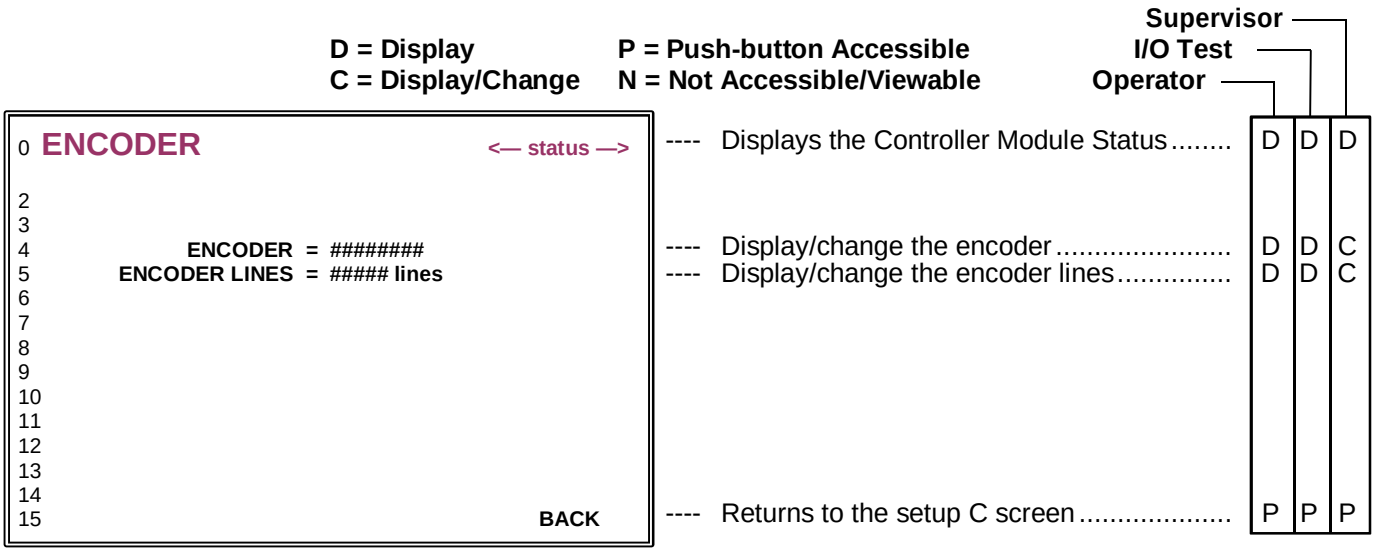
Pre-Op Dwell - The Pre-Op Dwell indicates the delay time in seconds between a logic signal transition or Start and pump operation in Production mode. The range is 0.00 seconds to 2.55 seconds with an increment value of 0.01. (Refer to section 3.3.1.6)

Post-Op Dwell - The Post-Op Dwell indicates the time in seconds from the end of a production operation and the logic output signal becomes inactive. The range is 0.00 seconds to 2.55 seconds with an increment value of 0.01. (Refer to section 3.3.1.6)

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

3.3.8.16 Encoder Screen



Encoder Screen Description - The Encoder screen displays encoder information and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

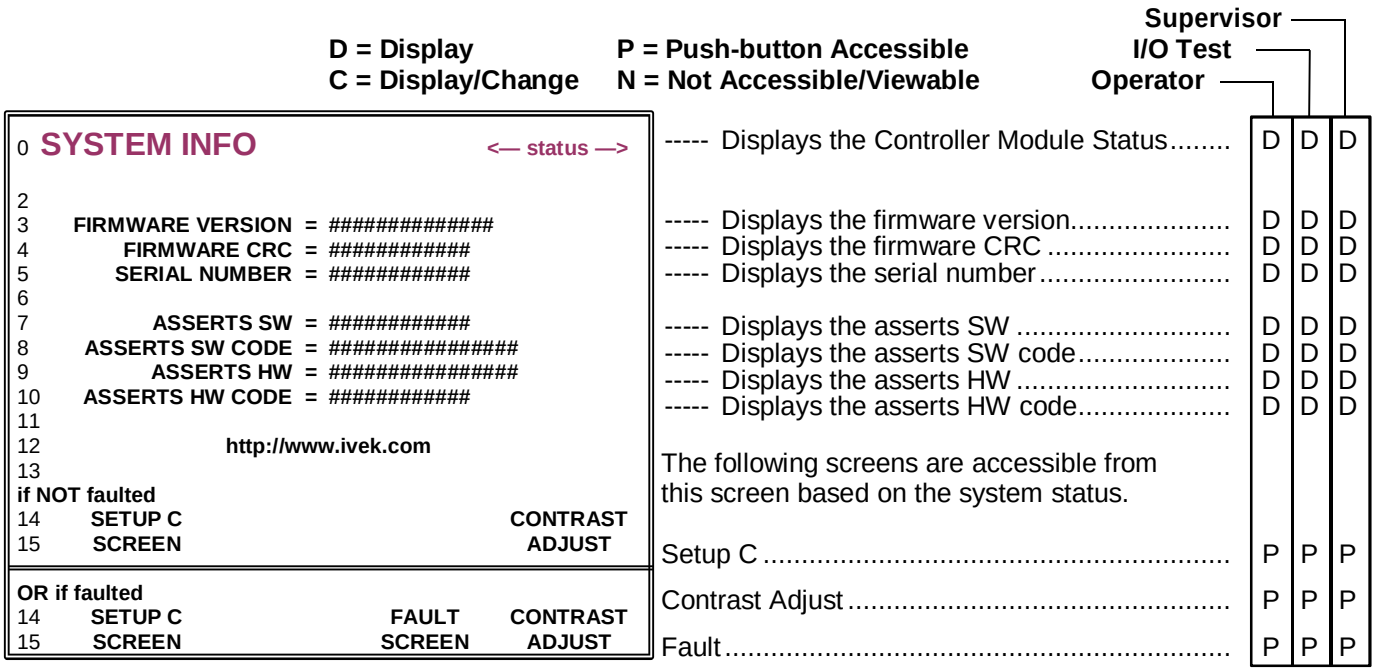
Encoder - The Encoder provides a feedback signal when the motor is operating. The setting can either be Disabled (if no encoder option purchased on the Actuator Module) or Enabled (if encoder option purchased on the Actuator Module).

Encoder Lines - The number of encoder lines is based on the encoder installed on the Actuator Module. The range is 200 to 4000 with an increment value of 1.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

3.3.8.17 System Info Screen



System Info Screen Description - The System Info screen displays information about the Controller Module. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

Firmware Version - The Firmware Version displays the current version of software installed on the Controller Module.

Firmware CRC - The Firmware CRC confirms the integrity of the firmware in the controller.

Serial Number - The Serial Number is a unique identifier assigned to the Controller Module and should be used when calling IVEK Corporation with problems or questions. The serial number should match the serial number on the tag located on the rear of the Controller Module.

Asserts SW - For IVEK use only.

Asserts SW Code - For IVEK use only.

Asserts HW - For IVEK use only.

Assert HW Code - For IVEK use only.

3.3.8.18 Select New Value and Enter New Value Screens

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

	Supervisor	I/O Test	Operator
0 **ENTER NEW VALUE**			
2			
3 **Value Label (units)**			
4 **0############**			
5			
6			
7 **############ MAXIMUM**			
8 **############ MINIMUM**			
9			
10 **############ INCREMENT**			
11			
If help NOT pressed			
12			
13			
If help pressed			
12 **Help message line 1 for value...**			
13 **Help message line 2 for value...**			
14			
15 **HELP MINIMUM MAXIMUM CANCEL**			
---- Displays the parameter to be changed.....	D	D	D
---- Display/change the value	D	D	C
---- Displays the maximum value	D	D	D
---- Displays the minimum value	D	D	D
---- Displays the increment value.....	D	D	D
---- Returns to the previous screen	P	P	P
---- Sets the value to the maximum setting	P	P	P
---- Sets the value to the minimum setting	P	P	P
---- Displays information on selected value.....	P	P	P

	Supervisor	I/O Test	Operator
0 **SELECT NEW VALUE**			
2			
3 **Value Label**			
4 **Selection 1**			
5 **Selection 2**			
6			
7			
8			
9			
10			
11			
If help NOT pressed			
12			
13			
If help pressed			
12 **Help message line 1 for selection…**			
13 **Help message line 2 for selection…**			
14			
15 **HELP CANCEL**			
----- Display/select the available values	D	D	C
----- Returns to the previous screen.....	P	P	P
----- Displays information on selected value.....	P	P	P

Enter New Value Description - The Enter New Value screen allows entry of a numerical value within the indicated range. This screen is only accessible with Supervisor permission.

Upon reaching the Enter New Value screen press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value. Press the Enter push-button to store the new value and return to the previous screen or press cancel to ignore the change.

Parameter - The first two lines of this screen display the parameter to be changed and the current value.

Maximum - Displays the maximum value for the parameter.

Minimum - Displays the minimum value for the parameter.

Increment - Displays the incremental value for the parameter.

