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3. DIGISPENSE 3020 CONTROLLER MODULE, STYLE B

3.1 DESCRIPTION

The Digispense 3020 Controller Module, Style B, hereafter referred to as the Controller Module, contains all the control, monitoring, and interface components for the dispensing operations. The Controller Module measures 8 1/4" (210mm) wide, 11 1/2" (292mm) deep, 5 3/4" (146mm) high (feet included) and weighs approximately 9.5 pounds (4.3 kilograms). 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.

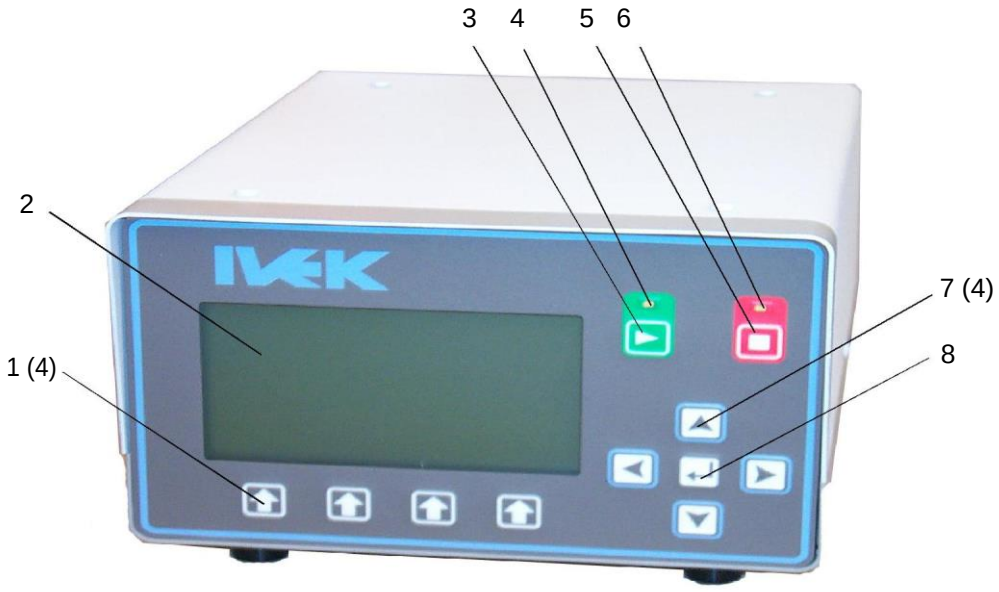


Figure 3.1 Digispense 3020 Controller Module Front Panel

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.

3.1.1.4 Active/Start Indicator (Figure 3.1 Item 4)

The Active Indicator 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 Indicator (Figure 3.1 Item 6)

The Idle Indicator illuminates when the pump is stopped.

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. Power Entry Module
2. Fan
3. MOTOR Connector
4. AUX1 AUX2 Connector
5. CC TRIGGERS Connector
6. USB Connector
7. RS232 Connector
8. RS485 Connector
9. LOGIC I/O Connector

3.1.2.1 Power Entry Module (Figure 3.2 Item 1)

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

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

3.1.2.2 Fan (Figure 3.2 Item 2)

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

3.1.2.3 MOTOR Connector (Figure 3.2 Item 3)

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.

3.1.2.4 AUX1 AUX2 Connector (Figure 3.2 Item 4)

The AUX1 AUX2 (Auxiliary) Connector provides two outputs for triggering a variety of functions. Refer to section 3.3.10.2 for additional information.

3.1.2.5 CC TRIGGERS Connector (Figure 3.2 Item 5)

The CC TRIGGERS (Contact Closure) connector provides two inputs (labeled 1 and 2) and a common for triggering a variety of functions. Refer to section 3.3.10.1 for additional information.

3.1.2.6 USB Connector (Figure 3.2 Item 6)

The USB Connector provides an interface to control a variety of functions. The connector is a type-B device connector. Refer to section 3.3.10.4 for additional information.

3.1.2.7 RS232 Connector (Figure 3.2 Item 7)

The RS232 interface provides control of all available functions and provides point-to-point communication. The hardware is configured as Data Communications Equipment (DCE) standard. Refer to section 3.3.10.4 for additional information.

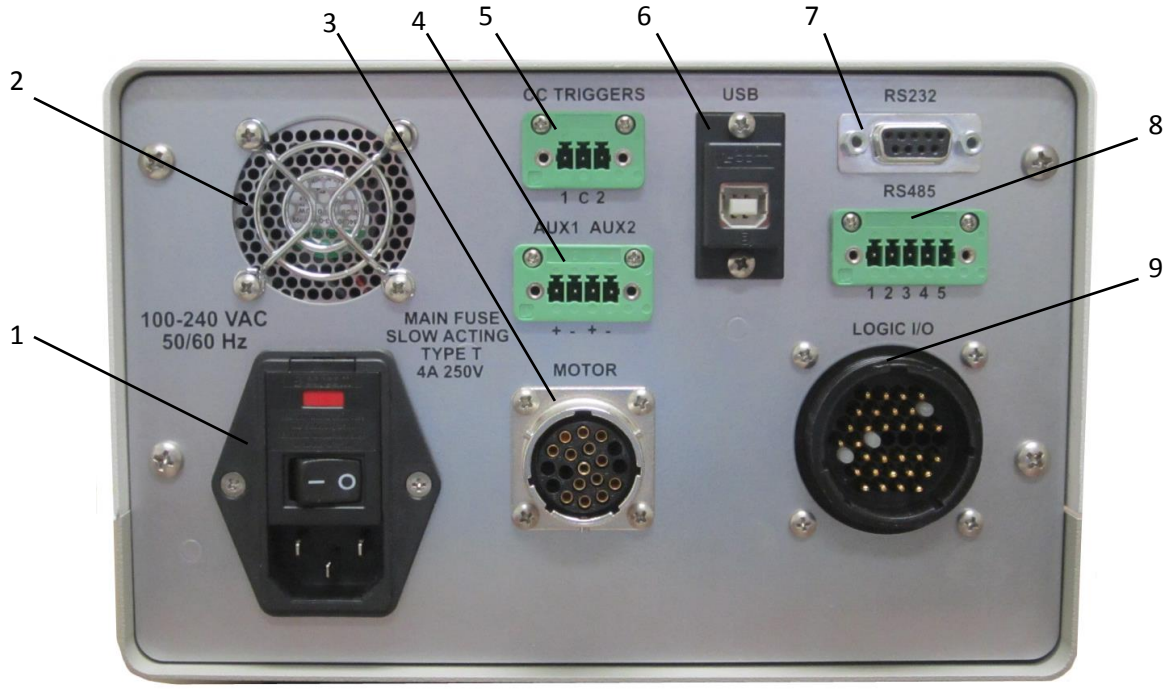


Figure 3.2 Digispense 3020 Controller Module Rear Panel

3.1.2.8 RS485 Connector (Figure 3.2 Item 8)

The RS485 Connector Provides control of all functions and allows for multi-drop communication. Refer to Section 3.3.10.4 for additional information.

3.1.2.9 LOGIC I/O Connector (Figure 3.2 Item 9)

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.

3.1.3 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
Increase 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 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	Less shear at tip
	Lower probability of fluid cavitations	Slightly longer cycle time
Increased Acceleration	More shear at tip	Higher probability of stalls
	Slightly shorter cycle time	Higher probability of fluid cavitations

3.1.7 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.

3.1.8 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

3.1.9 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

3.1.10 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.

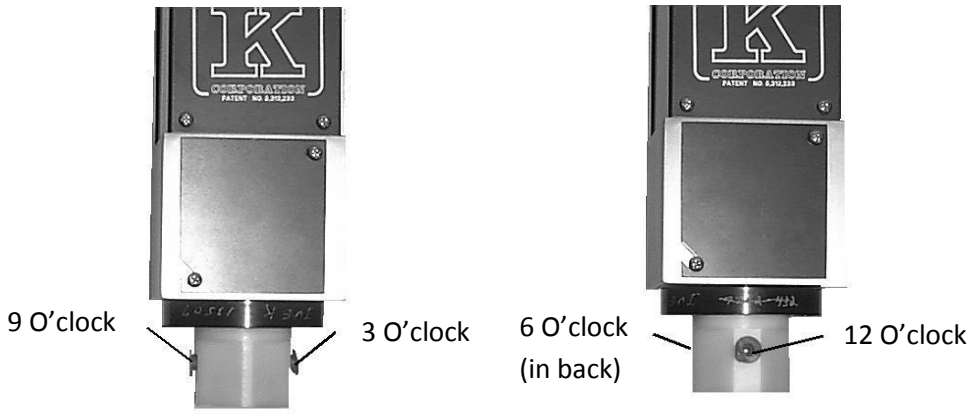
In Forward, Port A is always the input and Port B is the output. In Reverse, Port B is always the input and Port A is the output.