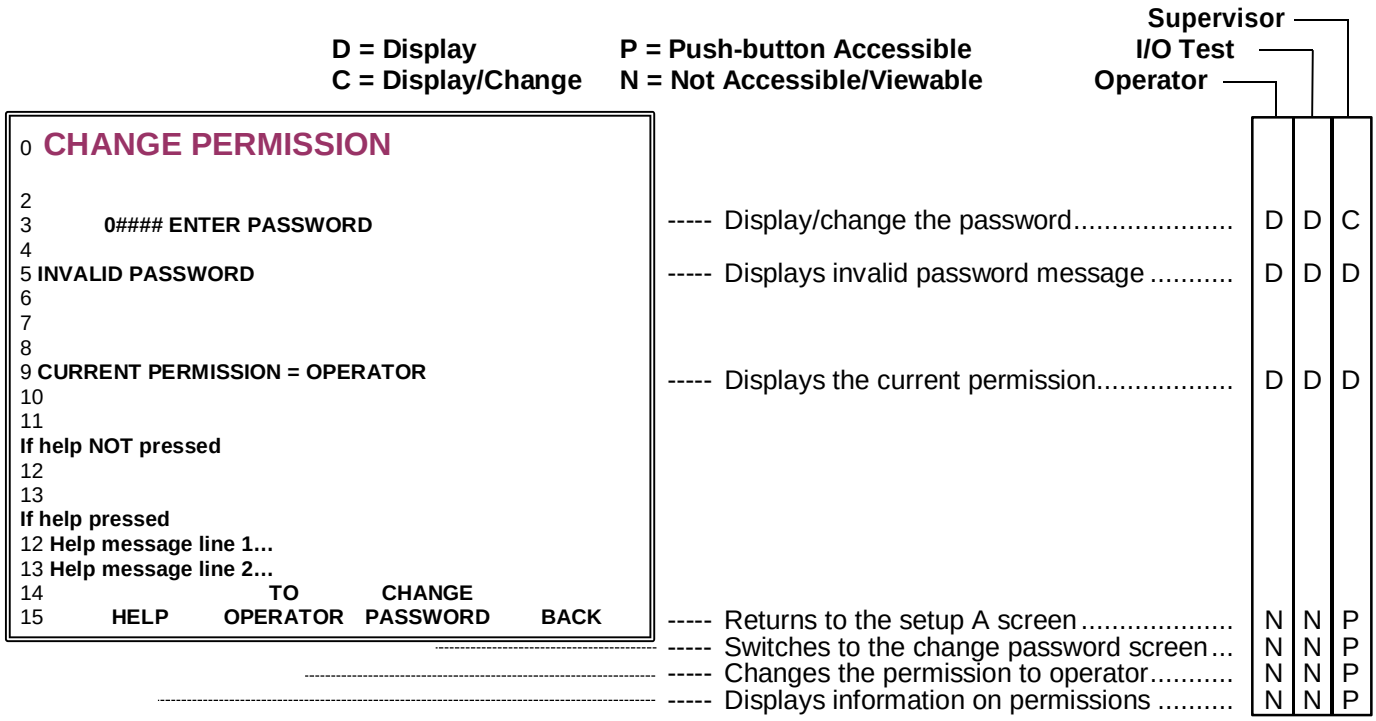
Select New Value Screen Description - The Select New Value screen selects a value from a list of values. The Enter New Value screen allows entry of a numerical value within the indicated range. This screen is only accessible with Supervisor permission.

Upon reaching the Select New Value screen, use the up and down arrow push-buttons to select the value. Press the Enter push-button to store the new value and return to the previous screen.

Parameter - The first line of this screen displays the parameter to be changed. The available choices start at the second line.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

3.3.8.19 Change Permission Screen



Change Permission Screen Description - The Change Permission screen is used to change the permission to a lower or higher level. This allows additional or more restrictive access to parameters and screens. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

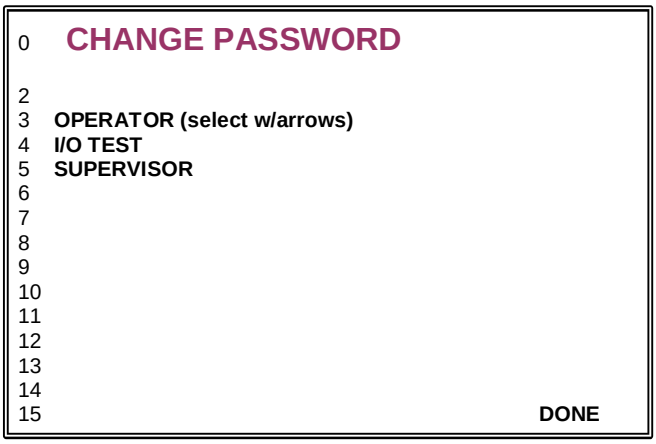
Enter Password - This field is used to enter the password for the desired permission level. Each permission level has a unique password to prevent unauthorized access to certain parameters. The permission level can either be Operator, I/O Test or Supervisor. Use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value. The minimum value for a password is '10'.

NOTE

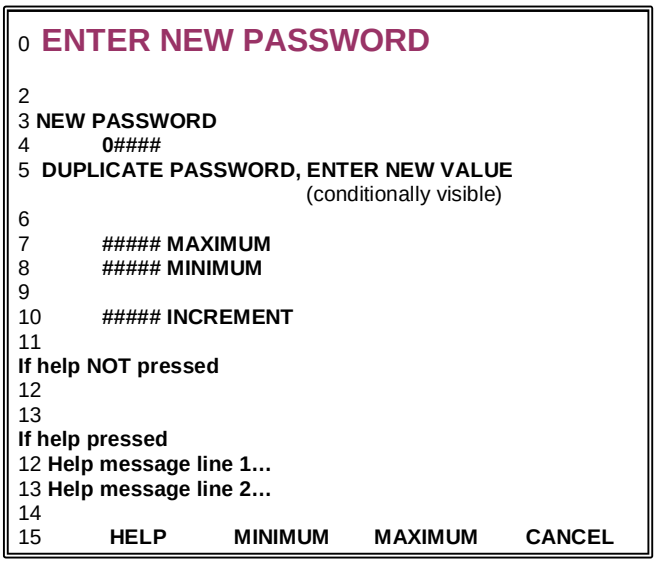
Entering a password causes the password field to reset to the minimum value.

3.3.8.20 Change Password and Enter New Password Screens

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable



	Supervisor	I/O Test	Operator
----- Display/select the permission to change.....	D	D	C
----- Returns to the previous screen.....	P	P	P



	Supervisor	I/O Test	Operator
----- Display/change the password.....	D	D	C
----- Displays error message	D	D	C
----- Displays the maximum value.....	D	D	C
----- Displays the minimum value.....	D	D	C
----- Displays the increment value.....	D	D	C
----- Returns to the change password screen.....	P	P	P
----- Sets the value to the maximum setting.....	P	P	P
----- Sets the value to the minimum setting.....	P	P	P
----- Displays password help information	P	P	P

Change Password and Enter New Password Screens Description - The Change Password screen selects the permission level and the Enter New Password screen allows a user with Supervisor permission to change the password. This screen is only accessible with Supervisor permission.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

New Password - The Password is changed here or press the Minimum or Maximum push-button to enter that value.

Minimum - Displays the minimum value for the password. The minimum value is 10.

Maximum - Displays the maximum value for the password. The maximum value is 65535.

Increment - Displays the incremental value for the password. The increment value is 1.

To change the password;

1. Use the up and down arrow push-buttons to select the permission.
2. Press the Enter push-button to bring up the Enter New Password screen.
3. Press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow push-buttons to change the digit's value.
4. Press the Enter push-button.

NOTE

The last password cannot be retrieved. Keep a record of changed passwords in a secure place.

IVEK cannot retrieve lost passwords, they can only be reset. Resetting the parameters resets all passwords and setups back to factory defaults and clears all recipes. Refer to section 3.3.8.25.

3.3.8.21 Contrast Adjust Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

Supervisor
I/O Test
Operator

```
0 CONTRAST ADJUST

2
3 Press UP Arrow to increase contrast
4 Press DOWN Arrow to increase contrast
5
6 Press SELECT to save and exit
7 Press CANCEL to exit without saving
8
9
10
11
12
13
14
15                                  CANCEL
```

----- Returns to the system info screen ..... P P P

Contrast Adjust Screen Description - The Contrast Adjust screen is used to change the contrast on the screen to compensate for changes in light levels within the room and changes in the display due to temperature. The current permission level determines which push-buttons are available as shown.

NOTE

The Contrast Adjust screen may not be available on all units.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Use the up arrow to increase the contrast and the down arrow to decrease the contrast. Once acceptable, press the select push-button to keep the contrast setting or cancel to revert back to the original setting.

NOTE

The contrast may change with temperature.

3.3.8.22 Recipe Screen

D = Display P = Push-button Accessible
C = Display/Change N = Not Accessible/Viewable

		Supervisor	I/O Test	Operator
0 **RECIPE**				
2				
3 **SAVE AS (OR GET FROM)**				
4				
5				
6 **RECIPE = ##**	----- Display/enter the recipe number.....	D	D	C
7				
8				
9 **BLANK RECIPE, SELECT AGAIN** (conditionally visible)	----- Displays error message	D	D	D
10				
11				
If help NOT pressed				
12				
13				
If help pressed				
12 **Help message line 1 ...**				
13 **Help message line 2 ...**				
14				
15 **HELP** **CANCEL**	----- Returns to the previous screen.....	P	P	P
	----- Display recipe help information	P	P	P

3.3.8.23 Warning Recipe Exists Screen

D = Display P = Push-button Accessible
C = Display/Change N = Not Accessible/Viewable

		Supervisor	I/O Test	Operator
0 **WARNING**				
2 **RECIPE EXISTS**				
4				
5 **“REPLACE” TO REPLACE WITH NEW VALUES**				
6 **“CANCEL” TO SELECT NEW RECIPE NUMBER**				
7				
8				
9				
10				
11				
12				
13				
14				
15 **REPLACE** **CANCEL**	----- Sets the value to the minimum setting.....	N	N	P
	----- Displays password help information	N	N	P

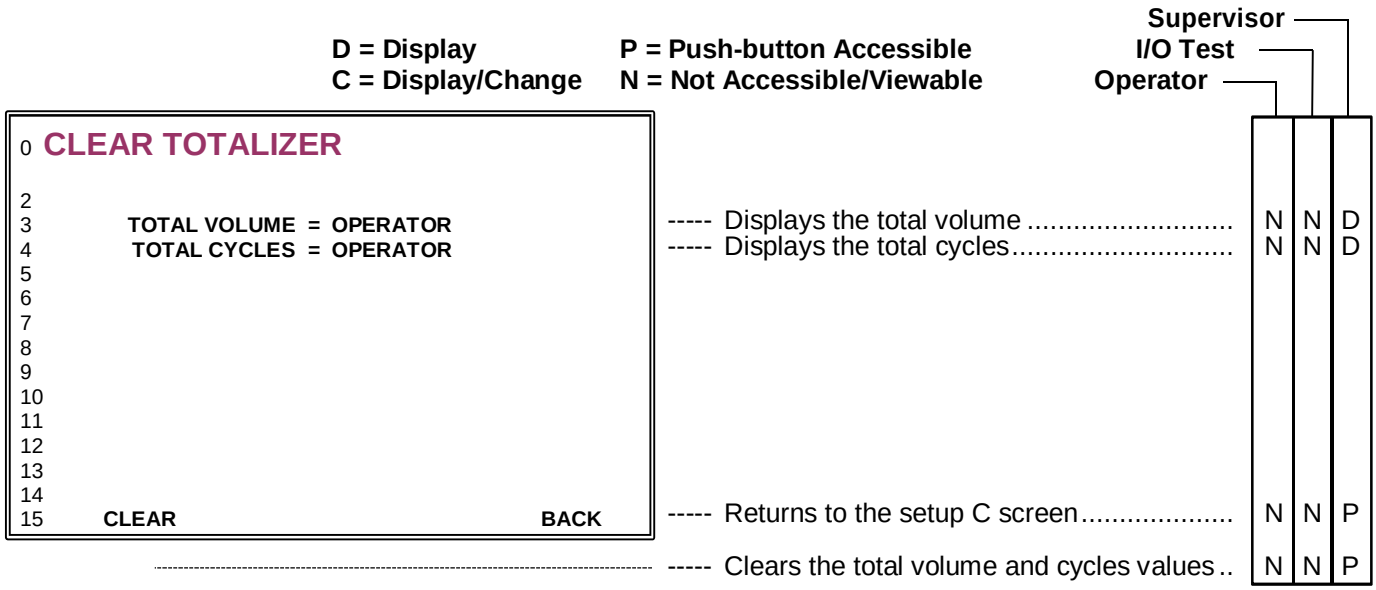
Recipe Screen Description - The Recipe screen is used to select an existing recipe to load into the Controller Module, save a changed recipe to the same number or a new number, or save a new recipe to an existing number or a new number. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

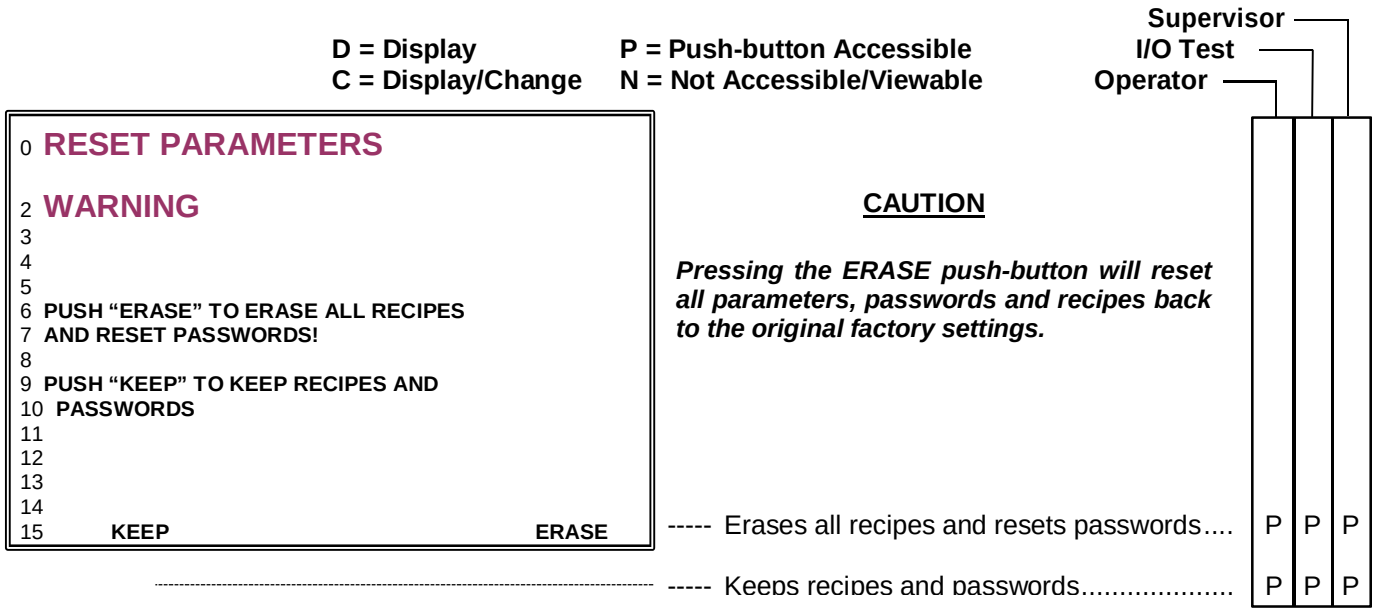
Warning Recipe Exists Screen Description - The Warning Recipe Exists screen is intended to prevent accidently overwriting an existing recipe. This screen will appear and offer a choice of either replacing the existing recipe or canceling and not replacing the existing recipe. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

3.3.8.24 Clear Totalizer Screen



3.3.8.25 Reset Parameter Warning Screen



Clear Totalizer Screen Description - The Clear Totalizer screen displays the total volume and cycles since the last clear and allows these values to be reset to 0. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

Reset Parameter Warning Screen Description - The Reset Parameter Warning screen is intended to prevent accidently resetting all the Controller Module parameters. This screen opens when the FPB3 and Down Arrow buttons are held continuously for six seconds during power up. The choice is either keeping the current parameters or resetting all the parameters to their default value. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

3.3.8.26 Fault Screen

D = Display
C = Display/Change
P = Push-button Accessible
N = Not Accessible/Viewable

	Supervisor	I/O Test	Operator
0 **FAULT** <— status —> ----- Displays the Controller Module status	D	D	D
2			
3 **Piston Home Fault** ----- Displays the fault description.....	D	D	D
4 **Error Code: ##########** ----- Displays the fault error code.....	D	D	D
5			
6			
7			
8			
9			
10			
11 **"CLEAR FAULT" = CLEAR FAULT & REFERENCE**			
12 **"SETUP A SCREEN" = CHANGE VALUES FIRST**			
13			
If NOT port home fault			
14 **SETUP A CLEAR**			
15 **SCREEN FAULT**			
If port home fault			
14 **SETUP A CLEAR MOVE**			
15 **SCREEN FAULT PISTON**			
----- Tests the movement of the piston.....	P	P	P
----- Clears the displayed fault.....	P	P	P
----- Switches to the setup A screen	P	P	P

If "MOVE PISTON" selected from above

0 **FAULT** <— status —> ----- Displays the Controller Module status	D	D	D
2			
3 **WARNING – trying to move a seized piston**			
4 **may break actuator coupling. Please**			
5 **remove pump before initiating move.**			
6			
7			
8			
9			
10 **"MOVE PISTON" = MOVE PISTON & REFERENCE**			
11 **"CLEAR FAULT" = CLEAR FAULT & REFERENCE**			
12 **"SETUP A SCREEN" = CHANGE VALUES FIRST**			
13			
14 **SETUP A CLEAR MOVE**			
15 **SCREEN FAULT PISTON**			
----- Tests the movement of the piston.....	P	P	P
----- Clears the displayed fault.....	P	P	P
----- Switches to the setup A screen	P	P	P

Fault Screen Description - The Fault screen displays faults which cause the system to stop operating. The current permission level determines which push-buttons are available as shown.

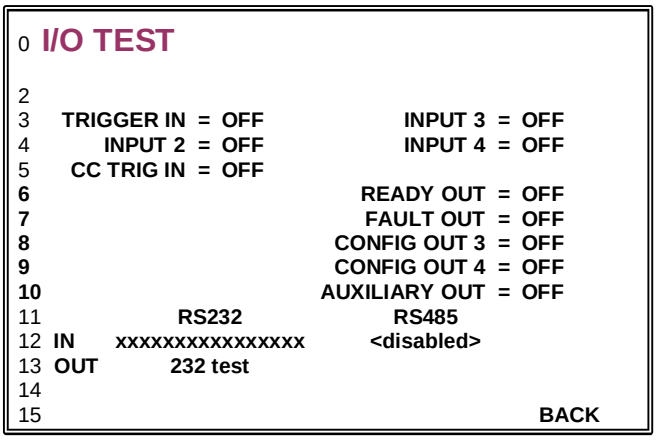
The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

The Fault description lists the operational fault. The error code is a numerical value and is to be used by IVEK Technical Service personnel. Normal operational faults will cause an error code of '0'.

Status - The status indicates the operational state of the system. Refer to section 3.3.9 for an explanation of each status type.

3.3.8.27 I/O Test Screen

D = Display **P = Push-button Accessible**
C = Display/Change **N = Not Accessible/Viewable**



		Supervisor	I/O Test	Operator
-----	Displays the trigger in and input 3 setting	N	D	D
-----	Displays the input 2 and input 4 settings	N	D	D
-----	Displays the CC trig in setting	N	D	D
-----	Display/change the ready out	N	D	C
-----	Display/change the fault out	N	C	C
-----	Display/change the config out 3	N	C	C
-----	Display/change the config out 4	N	C	C
-----	Display/change the auxiliary out	N	C	C
-----	Displays in test data	N	D	D
-----	Displays out test data	N	D	D
-----	Returns to the setup B screen	N	P	P

I/O Test Screen Description - The I/O Test screen is used for trouble shooting the inputs and outputs of the Controller Module. Each input and output can be exercised to verify functionality. The current permission level determines which push-buttons are available as shown.

The Start push-button is not functional, but the Stop push-button is functional while this screen is visible. Normal operation ceases for rear panel interfaces being controlled only by this screen.

Trigger In, Input 2, Input 3, Input 4, CC Trig In - The status of the input signals are displayed here. The status will be either OFF if no external signal is applied or ON if an external signal is applied.

Ready Out, Fault Out, Config Out 3, Config Out 4, Auxiliary Out - The status of the output signals are displayed and changed here. A status of OFF indicates the output is not conducting and a status of ON indicates the output is conducting.

RS232 - The RS232 In displays data being received through the interface, "<no input>" appears and scrolls off as characters are received. The text "232 test" flashes on the screen at RS232 Out as the text is sent through the interface.