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



3.2 ELECTRICAL

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Industry Canada Compliance to CAN ICES-3 (A)/NMB-3(A).

3.3 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.

3.3.1 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 0.05% 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.

3.3.2 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/RS485/USB 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.

3.3.3 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 0.05% 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.

3.3.4 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.

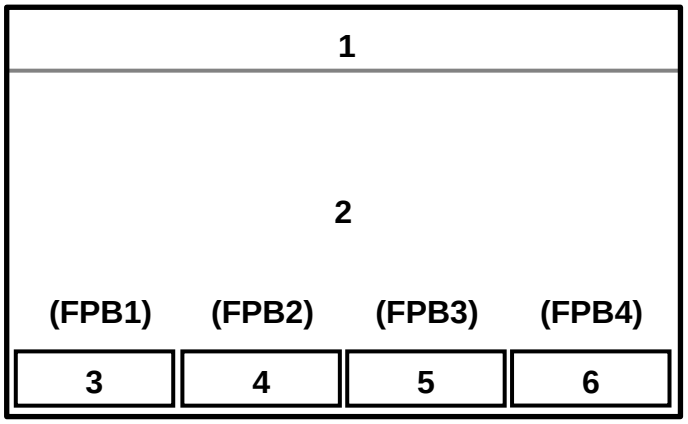
Field 2 - This field displays all the operating parameters.

Fields 3 thru 6 - 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), Configurable Input 2 (section 3.3.10.3) or the value of the Serial Interface "k1" command (Table 3.8).

Field 5 is the FPB3 key described in the Reset Parameter Warning screen (section 3.3.8.23).



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

The permission level can be changed in the Change Permission screen (Section 3.3.8.16).

The highest level is **Keylock**. This level allows access to all items on all screens including the Front Panel Lock. The most typical level is Supervisor, which allows access to all items on all screens other than the Front Panel Lock.

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. Recipes can be selected and loaded, but not changed.

3.3.7 Screens

There are twenty screens used to setup, operate and exit the system. The most commonly used screens are shown in Figure 3.3. Each screen contains information relating to operating the system. Table 3.1 lists each screen alphabetically and provides a brief overview of its function. Figure 3.3 shows the basic screens and provides a map of how to get 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 strokes, cycles, and allows changing volume, recipe, direction, rate and drawback 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 if present.
Meter	Displays total strokes, cycles, and allows changing recipe, direction, rate and drawback settings.
Power up	Displays the controller type.
Prime	Allows changing recipe, direction, rate and duration.
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 #, Permission level and allows changing Mode, Auto Retrigger and Production Dwells settings.
Warning Recipe Exists	Appears when you try to save a recipe using a previously used number.

Table 3.1 Screen Information

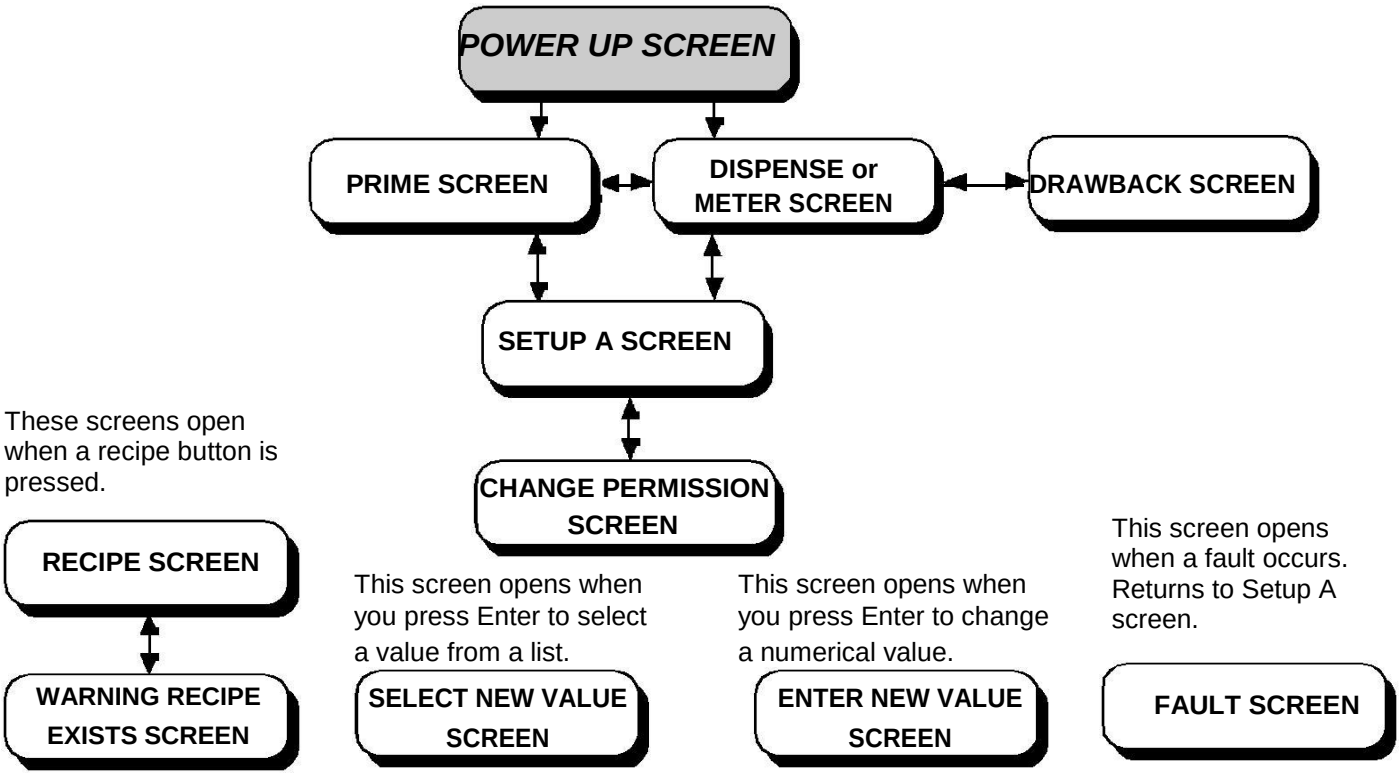


Figure 3.3 Standard Use Screen Navigation

3.3.7.1 Power Up Screen

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

	Keylock/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
```

NOTE

** Field 3 will display PRIME SCREEN when in Prime mode or AGITATE SCREEN when in Agitate mode.*

** Field 4 will display DISPENSE SCREEN when in Dispense mode or METER SCREEN when in Meter mode.*

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.

3.3.7.2 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
```

		Keylock/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

NOTE

** Field 3 will display DISPENSE SCREEN when in Dispense mode or METER SCREEN when in Meter mode.*

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

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

3.3.7.3 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
```

	Keylock/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

NOTE

** Field 3 will display PRIME SCREEN when in Prime mode or AGITATE SCREEN when in Agitate mode.*

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 3.3.8.11.

To change a value;

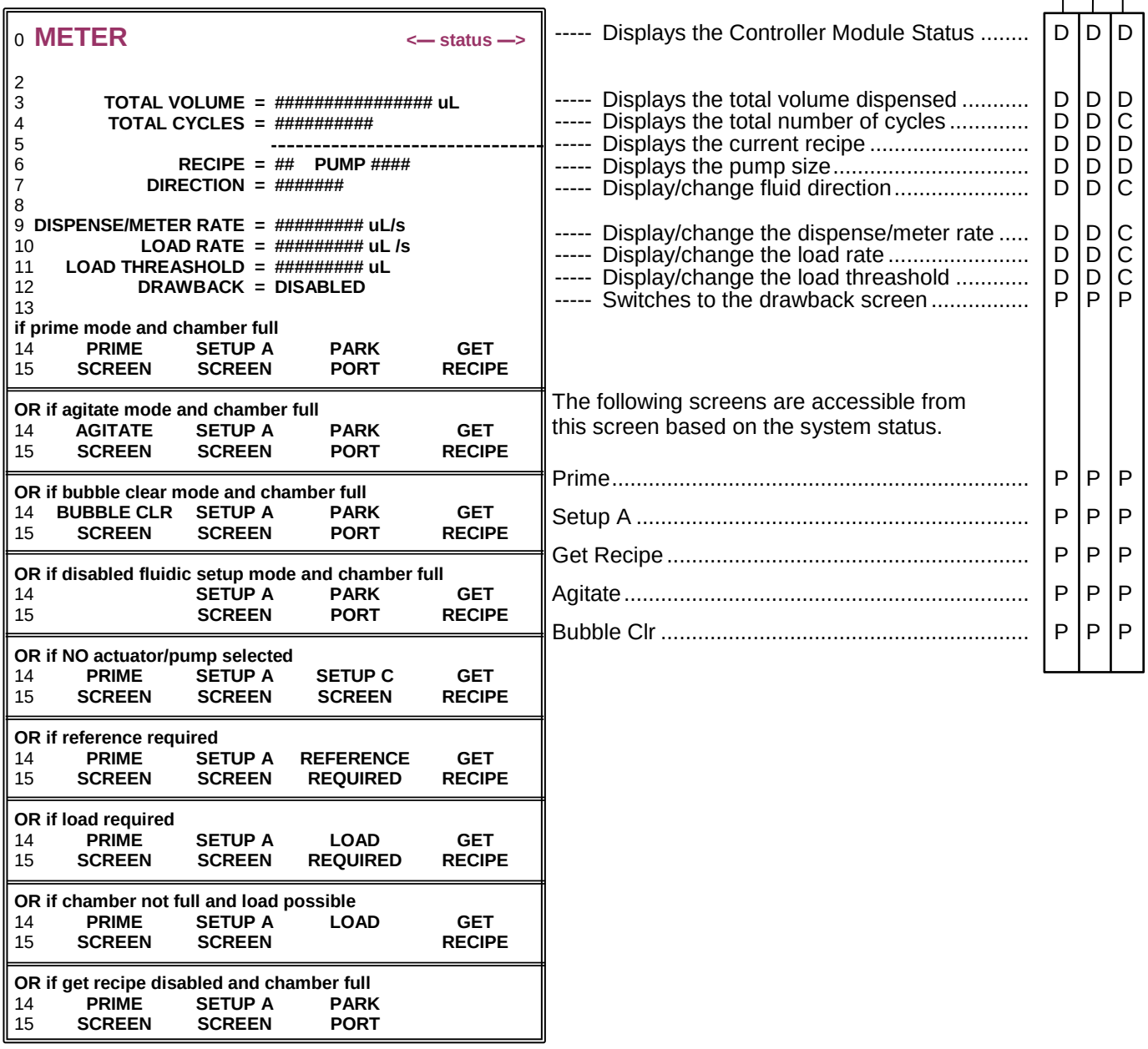
1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or 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

3.3.7.4 Meter Screen

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



		Keylock/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 3.3.8.11.

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

3.3.7.5 Setup A Screen

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

Line	Screen	Description	Operator	I/O Test	Keylock/Supervisor
0	**SETUP A** **<— status —>**	Displays the Controller Module Status	D	D	D
2	------------------------------				
3	**RECIPE = ## PUMP ####**	Displays the current recipe	D	D	D
4					
5	**PRODUCTION MODE = ########**	Display/change the production mode	D	D	C
6	**FLUIDIC SETUP MODE = ######**	Display/change the fluidic setup mode	D	D	C
7	**LOAD MODE = ######**	Display/change the load mode	D	D	C
8	**AUTO RETRIGGER = #######**	Display/change the auto retrigger setting	D	D	C
9	**PRODUCTION DWELLS = #######**	Display/change the production dwells setting	P	P	P
10	**FRONT PANEL LOCK = #######**	Display/change the front panel lock setting	D	D	*
11	**POWER-UP PERMISSION = #################**	Display/change the power up permission	D	D	C
12	**CURRENT PERMISSION = ##########**	Display/change the current permission	D	D	C
13					

if prime mode

Line				
14	**PRIME**	**SETUP B**		**SAVE**
15	**SCREEN**	**SCREEN**		**RECIPE**

OR if agitate mode

Line				
14	**AGITATE**	**SETUP B**		**SAVE**
15	**SCREEN**	**SCREEN**		**RECIPE**

OR if bubble clear mode

Line				
14	**BUBBLE CLR**	**SETUP B**		**SAVE**
15	**SCREEN**	**SCREEN**		**RECIPE**

OR if dispense mode and disabled fluidic setup mode

Line				
14	**DISPENSE**	**SETUP B**		**SAVE**
15	**SCREEN**	**SCREEN**		**RECIPE**

OR if meter mode and disabled fluidic setup mode

Line				
14	**METER**	**SETUP B**		**SAVE**
15	**SCREEN**	**SCREEN**		**RECIPE**

OR if disabled production mode and disabled fluidic setup mode

Line				
14	**GET**	**SETUP B**		**SAVE**
15	**RECIPE**	**SCREEN**		**RECIPE**

OR if prime mode and faulted

Line				
14	**PRIME**	**SETUP B**	**FAULT**	**SAVE**
15	**SCREEN**	**SCREEN**	**SCREEN**	**RECIPE**

OR if prime mode and save recipe disabled

Line				
14	**PRIME**	**SETUP B**		
15	**SCREEN**	**SCREEN**		

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

Screen	Operator	I/O Test	Keylock/Supervisor
Agitate	P	P	P
Save Recipe	P	P	P
Prime	P	P	P
Setup B	P	P	P
Dispense	P	P	P
Meter	P	P	P
Change Permission	P	P	P

*** D for Supervisor**

C for Keylock

NOTE