RS485 - The RS485 connection has not been configured and is reserved for a future enhancement.

To change a value;

1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up the Select New Value screen.
3. Press the Arrow push-buttons to select the desired value.
4. Press the Enter push-button.

3.3.9 Status

The status indicates the operational state of the system. The status is displayed in the upper right hand corner of the display on the Power-Up, Prime, Bubble Clear, Agitate, Dispense, Drawback, Disp Mult, Disp MCV, Meter, Meter Mult, Setup A, Auto Trig, Prod Dwells, Setup B, Setup C, Encoder, System Info, and Fault screens. The status will be one of the following:

IDLE	No operations are active, pump is selected, motion is not disabled, no operating faults exists
PRIMING	The Prime operation is active.
DISPENSING	A Dispense operation is active.
METERING	A Meter operation is active.
DRAWBACK DWELL	The Dispense or Meter operation is currently dwelling before drawback
DRAWBACK	The Dispense or Meter operation is currently performing a drawback
CLEARING FAULT	A fault is being cleared
FAULTED	An operating fault exists
REFERENCING	A Reference operation is active
MOTION STOPPED	All motion has been disabled via either a logic signal or a serial command
NOTCONFIGURED	The pump selection is set to None
INITIALIZING	The system is initializing upon power-up
PORT CHANGE	The valve is changing ports in response to a change in the Active Port setting
PRE-OP DWELL	A pre-operation dwell is occurring during a Production Mode operation
POST-OP DWELL	A post-operation dwell is occurring during a Production Mode operation
AUTOTRIG IDLE	A dwell is occurring between Auto Triggered Dispense operations
ISOLATING	The Isolation portion of an Agitate operation is active
AGITATING	The Agitate portion of an Agitate operation is active
RETURNING	The Return portion of an Agitate operation is active
BUBBLE CLEAR	A Bubble Clear operation is active
LOADING	A Load operation is active
PARKING PORT	The piston is moving toward the port park position.
PORT PARKED	The piston is at the port park position.
UNPARKING PORT	The piston is moving out of the port park position towards the outlet.

3.3.10 Rear Panel Interfaces

The rear panel has two terminal strips and two connectors for interfacing with additional equipment. The terminal strips provide a connection for an external trigger and a configurable output. The connectors provide a Logic I/O interface and a RS232 serial interface.

3.3.10.1CC TRIG Terminal Strip

If an external contact closure is to be used to initiate Dispense or Meter operation, connect it to the CC TRIG terminal strip. Do not connect any external power source to this terminal strip. The internal power source for this signal is optically isolated from the internal control electronics (isolated power shared with RS232 Serial Interface). See section 3.7 for signal descriptions.

3.3.10.2AUX OUT Terminal Strip

Select the function of the Auxiliary Output on the Setup B screen (see 3.3.8.11) or "h0" serial interface command. This signal will switch an externally-powered device. See 3.7 for signal constraints.

"C" is Conducting and "NC" is Not Conducting.			
Auxiliary Output Configuration	**Fluidic Setup Mode operation active**	**Production Mode operation active**	**Idle, all other operations**
Disabled	NC	NC	NC
Fluid	C	NC	NC
Fluid & Prod	C	C	NC
Prod	NC	C	NC

3.3.10.3LOGIC I/O Interface

The LOGIC I/O Interface provides connections between the Controller Module and the customer's PLC. Trigger input, ready out and fault out signals are communicated to and from the PLC.

Signal Functions

Trigger In - The 'Trigger In' signal initiates a cycle based on the current value for Production Mode (Dispense, Meter or Disabled). The trigger has no effect if 'Disabled'.

Dispense Mode - When the Controller Module is properly configured for Dispense Mode, the Controller Module is triggered at the transition when a signal is applied to the system trigger.

Meter Mode - When the Controller Module is properly configured for Meter Mode, metering is started and stopped as long as a signal is applied to the system trigger.

Config Input 2 - The Config Input 2 setting determines the signal function for the 2nd input. Refer to the following table for selections.

Config Input 3 - The Config Input 3 setting determines the signal function for the 3rd input. Refer to the following table for selections.

2 Config h12	Input 3 Config h13	Input 4 Config h14	Screen Text	Value for Serial Interface	Input Function
X	X	X	CLEAR FAULT & REF	0	Activate input to clear fault and initiate reference if required
X	X	X	FLUIDIC MODE TRIGGER	1	Activate input to initiate the currently configured Fluidic Setup Mode operation
X	X	X	ENABLE MOTION	2	Activate input to enable motion and deactivate to disable motion. Disabling motion while idle will inhibit operations from triggering. Disabling motion while an operation is active will generate a Motion Disabled During Operation Fault.
		X	EN FP RS	3	Activate input to Enable Front Panel Recipe Save function button
		X	EN FP RS VC	4	Activate input to Enable Front Panel Recipe Save function button and Value Changes
		X	EN FP RS VC PD	5	Activate input to Enable Front Panel Recipe Save function button, Value Changes, and Prime Direction function button
		X	EN FP RG&S VC	6	Activate input to Enable Front Panel Recipe Get & Save buttons and Value Changes
		X	EN FP RG&S VC PD	7	Activate input to Enable Front Panel Recipe Get & Save buttons, Value Changes, and Prime Direction function buttons
		X	EN FP RG&S VC PD S	8	Activate input to Enable Front Panel Recipe Get & Save buttons, Value Changes, Prime Direction function buttons, and Start and Stop buttons
X	X	X	LOAD TRIGGER	9	Activate input to initiate Load operation
X	X		PORT PARK	10	Activate input to trigger Port Park, deactivate to take out of port park.

Ready Output Table	Busy Discharge	Busy Production	Busy Moving	Ready Idle	Ready for Production
Idle	C	C	C	C	C
Idle, Reference Required	C	C	C	C	NC
Idle, Load Required	C	C	C	C	NC
Idle, Production Mode Disabled	C	C	C	C	NC
Idle, Fluidic Mode Disabled	C	C	C	C	C
Idle, Not Configured	C	C	C	NC	NC
Idle, Motion Stopped	C	C	C	NC	NC
Initializing	C	C	C	NC	NC
Faulted	C	C	C	NC	NC
Referencing	C	C	NC	NC	NC
Porting	C	C	NC	NC	NC
Loading	C	C	NC	NC	NC
Fluidic Mode Active	C	C	NC	NC	NC
Production Mode Active	NC*	NC	NC	NC	NC
Parking Port	C	C	NC	NC	NC
Port Parked	C	C	NC	NC	NC
Unparking Port	C	C	NC	NC	NC
* NC only during discharge portion of Production Mode; otherwise, C during dwells, drawback, reload, etc.					

Fault Output Table	
Fault Output	**Fault**
Idle	C
Idle, Reference Required	C
Idle, Load Required	C
Idle, Production Mode Disabled	C
Idle, Fluidic Mode Disabled	C
Idle, Not Configured	C
Idle, Motion Stopped	C
Initializing	C
Faulted	NC
Referencing	C
Porting	C
Loading	C
Fluidic Mode Active	C
Production Mode Active	C
Parking Port	C
Port Parked	C
Unparking Port	C
* Fault logic such that a broken connection between controller and PLC will appear as a Fault	

Output 3 & 4 Table				
Output 3 & Output 4	**Other Settings**	**Reference Req'd**	**Load Req'd**	**Port Park**
Idle	*	NC	NC	NC
Idle, Reference Required	*	C	NC	NC
Idle, Load Required	*	NC	C	NC
Idle, Production Mode Disabled	*	NC	NC	NC
Idle, Fluidic Mode Disabled	*	NC	NC	NC
Idle, Not Configured	*	NC	NC	NC
Idle, Motion Stopped	*	NC	NC	NC
Initializing	*	NC	NC	NC
Faulted	*	NC	NC	NC
Referencing	*	C	NC	NC
Porting	*	NC	NC	NC
Loading	*	NC	C	NC
Fluidic Mode Active	*	NC	NC	NC
Production Mode Active	*	NC	NC	NC
Parking Port		NC	NC	C
Port Parked		NC	NC	C
UnparkingPort		NC	NC	C
* Production Discharge, Production, Moving, Idle, Ready for Production same as Ready Output, see table above.				

Config Input 4 - The Config Input 4 setting determines the signal function for the 4th input. Refer to the following table for selections. For "front panel enable" functions, the indicated functions are only enabled when the input is applied, all other front panel functions are enabled regardless of the input (with the correct permission level).

Ready Out - The 'Ready Out' signal indicates the active/idle state of the Controller Module. The output is true when the Controller Module is 'ready'. This output is false if the Controller Module is not 'ready'.

Fault Out - The 'Fault Out' signal indicates a fault has been detected in the operation. This output is complemented, i.e., the output is true when no fault exists and is false when one or more faults exist.

Config Out 3 - The Output 3 Config settings determines the signal type for the 3rd output.

Config Output 4 - The Output 4 Config settings determines the signal type for the 4th output.

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.

Connections

All connections are through a 37-pin circular plastic connector, with the mating connector (AMP # 206150-1), backshell (AMP
206138-1), pins (AMP # 66105-4), and key (AMP # 200821-1) supplied with the unit. Table 3.1 shows the connector pin layout.

Table 3.1 LOGIC I/O Interface

PIN	SIGNAL	PIN	SIGNAL
1	TRIGGER IN +	20	(reserved)
2	TRIGGER IN -	21	(reserved)
3	CONFIG IN 2 +	22	(reserved)
4	CONFIG IN 2 -	23	Key
5	CONFIG IN 3 +	24	(reserved)
6	CONFIG IN 3 -	25	(reserved)
7	CONFIG IN 4 +	26	(reserved)
8	CONFIG IN 4 -	27	(reserved)
9	Key	28	(reserved)
10	READY OUT +	29	(reserved)
11	READY OUT -	30	(reserved)
12	FAULT OUT+	31	(reserved)
13	FAULT OUT -	32	(reserved)
14	CONFIG OUT 3 +	33	(reserved)
15	CONFIG OUT 3 -	34	(reserved)
16	CONFIG OUT 4 +	35	(reserved)
17	CONFIG OUT 4 -	36	(reserved)
18	Key	37	(reserved)
19	(reserved)		

3.3.11 RS232 Serial Interface

The RS232 serial interface provides control of all functions available, with electrical isolation between the RS232 input signals and the internal control electronics (isolated power shared with CC TRIG input). The hardware is configured as RS232 Data Communications Equipment (DCE) standard with the pin configuration shown in Table 3.2.