1. Field 3 will display PRIME SCREEN when in Prime mode or AGITATE SCREEN when in Agitate mode.

2. When Fluidic Setup Mode is disabled, Field 3 will display DISPENSE SCREEN when in Dispense mode or METER SCREEN when in Meter mode.

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.

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 3.3.8.6.

Production Dwells - Refer to Section 3.3.8.6.

Front Panel Lock - The Front Panel Lock locks certain functions based on the selection. The following list shows the available settings and locked function(s).

Settings	Locked Function
DISABLED	Nothing
RS	Recipe Save
RS, VC	Recipe Save, Value Change
RS, VC, PD	Recipe Save, Value Change, Prime Direction
RS&G, VC	Recipe Save and Get, Value Change
RS&G, VC, PD	Recipe Save and Get, Value Change, Prime Direction
RS&G, VC, PD, S	Recipe Save and Get, Value Change, Prime Direction, Start & Stop

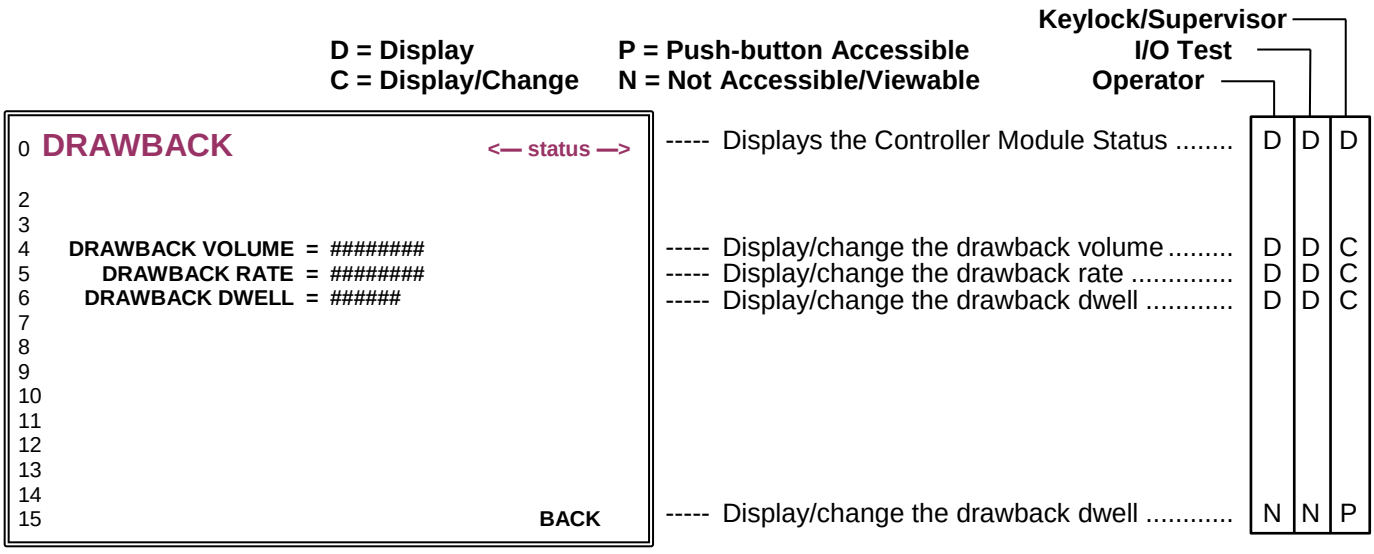
Power-Up Permission - The Power-Up Permission configures the current setting for the permission when the Controller Module is powered on. The mode can be either Operator or Last At Power Off.

Current-Permission - Refer to Section 3.3.8.16.

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.

3.3.7.6 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 3.1.7 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;

5. Press the Arrow push-buttons to highlight the parameter.
6. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
7. 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.
8. Press the Enter push-button.

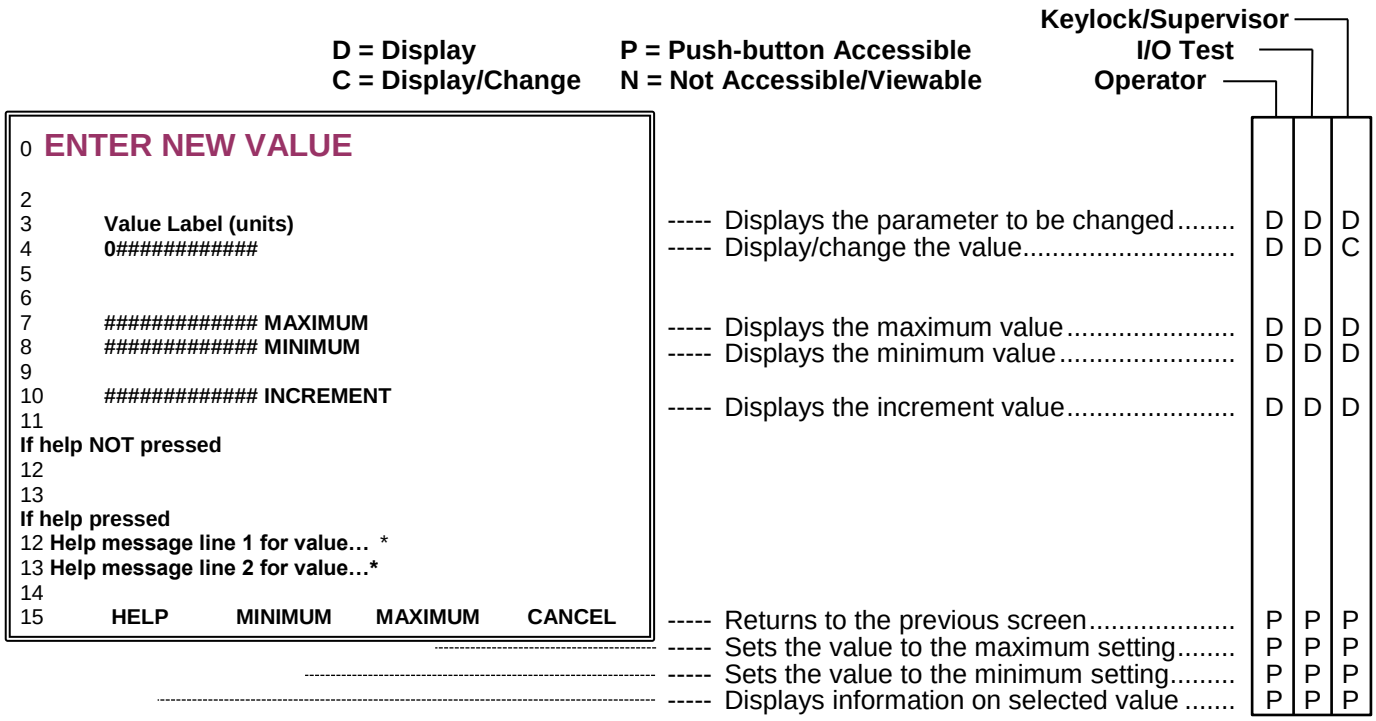
Drawback Minimum/Maximum Chart				
Pump Size	**Minimum Volume µl**	**Maximum Volume µl**	**Minimum Rate µl/Sec**	**Maximum Rate µl/Sec**
4A	0.0	< 20	0.010	40
3A	0.0	< 50	0.025	100
2A	0.0	< 100	0.05	200
1A	0.0	< 200	0.10	400
B	0.0	< 400	0.20	800
C	0.0	< 1000	0.50	2000
D	0.0	< 2000	1.00	4000

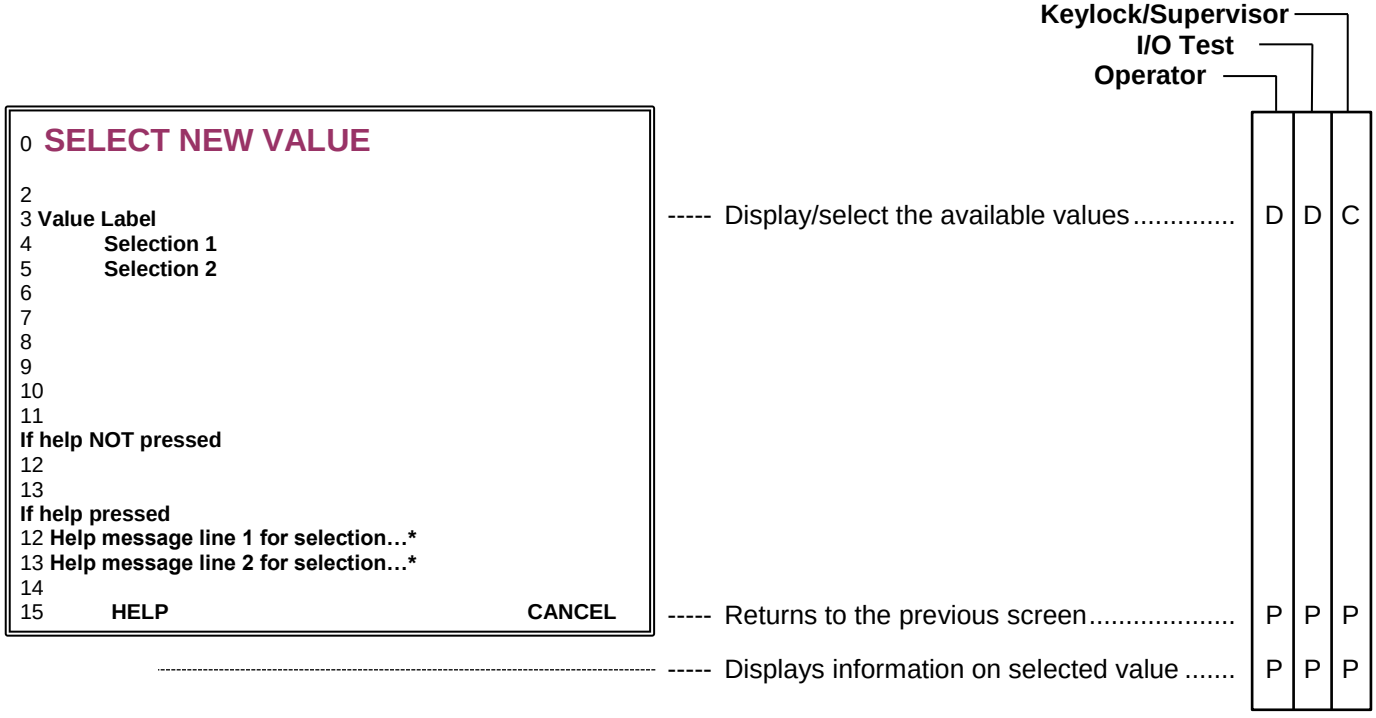
NOTE

Changing Drawback Volume, Drawback Rate or Drawback Dwell affects the drawback settings for both Dispense and Meter modes. The drawback settings do not affect Prime or Agitate modes as these modes do not provide Drawback.

3.3.7.7 Select New Value and Enter New Value Screens

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





*** Indicated the list is too long to fit on the screen, the rest of the list can be accessed by using the Up or Down buttons to scroll.**

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 possible value for the parameter.

Minimum - Displays the minimum possible value for the parameter.

Increment - Displays the incremental value for the parameter.

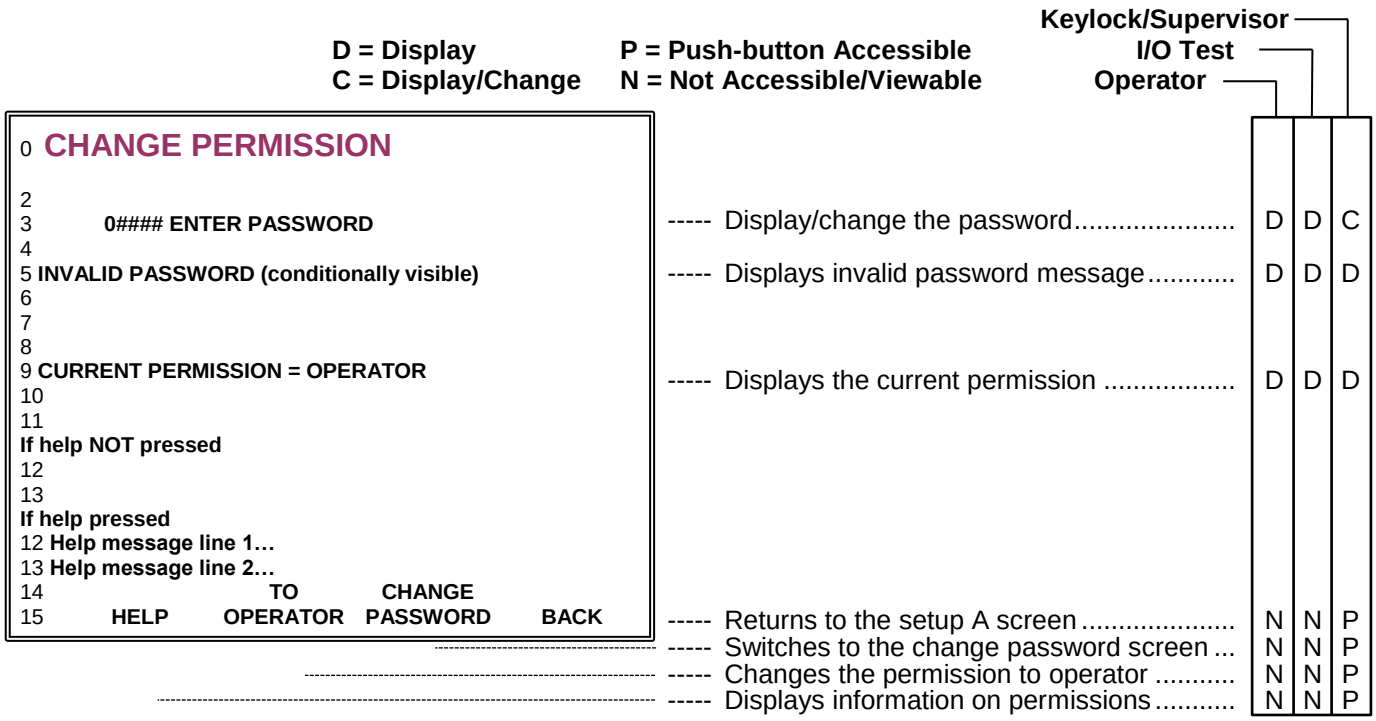
Select New Value Screen Description - The Select New Value screen selects a value from a list of values. This screen is only accessible with Supervisor permission.

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.

3.3.7.8 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.

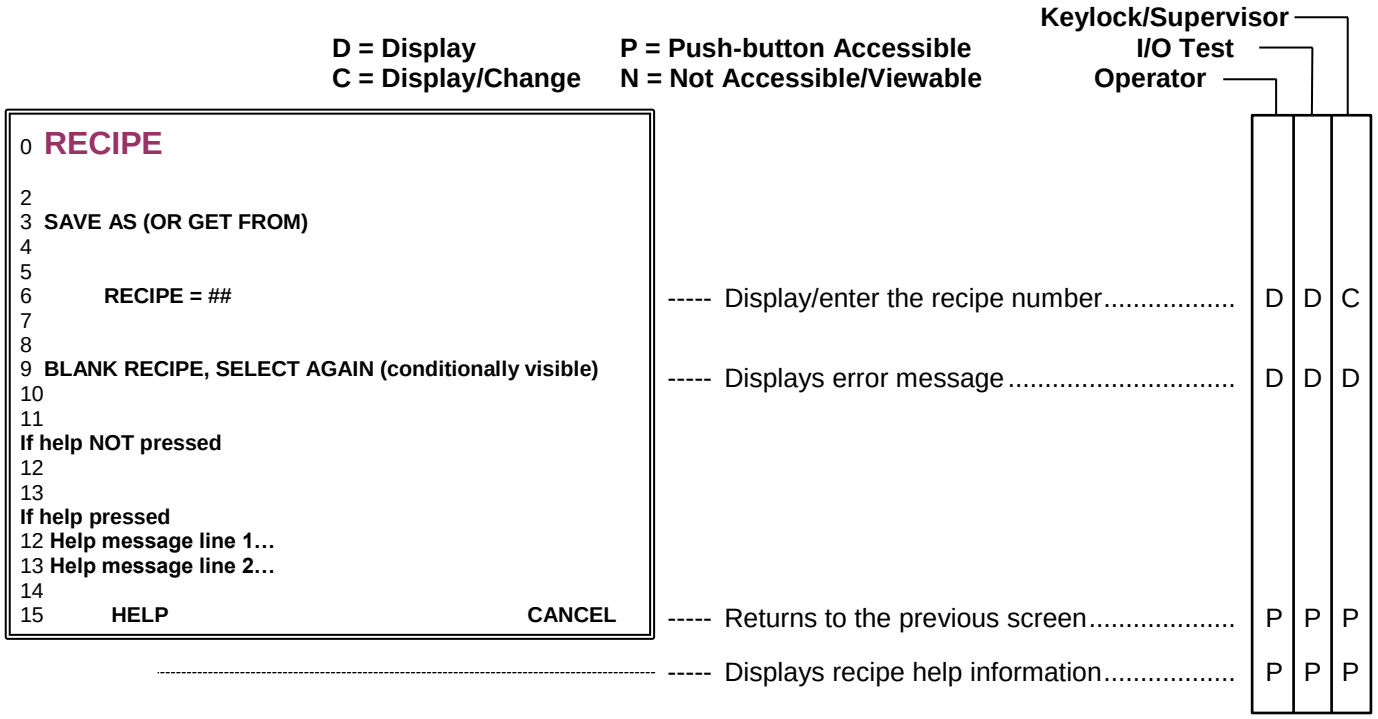
The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

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'.

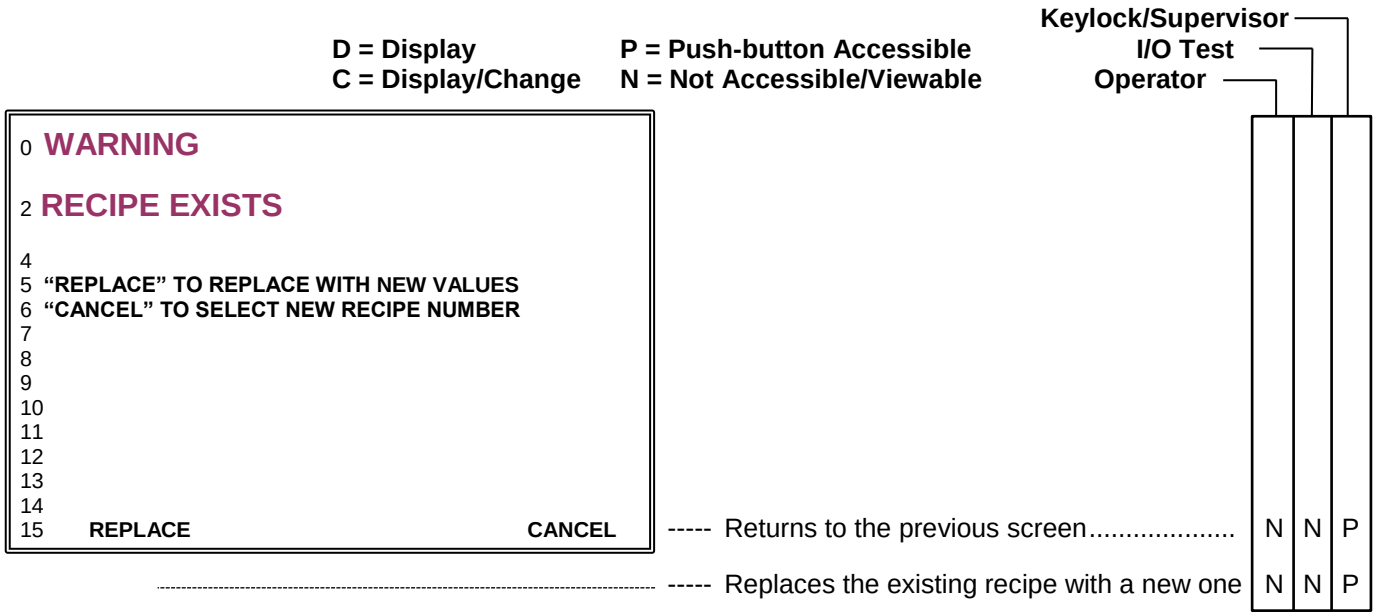
NOTE

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

3.3.7.9 Recipe Screen



3.3.7.10 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.

NOTE

The supervisor permission is the only level allowing saving recipes. Any permission level may get recipes.

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.

3.3.7.11 Fault Screen

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

		Keylock/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 Setup

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)

3.3.9 Start-up

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

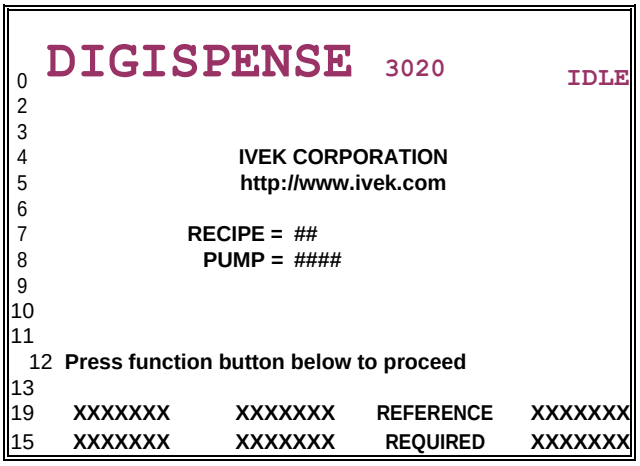
2. The display will illuminate and show the following information. The status will change from Initializing to Idle and the information for **your** system will be displayed including the current recipe and pump size and there may be additional push-button selections depending on your system settings.

   Refer to Section 3.2.4 in your manual for field descriptions.

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

3. 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.



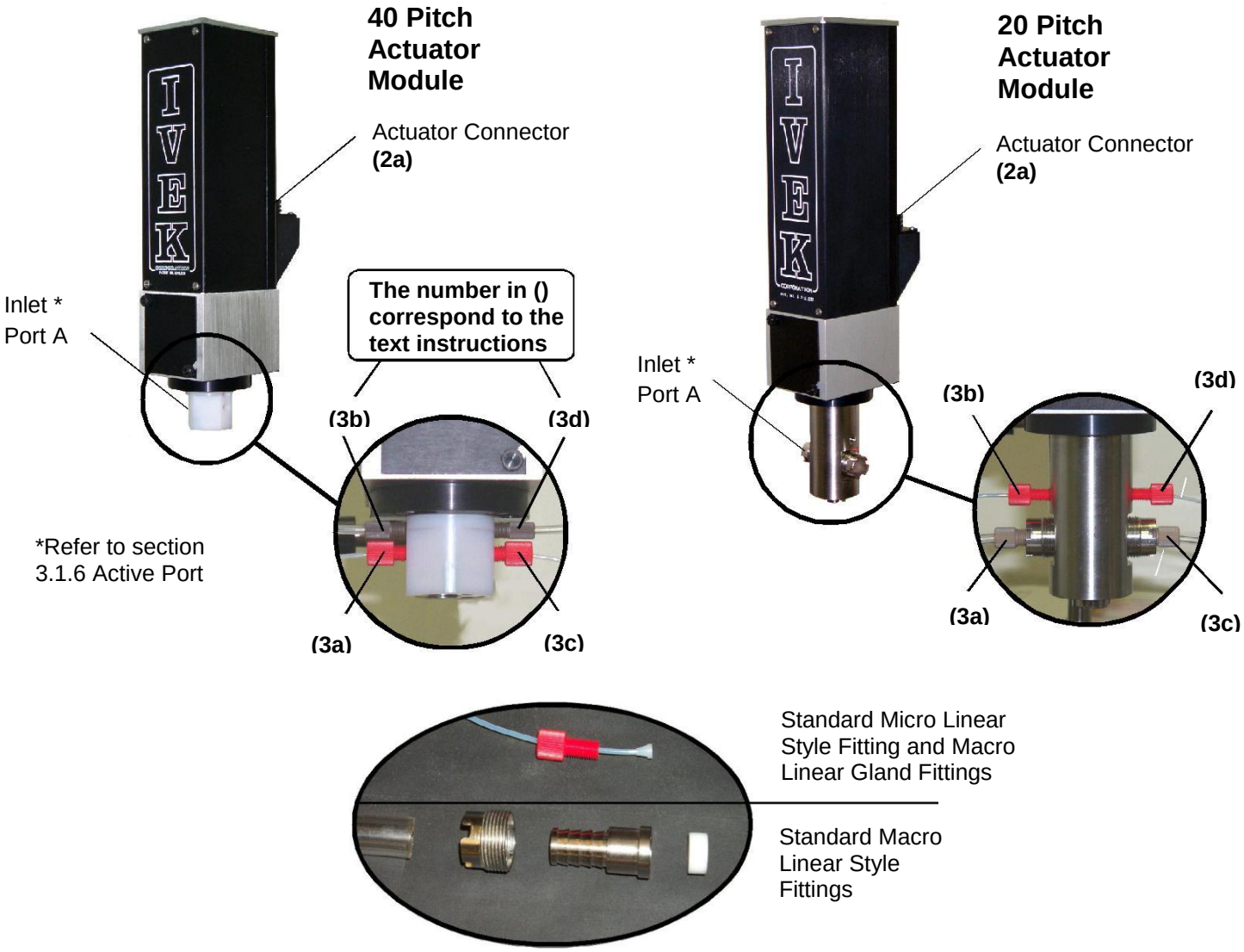
NOTE

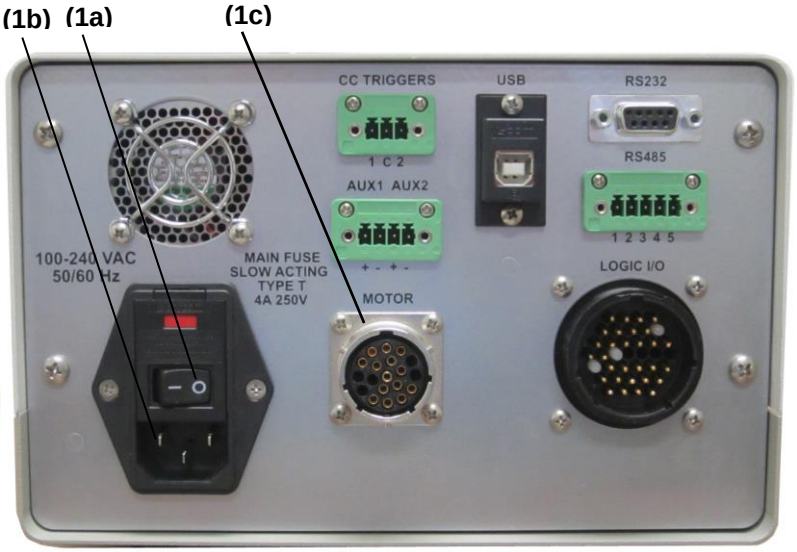
All Controller Modules are shipped from the factory with a permission level of Supervisor.

3.3.9.1 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 will prime based on the Priming Rate and Prime Volume settings. Pressing the STOP push-button can stop the priming any time.


40 Pitch Actuator Module
Actuator Connector (2a)
Inlet * Port A
The number in () correspond to the text instructions
(3b)
(3d)
(3a)
(3c)
*Refer to section 3.1.6 Active Port
20 Pitch Actuator Module
Actuator Connector (2a)
Inlet * Port A
(3b)
(3d)
(3a)
(3c)
Standard Micro Linear Style Fitting and Macro Linear Gland Fittings
Standard Macro Linear Style Fittings


(1b)
(1a)
(1c)
CC TRIGGERS
1 C 2
AUX1 AUX2
+ - + -
USB
RS232
RS485
1 2 3 4 5
LOGIC I/O
MOTOR
100-240 VAC 50/60 Hz
MAIN FUSE SLOW ACTING TYPE T 4A 250V

NOTE

To determine the correct inlet side, the motor connector must be located as shown in the following photos.

3.3.9.2 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.

3.3.9.3 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.

3.3.10 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 3.3.12 for a list and description of each fault.

3.4 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.

3.4.1 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.

3.4.1.1 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 0.05% 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.

3.4.1.2 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 0.05% of the pump chamber volume up to a maximum of the full chamber volume.

3.4.1.3 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.

3.4.1.4 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/RS485/USB commands, Contact Closure Triggers orLogic 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.

3.4.1.5 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.

3.4.1.6 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.

3.4.2 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.