Table 3.2 RS232 Interface Connections (DCE, 9 pin D-sub female)

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

No hardware signals are currently used for handshaking.

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

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

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.

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 local echo of sent characters.

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

<cmd> Command
First alphabetic character seen in the command string will be evaluated as the command character. All nonalphabetic characters before the first alphabetic character are ignored.
All subsequent alphabetic characters will cause the entire command to be ignored and the response will include the 'second command character' warning.

Command characters **are case sensitive**. (lower case only)
An error response will be generated for any command string not containing a valid command. An exception is a <CR> response will be generated for each command string containing only a <CR>.

<value1> First numerical parameter

The first 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 cause an error response.
A field delimiter character after the command character and before the first numerical character will be interpreted as the first parameter having 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

A null argument will be evaluated as a value of zero if there are no numerical characters between the field delimiter for the first parameter and a following field delimiter. If there is a field delimiter for the first parameter, immediately followed by the end of command character, it will be evaluated as having no second parameter.

<value3> Third numerical parameter

This is a read only parameter and all numerical values will be ignored. All values in the command string which are not required by the command specified will be ignored.

Following is an example of a command string.

p1,100<CR> Command p1 (valving speed) a setting of 100%.

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

Response String

The response from the Controller Module has a format which is very similar to the command with the addition of a fault or warning value.

<name> Represents an 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:
<cmd><value1>,<value2>,<value3><C
R>

The description for the response string above follows the structure of the command string previously described except for value3 which is a warning or fault code. Some responses to errant command strings contain special identifiers in the <cmd> location.

Commands

The command set controls the overall settings of the system. Tables 3.3 list the commands.

NOTE

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

<value3> has been omitted from the response in this table, but will either be a 0 if no faults or warnings exist, or will provide the fault or warning number.

Table 3.3 Commands

Command	Response	Description
a => Autoload		
a or a0		a0,<value2>
a0,<value2>	a0,<value2>	Returns current Load Operation setting.
		Load Operation.
		<value2>:
		0 = Manual
		1 = Empty (default)
a1	a1,<value2>	2 = Every
a1,<value2>	a1,<value2>	Returns current MCV Conserve Mode setting.
		MCV Conserve Mode.
		<value2>:
		0 = disabled
a2	a2,<value2>	1 = enabled (default)
a2,<value2>	a2,<value2>	Returns current Autotrigger Mode setting.
		Autotrigger Mode.
		<value2>:
		0 = Disabled (default)
		1 = Count
a3	a3,<value2>	2 = Infinite
a3,<value2>	a3,<value2>	Returns current Autotrigger Count setting.
		Autotrigger Count.
		<value2>:
		2 = minimum (default)
a4	a4,<value2>	65535 = maximum
a4,<value2>	a4,<value2>	Returns current Autoreload Count setting.
		Autoreload Count.
		<value2>:
		0 = minimum (default)
b => BEGIN		65535 = maximum
b or b0	b0,0	
b1	b1,0	Begin Production Mode operation.
c => CLEAR FAULTS		Begin Fluidic Mode operation.
c or c0		c0,<value2>
d => DIRECTION		Clears all faults and reference pump.
d or d0		d0,<value2>
d0,<value2>	d0,<value2>	Returns current Production Mode direction setting.
		Sets the Production Mode fluid direction.
		<value2>:
		0 = Reverse
d1	d1,<value2>	1 = Forward (default)
d1,<value2>	d1,<value2>	Returns current Fluidic Mode direction setting.
		Sets the Fluidic Mode fluid direction.
		<value2>:
		0 = Reverse
e => END		1 = Forward (default)
e or e0	e0	

Command	Response	Description
f => REFERENCE		
f or f0	f0	References the pump.
g => TOTALIZER		
g or g0	g0,<value2>	Returns the volume totalizer value in microliters.
g0,<value2>	g0,<value2>	Resets the volume totalizer to 0. <value2>: 0 = Resets the totalizer value to zero.
g1	g1,<value2>	Returns the cycle totalizer value in number of Cycles.
g1,<value2>	g1,<value2>	Resets the cycle totalizer to 0. <value2>: 0 = Resets the totalizer value to zero.
g2	g2,<value2>	Returns the last prime volume/agitate volume read in microliters.

MAX VALUE: *The totalizer will increment to a maximum value of 3,999,999,999 then 'wrap around'.*

h => HARDWIRED READY SIGNAL OPERATION		
h or h0	h0,<value2>	Returns the Auxiliary Output configuration setting.
h0,<value2>	h0,<value2>	Sets the Auxiliary Output configuration. <value2> 0 = Disabled 1 = Conducts during fluid mode 2 = Conducts during both (default) 3 = Conducts during prod mode
h1	h1,<value2>	Returns the Controller address for RS485 serial interface setting.
h1,<value2>	h1,<value2>	Sets the Controller address for RS485 serial interface configuration. <value2> 0 = Minimum (default) 99 = Maximum
h2,<value2>	h2,<value2>	Sets the contrast percentage. <value2> 30 = Minimum 50 = (default) 70 = Maximum
h12	h12,<value2>	Returns the Input 2 setting.
h12,<value2>	h12,<value2>	Sets the Input 2 configuration. <value2> 0 = Clear fault & reference 1 = Fluidic trigger 2 = Enable motion 9 = Load trigger (default) 10 = Port Park
h13	h13,<value2>	Returns the Input 3 setting.
h13,<value2>	h13,<value2>	Sets the Input 3 configuration. <value2> 0 = Clear fault & reference (default) 1 = Fluidic trigger 2 = Enable motion 9 = Load trigger 10 = Port Park
h14	h14,<value2>	Returns the Input 4 setting.
h14,<value2>	h14,<value2>	Sets the Input 4 configuration. <value2>

Command	Response	Description
		0 = Clear fault & reference
		1 = Fluidic trigger (default)
		2 = Enable motion
		3 = Enable recipe save
		4 = Enable recipe save & value change
		5 = Enable recipe save, value change & prime direction
		6 = Enable recipe save, value change & recipe get
		7 = Enable recipe save, value change, prime direction & recipe get
		8 = Enable recipe save, value change, prime direction, recipe get & start stop
		9 = Load trigger
h21	h21,<value2>	Returns the Ready Output setting.
h21,<value2>	h21,<value2>	Sets the Ready Output configuration.
		<value2>
		0 = Disabled
		1 = Busy during discharge only
		2 = Busy during production operation only
		3 = Busy moving
		4 = Ready out idle
		5 = Ready Out for production operation (default)
h23	h23,<value2>	Returns the Output 3 setting.
h23,<value2>	h23,<value2>	Sets the Output 3 configuration.
		<value2>
		0 = Disabled
		1 = Busy during discharge only
		2 = Busy during production operation only
		3 = Busy moving
		4 = Ready out idle
		5 = Ready Out for production operation
		6 = Reference Required
		7 = Load Required (default)
		8 = Port Park
h24	h24,<value2>	Returns the Output 4 setting.
h24,<value2>	h24,<value2>	Sets the Output 4 configuration.
		<value2>
		0 = Disabled
		1 = Busy during discharge only
		2 = Busy during production operation only
		3 = Busy moving
		4 = Ready out idle
		5 = Ready Out for productionoperation
		6 = Reference Required (default)
		7 = Load Required
		8 = Port Park

k => KEYLOCK

k or k0	k0,<value2>	Returns the current Motion setting.
k0,<value2>	k0,<value2>	Sets the Motion configuration.
		<value2>
		0 = Disable
		1 = Enable (default)
k1	k1,<value2>	Returns the current Front Panel Lock setting.

Command	Response	Description
k1,<value2>	k1,<value2>	Sets the Front Panel Lock configuration. <value2> 0 = Enable All (default) 1 = Disable Recipe Save 2 = Disable Recipe Save & Value Change 3 = Disable Recipe Save, Value Change & Prime Direction 4 = Disable Recipe Save, Value Change & Recipe Get 5 = Disable Recipe Save, Value Change, Recipe Get & Prime Direction 6 = Disable Recipe Save, Value Change, Recipe Get Prime Direction & Start Stop
k2	k2,<value2>	Returns the current Change Permission level. 0 = Operator 1 = I/O Test 2 = Supervisor (default)
k2,<value2>	k2,<value2>	Change Permission. <value2> Password for Desired Permission Level in command Current Permission Level in response. Maximum: 65,535 Minimum: 10
k3	k3,<value2>	Returns the current Power Up Permission setting.
k3,<value2>	k3,<value2>	Sets the Power Up Permission configuration. <value2> 0 = Operator 1 = Last at Power Off (default)

l => LOAD

l or l0	l0	Begin a load operation.

m => MODE

m or m0	m0,<value2>	Returns the current Production Mode.
m0,<value2>	m0,<value2>	Sets the Production Mode. <value2>: 0 = Disabled 2 = Dispense (default) 3 = Meter 7 = Dispense minimum chamber volume 8 = Dispense multi-chamber 9 = Meter multi-chamber
m1,<value2>	m1,<value2>	Sets the Fluidic Mode. <value2>: 0 = Disabled 1 = Prime (default) 4 = Bubble Clear 6 = Agitate

n => RECIPE

n or n0	n0,<value2>	Returns the current Recipe Number.
n0,<value2>	n0,<value2>	Get the Specified Recipe. <value2>: Maximum: 32 Minimum: 1