3.4.2.1 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 0.05% 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.

3.4.2.2 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.

3.4.2.3 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.

3.4.3 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.

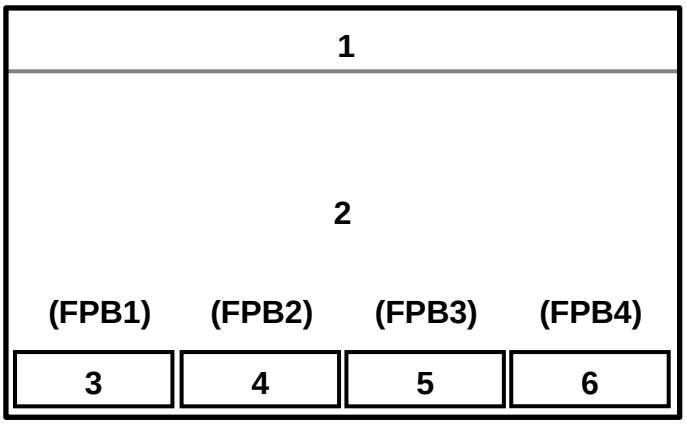
3.4.4 Display

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 thru 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.



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

Field 2 - This field displays all the operating parameters.

Fields 3 thru 6 - 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 per-mitted due to permission levels (section 3.2.6), Configurable Input 2 (section 3.3.10.3) or the value of the Serial Interface "k1" command (Table 3.8).

Field 5 is the FPB3 key described in the Reset Parameter Warning screen (section 3.3.8.23).

3.4.5 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.

3.4.6 Permission Levels

There are four levels of permission; Keylock, Supervisor, Operator and I/O Test. 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 **Keylock**. This level allows access to all items on all screens.

The **Supervisor** level allows access to all items on all screens other than the FRONT PANEL LOCK and is the default permission level.

The **Operator** level does not allow changing system parameters. Recipes can be selected and loaded, but not changed. Use this level to prevent the operator from changing settings.

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.

3.4.7 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. There are 32 recipes available (1-32). A "0" indicates a value change since the last "Get Recipe".

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

3.4.8 Screens

There are thirty three screens used to setup, operate and exit the system as shown in Figure 3.4. Each screen contains information relating to operating the system. Table 3.2 lists each screen alphabetically and provides a brief overview of its function. Figure 3.4 shows the screens and provides a map of how to get to each screen. Transition between screens is limited by permission level, operating mode and interface signals.

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.
Caution	Cautions against certain actions
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.
FP Lock	Displays the current front panel lock setting.
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 #, Permission level and allows changing Mode, Auto Retrigger, Production Dwells and Keylock settings.
Setup B	Allows changing Input 1-4, Input CC 1 & 2, Output 1-4 Aux Out 1 & 2.
Setup C	Allows changing Pump Size, Stalls per Fault, Stop Position, Torque, Acceleration, Encoder and Initial Rate.
Setup D	Allows changing RS232/RS485/USB baud rates and the Comm Address and Gateway
Setup E	Allows changing the LOGIC I/O Gateway and the true state of the outputs
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.

Table 3.3 Screen Information

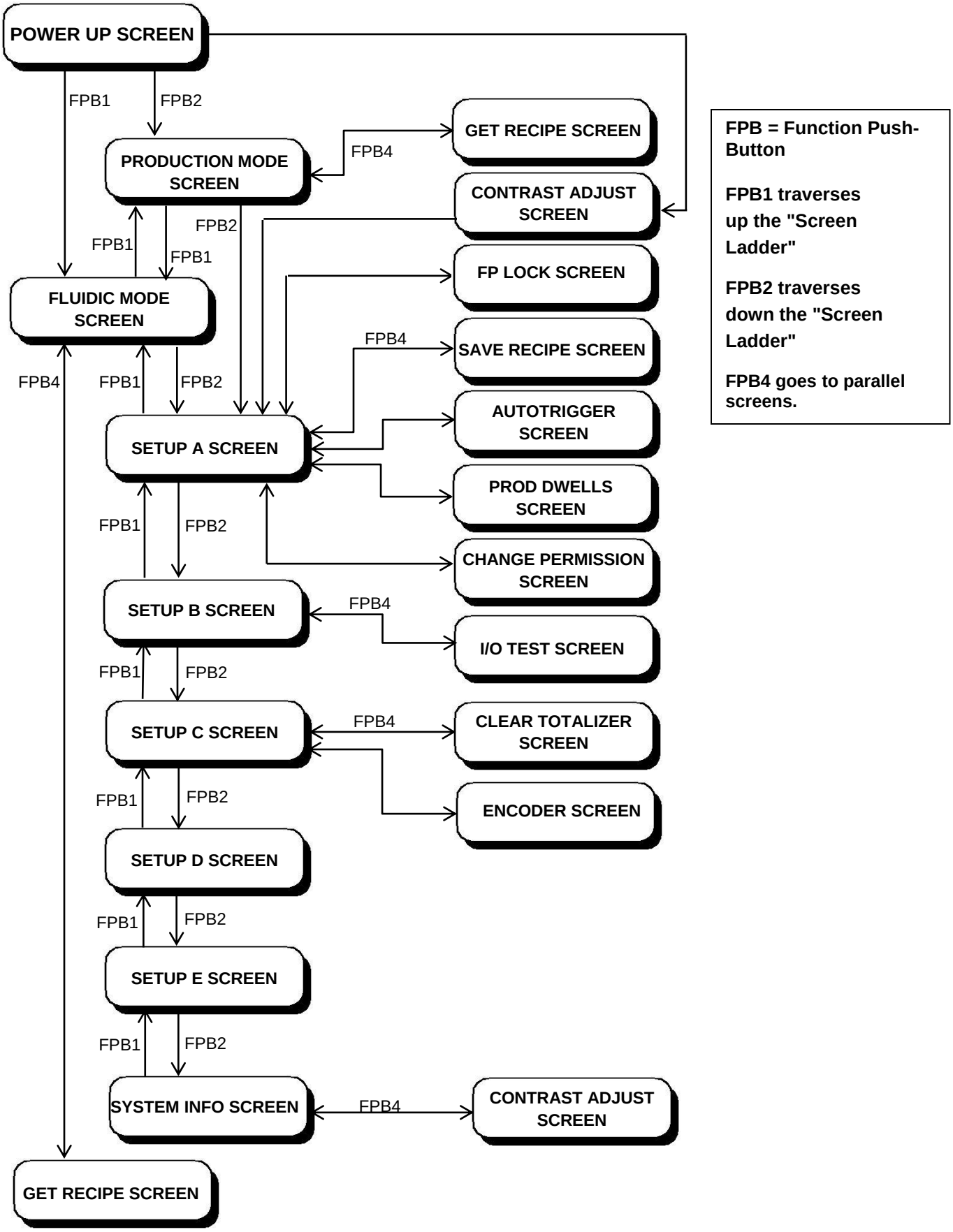


Table 3.4 Advanced Use Screen Navigation

3.4.8.1 Power Up Screen

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

0 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 SCREEN**	**DISPENSE SCREEN**		**CONTRAST ADJUST**
15			
OR if agitate mode and dispense mode			
14 **AGITATE SCREEN**	**DISPENSE SCREEN**		**CONTRAST ADJUST**
15			
OR if bubble clear mode and dispense mode			
14 **BUBBLE CLR SCREEN**	**DISPENSE SCREEN**		**CONTRAST ADJUST**
15			
OR if disabled fluidic setup mode and dispense mode			
14	**DISPENSE SCREEN**		**CONTRAST ADJUST**
15			
OR if prime mode and meter mode			
14 **PRIME SCREEN**	**METER SCREEN**		**CONTRAST ADJUST**
15			
OR if prime mode and disabled production mode			
14 **PRIME SCREEN**			**CONTRAST ADJUST**
15			
OR if disabled fluidic setup mode and disabled production mode			
14 **SETUP A SCREEN**			**CONTRAST ADJUST**
15			
OR if NO actuator/pump selected			
14 **PRIME SCREEN**	**DISPENSE SCREEN**	**SETUP C SCREEN**	**CONTRAST ADJUST**
15			
OR if actuator/pump selected and reference required			
14 **PRIME SCREEN**	**DISPENSE SCREEN**	**REFERENCE REQUIRED**	**CONTRAST ADJUST**
15			
if-faulted			
14		**FAULT SCREEN**	**CONTRAST ADJUST**
15			

	Keylock/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

NOTE

** Field 3 will display PRIME SCREEN when in Prime mode or AGITATE SCREEN when in Agitate mode.*

** Field 4 will display DISPENSE SCREEN when in Dispense mode or METER SCREEN when in Meter mode.*

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.

3.4.8.2 Prime Screen

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

		Keylock/Supervisor	I/O Test	Operator
0 **PRIME** <— status —>	----- Displays the Controller Module Status	D	D	D
3 VOLUME PRIMED = ############ uL	----- Displays the current or last prime volume ...	D	D	D
6 RECIPE = ## PUMP ####	----- Displays the current recipe	D	D	D
7 PRIME DIRECTION = #######	----- Displays the pump size	D	D	D
8 PRIME VOLUME = ############ uL	----- Display/change fluid direction	D	D	C
9 DISCHARGE RATE = ######### uL/s	----- Display/change the prime volume	D	D	C
10 INTAKE RATE = ######### uL/s	----- Display/change the discharge rate	D	D	C
	----- Display/change the Intake rate	D	D	C
if dispense mode				
14 DISPENSE SCREEN / SETUP A SCREEN / CHANGE DIRECTION / GET RECIPE	The following screens are accessible from this screen based on the system status.			
15	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

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

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

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

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

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

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

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

NOTE

** Field 3 will display DISPENSE SCREEN when in Dispense mode or METER SCREEN when in Meter mode.*

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;

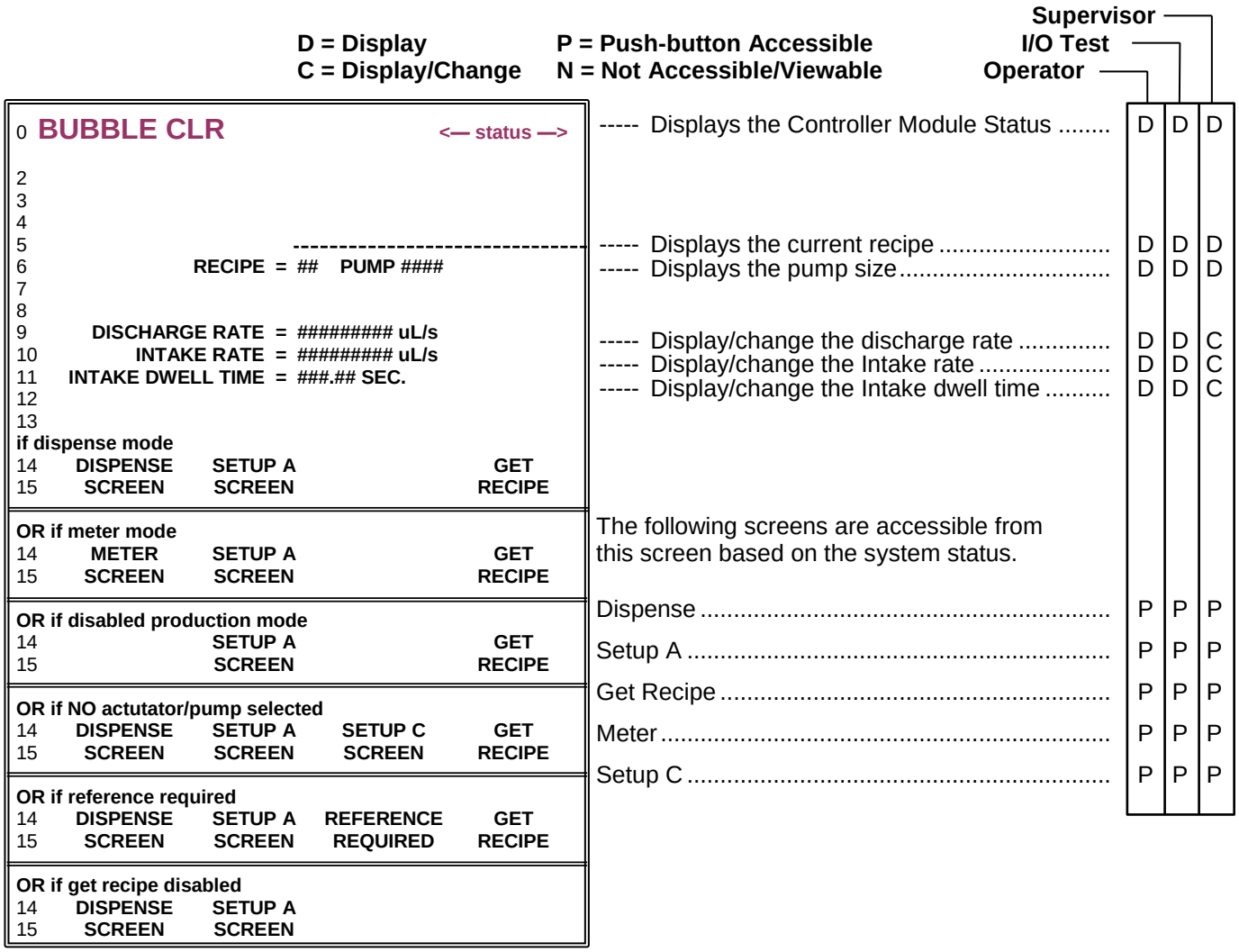
1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or 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

3.4.8.3 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

3.4.8.4 Agitate Screen

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