Command	Response	Description
n98,<value2>	n98,<value2>	Saves the current values to specified recipe if recipe is blank. <value2>: Maximum: 32 Minimum: 1
n99,<value2>	n99,<value2>	Saves the current values to specified recipe and overwrites any existing recipe. <value2>: Maximum: 32 Minimum: 1

p => PORT

p or p0	p0,<value2>	Returns the Active Port setting.
p0,<value2>	p0,<value2>	Sets the Active Port. <value2>: 0 = Port A 1 = Port B (default)
p1	p1,<value2>	Returns the Valving Speed percentage setting.
p1,<value2>	p1,<value2>	Sets the Valving Speed percentage. <value2>: Maximum: 100 (default) Minimum: 1
p2	p2,<value2>	Returns the Park Position
p2, <value2>	p2,<value2>	Sets the Park Position Maximum: 359 Minimum: 0 Default: 180
p3	p3,<value2>	Parks/unparks the Port <value2>: 0 = unpark port 1 = park port

q => READY/BUSY

q or q0	q0,<value2>	Indicates the current operation state. <value2>: 0 = Idle 1 = Priming 2 = Dispensing 3 = Metering 4 = Drawback Dwell 5 = Drawback 6 = Fault 7 = Referencing 8 = Initializing (on power-up) 9 = Pre-op dwelling 10 = Post-op dwelling 11 = Auto dwelling 12 = Isolating (agitate mode) 13 = Agitating 14 = Returning (agitate mode) 15 = Bubble Clear 16 = Loading 17 = Porting (upon changing the active port setting) 18 = Agitate Dwelling 19 = Parking Port

Command	Response	Description
		20 = Port Parked 21 = Unparking Port 26 = A fault is being cleared
r => RATE		
r or r0	r0,<value2>	Returns the current Production Mode dispense rate
r0,<value2>	r0,<value2>	Sets the current Production Mode dispense rate in microliters per second. <value2>: Maximum:(Pump Dependent) Minimum: (Pump Dependent)
r1	r1,<value2>	Returns the current Fluidic Mode dispense rate.
r1,<value2>	r1,<value2>	Sets the current Fluidic Mode dispense rate in microliters per second. <value2>: Maximum:(Pump Dependent) Minimum: (Pump Dependent)
r2	r2,<value2>	Returns the current Production Mode load rate.
r2,<value2>	r2,<value2>	Sets the current Production Mode load rate in microliters per second. <value2>: Maximum:(Pump Dependent) Minimum: (Pump Dependent)
r3	r3,<value2>	Returns the current Fluidic Mode load rate.
r3,<value2>	r3,<value2>	Sets the current Fluidic Mode load rate in microliters per second. <value2>: Maximum:(Pump Dependent) Minimum: (Pump Dependent)
s => STATUS		
s0	s0,<value2>	Returns the volume remaining in the chamber.
s3	s3,<value2>	Dump parameters, multiple line response.
s4	s4,<value2>	Dump status, multiple line response.
s5	s5,<value2>	Returns the Chamber Location - piston location relative to home.
s6	s6,<value2>	Returns the Chamber Volume in microliters.
s8	s8,<value2>	Returns the current Fault Code.
s9	s9,<value2>	Returns the current Error Code.
s10	s10,<value2>	Returns the Assert SW Number.
s11	s11,<value2>	Returns the Assert SW Code.
s12	s12,<value2>	Returns the Assert HW Number.
s13	s13,<value2>	Returns the Assert HW Code.
s14	s14,<value2>	Returns the Serial Number.
t => DWELL		
t2	t2,<value2>	Returns the current Pre-Op Dwell in seconds.
t2,<value2>	t2,<value2>	Sets the Pre-Op Dwell. <value2>: Maximum: 2.55 Minimum: 0.00 (default)
t3	t3,<value2>	Returns the current Post-Op Dwell in seconds.
t3,<value2>	t3,<value2>	Sets the Post-Op dwell. <value2>: Maximum: 2.55 Minimum: 0.00 (default)

Command	Response	Description
t4	t4,<value2>	Returns the current Autotrigger Dwell in seconds.
t4,<value2>	t4,<value2>	Sets the Autotrigger Dwell. <value2>: Maximum: 300.00 Minimum: 0.00 (default)
t5	t5,<value2>	Returns the Bubble Intake / Agitate Dwell in seconds.
t5,<value2>	t5,<value2>	Sets the Bubble Intake / Agitate Dwell . <value2>: Maximum: 300.00 Minimum: 0.00 Default: 0.05

v => DISPENSE VOLUME

v or v0	v0,<value2>	Returns the Production Mode volume.
v0,<value2>	v0,<value2>	Sets the Production Mode volume. <value2>: Dependent on pump selection and mode.
v1	v1,<value2>	Returns the Fluidic Mode volume.
v1,<value2>	v1,<value2>	Sets the Fluidic Mode volume. <value2>: Dependent on pump selection and mode
v2	v2,<value2>	Returns the Load Threshold.
v2,<value2>	v2,<value2>	Sets the Load Threshold. <value2>: Dependent on pump selection and Mode
v3	v3,<value2>	Returns the Fluidic Mode isolation volume.
v3,<value2>	v3,<value2>	Sets the Fluidic Mode isolation volume. <value2>: Dependent on pump selection and Mode

w => DRAWBACK

w or w0	w0,<value2>	Returns the Drawback Volume in microliters.
w0,<value2>	w0,<value2>	Sets the Drawback Volume. <value2>: Minimum = 0 Maximum = Chamber volume of current pump - Dispense Volume
w1	w1,<value2>	Returns the current Drawback Rate in microliters/second.
w1,<value2>	w1,<value2>	Sets the Drawback Rate. <value2>: Dependent on pump selection and Mode
w2	w2,<value2>	Returns the current Drawback Dwell in seconds.
w2,<value2>	w2,<value2>	Sets the Drawback Dwell. <value2>: Maximum: 2.55 Minimum: 0.00 Default: 0.05

y => MOTOR/BASE

y or y0	y0,<value2>	Returns the current Acceleration setting.
y0,<value2>	y0,<value2>	Sets the Acceleration configuration. <value2>: 0 = Slow

Command	Response	Description
		1 = Medium 2 = Standard (default) 3 = Fast
y1	y1,<value2>	Returns the current Torque setting.
y1,<value2>	y1,<value2>	Sets the Torque Configuration. <value2>: 0 = Low 1 = Medium (default) 2 = High
y6	y6,<value2>	Returns the current Pump / Actuator selection.
y6,<value2>	y6,<value2>	Sets the Pump / Actuator configuration. <value2>: 0 = None / none (default) 1 = 4A / 40 Pitch 2 = 3A / 40 Pitch 3 = 2A / 40 Pitch 4 = 1A / 40 Pitch 5 = B / 20 Pitch 6 = C / 20 Pitch 7 = D / 20 Pitch
y8	y8,<value2>	Returns the Encoder setting.
y8,<value2>	y8,<value2>	Sets the Encoder setting. <value2>: 0 = Disabled (default) 1 = Enabled
y9	y9,<value2>	Returns the Encoder Lines.
y9,<value2>	y9,<value2>	Sets the Encoder Lines. <value2>: Maximum: 4000 Minimum: 200 (default)
y10,	y10,<value2>	Returns the Pump 90 degree offset.
y10,<value2>	y10,<value2>	Sets the Pump 90 degree offset. <value2>: 0 = Disabled (default) 1 = Enabled

z => SOFTWARE VERSION

z or z0	z0,<value2>	Returns the Software Version as text. This is the only command that returns a text value, rather than a numerical value.
z1	z1,<value2>	Returns the Current device type (DS3020)
z2	z2,<value2>	Returns the firmware CRC

3.3.12 Warnings

Warnings indicate problems in the command received, or a state of the Actuator Module which prohibits immediate operation. 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 **Can't Start, Load Required** - A load must be initiated to continue.
4 **Can't Start, Reference Required** - The pump must be referenced to continue.
5 **Production Mode Disabled** - An attempt was made to run in production mode while it is disabled.
8 **Serial In Motion Not Enabled** - Serial command sent to begin motion while motion disabled due to serial command. (k0)

11 Second Command Character - A second command character (alphabetic character) was seen in a single command (before <CR> character). Entire command is ignored.
15 Descriptor Not Valid - First numerical value not valid for command letter.
16 Recipe Is Blank
17 Recipe Is Not Blank
18 Motion Is Disabled Via Logic - Serial command sent to begin motion while motion disabled due to logic input.
20 Command Missing - The command string did not contain an alphabetic character. The '?' character will be inserted in place of the <cmd> field in the response.
21 Command String Overflow - The length of the command string exceeded the input buffer.
22 Unexpected Character in Command String - There was a character in the command string that was not alphabetic, numerical, or a field delimiter .
23 Not Configured - Pump not selected.
24 Fluidic Mode Disabled - A Fluidic Mode operation was initiated but Fluidic Mode is disabled.
25 Invalid Permission for Command - The permission setting is too low for the command sent.
26 Can't Start, Other Operation Active - An operation was attempted while another operation is active.
26 Can't Start, Port Parked

3.3.13 Faults

Faults are a result of the system detecting improper operation of the Actuator Module. All fault numbers will be greater than or equal to 1000. The 'clear faults' command must be used before any subsequent operation of the affected channel is performed.

Faults cause the Fault screen (section 3.2.7.11) to appear. If a fault occurs, the type of fault will be displayed on the screen. Once the problem is corrected, press the Reference push-button.

After a fault, the normal action is to "CLEAR FAULT", which will also reference the actuator if required. If repeated "CLEAR FAULTS" all result in faults, go through Setup A screen to Setup C screen and insure TORQUE = HIGH. Return to the Fault screen and clear the fault.

1001 Piston Home - "Home" position sensor for the piston was not detected or detected at wrong location.

1002 Port Home - "Home" position sensor for valving was not detected or detected at wrong location.

NOTE

If "PORT HOME" fault repeatedly appears, the piston may be jammed against the end of the chamber. Push "MOVE PISTON" to move the piston a short distance away from the end of the chamber before referencing.

1003 Piston Stall - Encoder indicates stall during piston movement.
1004 Port Stall - Encoder indicates stall during valving.
1005 Motor Drive - Signal from motor drive module - short circuit sensed at motor connections.
1013 Non-Volatile Memory - Error in reading from or writing to the non-volatile memory (recipes and power-up values).
1014 Low Voltage - Blown motor fuse on main circuit board, malfunction in main power supply, malfunction on main circuit board.
1015 Step Motor Hardware (ADC) - A problem with motor control was detected.
1016 Internal Software - An error was detected in the internal software.
1017 Motion Disabled during Operation - Either the Motion Enable signal or the serial command disabling motion occurred during an operation.

3.3.14 Operating The System

There are several different modes of operation providing 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.

3.3.14.1Setup (Figure 3.6)

The following steps will guide you through a basic setup for turning your system on for the first time:

1. On the rear of the Controller Module

a. Make sure the 1/0 (On/Off) (1a) switch is set to 0 (Off).
b. Connect the power cord to the Controller Module (1b) and the power source.
c. Connect the Actuator Cable; the larger connector connects to the Controller Module (1c).

2. On the Actuator Module

a. Connect the other end of the Actuator Cable (2a).
b. Make sure the Actuator is secure.

3. Set the inlet and outlet port configuration. Refer to section 3.1.6.

4. On the Pump Module

NOTE

Make sure the inlet tubing is larger than, or the same size as, the outlet tubing. Start with the reservoir even with or slightly higher than the Pump Module and the Pump Module even with or slightly higher than the dispense tip. Adjust as necessary to fit your application.

a. Connect the inlet fitting and tubing (3a)
b. Connect the gland inlet fitting and tubing (3b) (*****optional)
c. Connect the outlet fitting and tubing (3c)
d. Connect the gland outlet fitting and tubing (3d) (*****optional)

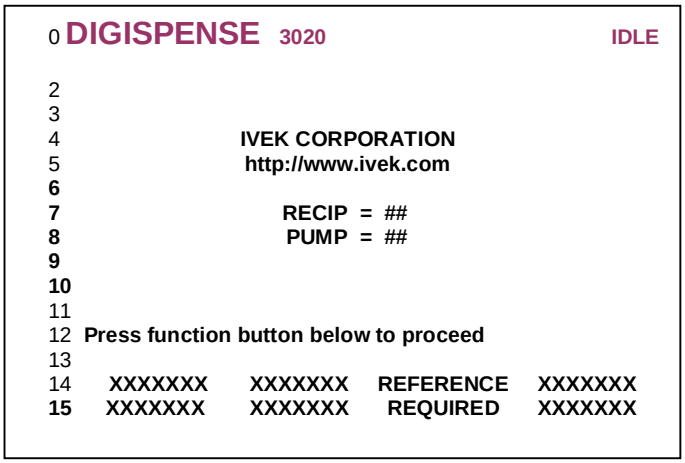
3.3.14.2 Start-up

a. Switch the 1/0 power switch to the "1" position.

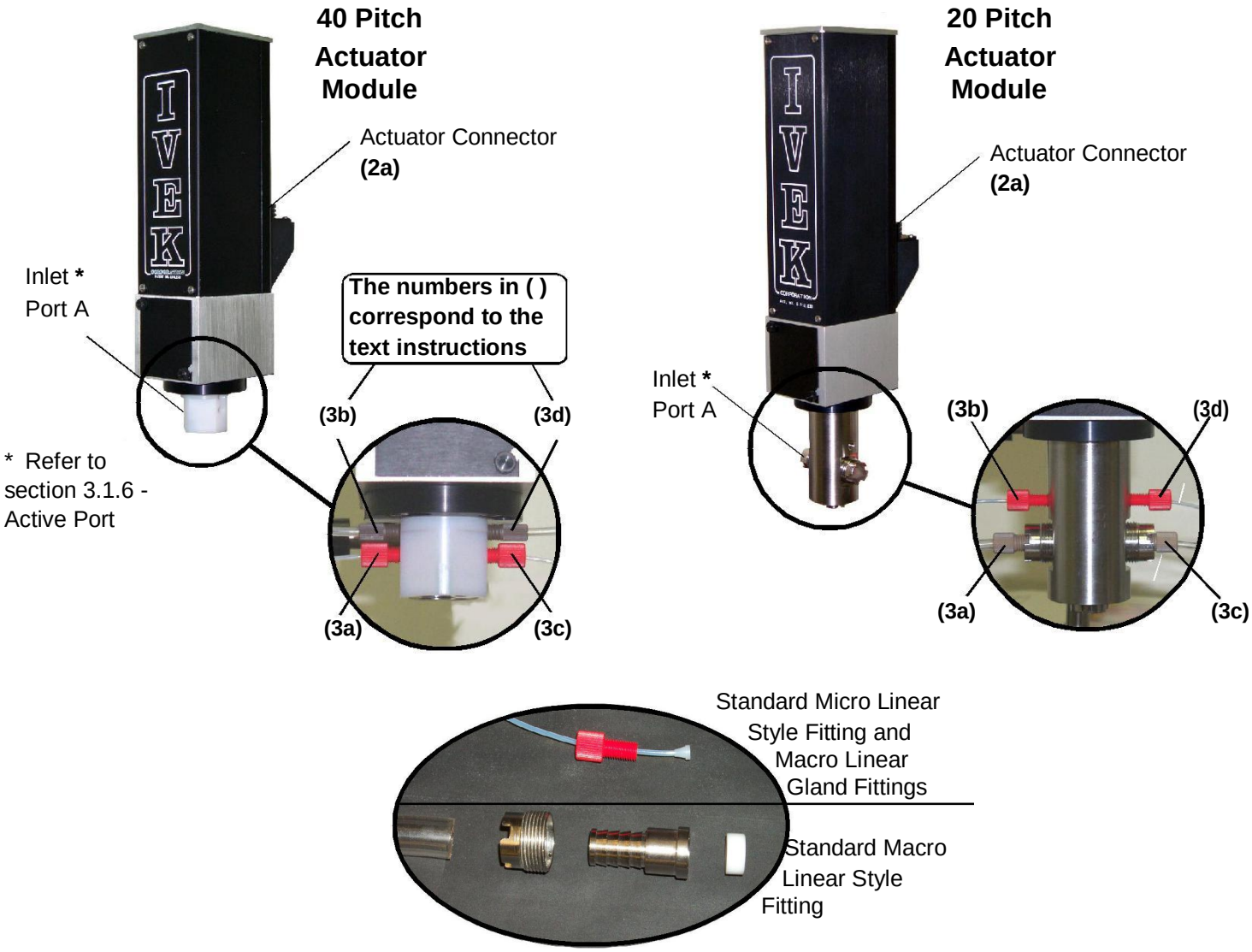
b. The display will illuminate and show the following information. The status will change from Initializing to Idle and the information for **your** system will be displayed including the current recipe and pump size and there may have additional push-button selections depending on your system settings.

Refer to Section 3.2.4 in your manual for field descriptions.

REFERENCE REQUIRED may be flashing indicating the system needs to be referenced or SETUP C may be flashing indicating no pump is selected.



c. Press the Reference push-button to reference the system and the Actuator Module will reference.



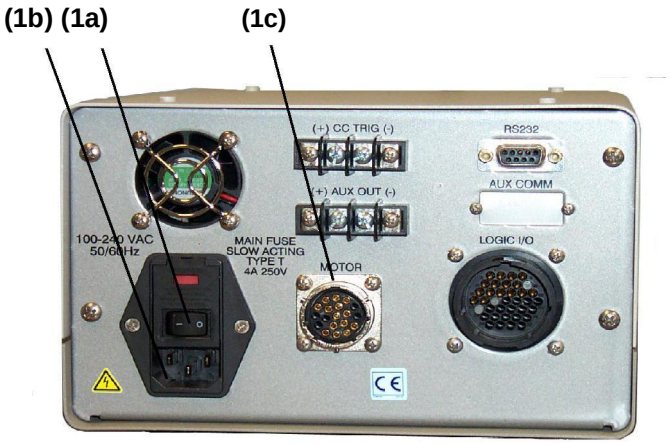


Figure 3.6 Setup

Go to the Dispense section (3.3.14.4) or Meter section (3.3.14.7) if the system has previously been primed. If not, follow the instructions in the following section.

NOTE

All Controller Modules are shipped from the factory set to Supervisor Level.

3.3.14.3 Prime

Press the PRIME SCREEN push-button to enter Prime Mode.

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. To start priming press the START push-button, enter a RS232 command or supply a trigger to the rear panel. The system cannot be initiated using the rear panel "CC TRIG" signal. The system will prime based on the Direction, Volume and Rate settings. Pressing the STOP push-button can stop the priming any time.

3.3.14.4 Dispense

Press the DISPENSE SCREEN push-button to enter Dispense Mode. If the DISPENSE SCREEN is not shown go to SETUP A screen and change Production Mode to DISPENSE.

To start dispensing press the START button, enter a RS232 command or supply a trigger to the rear panel. The system will dispense based on the Direction, Volume, Rate, Load Rate, Load Threashold and Drawback settings. Pressing the STOP push-button can stop the dispensing any time.

When drawback is enabled, the Volume setting specifies the net fluid displaced, the actual forward motion is the sum of the specified dispense volume and the drawback volume. The Drawback Rate during drawback and the Drawback Dwell (time between the forward and reverse portions of the cycle) settings are shown on the Drawback screen.

3.3.14.5 Dispense MCV

Press the DISPENSE SCREEN push-button to enter Dispense MCV Mode. If the DISPENSE SCREEN is not shown or if the Dispense screen appears go to SETUP A screen and change Production Mode to DISPENSE MCV.

To start dispensing press the START button, enter a RS232 command or supply a trigger to the rear panel. The system will dispense based on the Direction, Volume, Rate, Load Rate, MCV Conserve Fluid and Drawback settings. Pressing the STOP push-button can stop the dispensing any time.

When drawback is enabled, the Volume setting specifies the net fluid displaced, the actual forward motion is the sum of the specified dispense volume and the drawback volume. The Drawback Rate during drawback and the Drawback Dwell (time between the forward and reverse portions of the cycle) settings are shown on the Drawback screen.

3.3.14.6 Dispense Mult

Press the DISPENSE SCREEN push-button to enter Dispense Mult Mode. If the DISPENSE SCREEN is not shown or if the Dispense screen appears go to SETUP A screen and change Production Mode to DISPENSE MULT.

To start dispensing press the START button, enter a RS232 command or supply a trigger to the rear panel. The system will dispense based on the Direction, Volume, Rate and Load Rate. Pressing the STOP push-button can stop the dispensing any time.

3.3.14.7 Meter

Press the METER SCREEN push-button to enter Meter Mode. If the METER SCREEN is not shown go to SETUP A screen and change Production Mode to METER.

To start metering press the START button, enter a RS232 command, or supply a trigger to the rear panel. The system will meter based on the Direction, Load Threshold, Rate, Load Rate and Drawback settings. Pressing the STOP push-button can stop the priming any time.

The Drawback Rate during drawback and the Drawback Dwell (time between the forward and reverse portions of the cycle) settings are shown on the Drawback screen.

3.3.14.8 Meter Mult

Press the METER SCREEN push-button to enter Meter Mult Mode. If the METER SCREEN is not shown or if the METER screen appears go to SETUP A screen and change Production Mode to METER MULT.

To start metering press the START button, enter a RS232 command or supply a trigger to the rear panel. The system will meter based on the Direction, Rate and Load Rate. Pressing the STOP push-button can stop the priming any time.

3.4 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.

3.5 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.

- Main Power Fuse

3.5.1.1 Main Power Fuse

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 covered side on the fuse holder should be up.
2. Close the power entry module's cover.
3. Connect the power cord.

3.6 PROBLEM GUIDE

Table 3.4 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

CC TRIG Signal Requirements (Standard):
Accepts mechanical contact closure or solid state switch capable of +5 VDC @ 15mA (max) Power source in Digispense 3020
DO NOT APPLY VOLTAGE

Logic I/O Trigger In Requirements:
+24 VDC @ 20mA (max), Customer power source

AUX OUT Signal Requirements:
Maximum external voltage: 48 VDC
Maximum current: 250 mA

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.

520219 - # # # # #

Motor
A - 1200 RPM, 44VDC@3A

Logic Interface
A - Trig In (CC), Logic (OI)

Parameter Interface
A - RS232 Serial

Front Panel
A - Membrane Sw, LCD w/LED Bk Lt

Line Cord & Agency Approval
A - US Cord & CE
B - International Cord (no plug) & CE

3.9 ILLUSTRATED PARTS BREAKDOWN

Contact IVEK Corporation Technical Support for information pertaining to replacement parts for this Controller Module.

Table 3.4 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 100 - 240 VAC, 50/60 Hz, rated at 4.0 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.
	Supply Breaker is tripped.	Check or reset breaker at panel.
Power is on, controller accepts a trigger, (START indicator illuminates, STOP indicator does not), motor fails to rotate, and motor is silent.	A motor malfunction can cause this problem.	Turn off controller 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 and pump modules to IVEK Corporation for repair.
Controller power on and operational, but will not actuate pump motor.	Motor Cable	Check the cable connection between the Controller Module and Actuator Module. Inspect and repair faulty cable.
Cannot reach Dispense or Meter screen.	Production mode is disabled.	Go to Setup A screen, change mode to Dispense or Meter.
The XXXX function button is not visible.	Permission level - confirm level on SETUP A screen.	Change permission to a higher level.
	Configurable Input 4 - Confirm current configuration on SETUP B screen.	Apply signal to LOGIC I/O input 4 or change function of Input 4 with "h14" command.
	Inhibited by Serial Interface - Confirm current Lock Front Panel configuration using the 'k1' command.	Change value of 'k1' command.
Power is on, Controller Module accepts a trigger, arrow push-button do not function.	Permission level is Operator - Confirm level in Setup A screen.	Change permission level to Supervisor. In Setup A screen, press Change Permission key, type in password, press enter.
Power is on, display is blank, START and STOP indicators flashing.	The program memory is corrupted.	Cycle power.
Screen displays “Power Down….” For a few seconds before changing to the Power-Up screen	Power switch turned off momentarily.	Make sure nothing is placing pressure on the AC power switch in the back of the unit.

Table 3.4 Common Operational Problems And Solutions - Cont.

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
	AC line briefly disconnected.	Make sure AC line cable is securely fastened to back of unit and to wall outlet.
	A brownout condition occurred on the AC line.	Make sure AC power to unit is available.
	EMI or ESD event.	Make sure unit is grounded to earth through AC line and enclosure cover is on the unit. Keep unit and cable away from high EMI producing equipment and cables
Screen blank upon power-up	Contrast set too low.	Upon power-up, unit will be in Power-up screen. Press FPB4 to enter Contrast Adjust screen and then press Up Arrow until contrast is acceptable.
Screen dark upon power-up	Contrast set too high.	Upon power-up, unit will be in Power-up screen. Press FPB4 to enter Contrast Adjust screen and then press Down Arrow until contrast is acceptable.
No fluid movement.	Pump 90 Degree Offset doesn't match pump orientation.	Make sure pump orientation matches this setting.
Port Home Fault	Fluid viscosity too high for valving speed causing a stall during valving	Reduce valving speed.
	Piston jammed against end of chamber.	Initiate Piston Move. WARNING: may break piston if piston is actually seized, it is advisable to remove the pump before initiating a Piston Move.
	Piston seized.	Refer to Chapter 7.
	Faulty cable connection.	Check the cable connection. Inspect and repair faulty cable.
Piston Home Fault	Fluid viscosity too high for rate of piston movement.	Decrease Dispense Rate, Load Rate, or Acceleration settings.
	Fluid viscosity too high for torque setting.	Increase Torque setting.
	Tubing too small for rate of fluid movement.	Increase tubing diameter.
	Piston seized.	Refer to Chapter 7.
	Faulty cable connection.	Check the cable connection. Inspect and repair faulty cable.

Table 3.4 Common Operational Problems And Solutions - Cont.

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
Port Stall Fault	Encoder enabled on controller with a non-encoder actuator.	Disable encoder on controller
	Fluid viscosity too high for valving speed causing a stall during valving	Reduce valving speed.
	Piston jammed against end of chamber.	Initiate Piston Move. WARNING: may break piston if piston is actually seized, it is advisable to remove the pump before initiating a Piston Move.
	Piston seized.	Refer to Chapter 7.
	Faulty cable connection.	Check the cable connection. Inspect and repair faulty cable.
Piston Stall Fault	Fluid viscosity too high for rate of piston movement.	Decrease Dispense Rate, Load Rate, or Acceleration settings.
	Fluid viscosity too high for torque setting.	Increase Torque setting.
	Tubing too small for rate of fluid movement.	Increase tubing diameter.
	Piston seized.	Refer to Chapter 7.
	Faulty cable connection.	Check the cable connection. Inspect and repair faulty cable.
Motor Module Fault	Disconnected cable while powered.	Turn off power, reconnect cable, turn-on power.
	Shorted cable signal.	Check the cable connection. Inspect and repair faulty cable.
Motor Control Hardware Fault	Component failure in controller.	Recycle power. If fault continues contact IVEK Technical support.
Low Motor Voltage Fault	AC power brownout	Make sure AC power is available to the unit.
Internal Operation Fault	Internal software error	Clear fault and cycle power.
Motion Disabled during Operation Fault	Logic Enable signal disabled, k0,0 command received	Enable Logic, Enable signal , or issue k0,1, Clear Fault

Table 3.4 Common Operational Problems And Solutions - Cont.

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
Backup Recipe Fault	The recipe's backup copy is corrupted.	Re-save the recipe so that both copies will be updated and cycle power.
Recipe Read Fault	Recipe copies corrupted.	Re-configure unit with desired settings and re-save the recipe.
Recipe Read Limit Fault	A parameter stored in the recipe exceeded system limits.	Check all recipe settings and re-save the recipe.
Recipe Read Version Fault	The saved recipe is a different recipe than expected	Check all recipe settings and re-save the recipe.
Recipe Save Backup Fault	A corruption occurred during saving a recipe.	Check all recipe settings and re-save the recipe.
Unable to Save Recipe	A corruption occurred during saving a recipe.	Cycle power, re-configure for desired settings and attempt to save the recipe.
Unable to Erase All Recipes	An error occurred when resetting parameters.	Cycle power and attempt to reset parameters again.
Unable to Erase At Least One Backup Recipe	An error occurred when resetting parameters.	Cycle power and attempt to reset parameters again.
Unable to Erase Any Recipes	An error occurred when resetting parameters.	Cycle power and attempt to reset parameters again.
Backup Parameter Read Fault	The parameters backup copy is corrupted.	Clear fault. Check all parameter values. Cycle power. Check all parameter values.
Parameter Value Out of Bounds Fault	A value in the saved parameters is out of bounds of the system.	Clear fault. Check all parameter values. Cycle power. Check all parameter values.
Parameter Version Fault	The saved parameters contain an unexpected version number	Clear fault. Check all parameter values. Cycle power. Check all parameter values. Reset parameters (WARNING: will reset all recipes).
Parameters Blank Fault	The stored parameters are corrupted.	Clear fault. Check all parameter values. Cycle power. Check all parameter values. Reset parameters (WARNING: will reset all recipes). Cycle power.

Table 3.4 Common Operational Problems And Solutions - Cont.

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
Backup Configuration Read Fault	An error exists in backup copy of the configuration data	Reset parameters (WARNING: will reset all parameters and recipes)
	The stored configuration data is corrupted.	Cycle power.
Configuration Read Fault	The nonvolatile memory is corrupted.	Reset parameters (WARNING: will reset all parameters and recipes)
Configuration Value Out of Bounds Fault	A stored configuration data is corrupted.	Cycle power.
		Reset parameters (WARNING: will reset all parameters and recipes)
Configuration Version Fault	The stored configuration data has an unexpected version	Cycle power.
		Reset parameters (WARNING: will reset all parameters and recipes)
Fluid dispensed during operation does not match setting	Pump size configured in controller does not match actual pump size	Make sure pump size configuration in controller matches pump size attached to actuator.
		If none of the above solves the problem, contact IVEK technical support for assistance.