```
0 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
15SCREEN      SCREEN
```

		Keylock/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

NOTE

**Field 3 will display DISPENSE SCREEN when in Dispense mode or METER SCREEN when in Meter mode.*

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

NOTE

Changing Agitate Volume, Agitate Rate or Agitate Direction does not affect the settings of Dispense and Meter mode. However, they do affect Prime mode.

3.4.8.5 Dispense Screen

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

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
```

		Keylock	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	

NOTE

** Field 3 will display PRIME SCREEN when in Prime mode or AGITATE SCREEN when in Agitate mode.*

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 3.3.8.11.

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

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.

NOTE

Changing Direction, Dispense/Meter Rate or Drawback does not affect the settings of Prime or Agitate mode. However, they do affect Meter mode.

3.4.8.6 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;

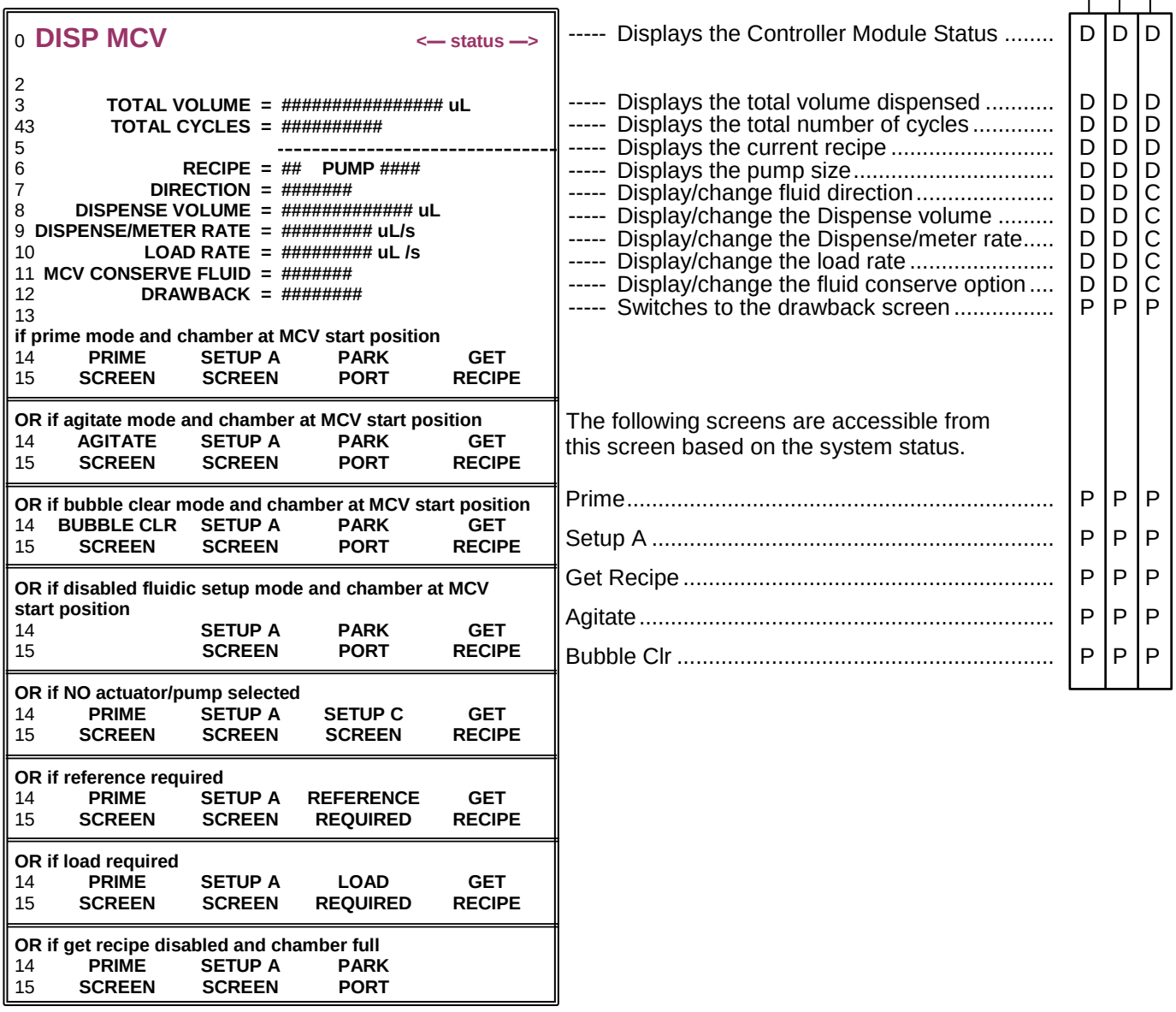
1. Press the Arrow push-buttons to highlight the parameter.
2. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
3. In the Select New Value screen use the up and down arrow push-buttons to select the value. In the Enter New Value screen press the Minimum or 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

3.4.8.7 Dispense MCV 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 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.

3.4.8.8 Meter Screen

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

	Keylock/Supervisor Operator	I/O Test	
----- 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

```
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
```

NOTE

** Field 3 will display PRIME SCREEN when in Prime mode or AGITATE SCREEN when in Agitate mode.*

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 3.3.8.11.

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

NOTE

Changing Direction, Dispense/Meter Rate or Drawback does not affect the settings of Prime or Agitate mode. However, they do affect Dispense mode.

3.4.8.9 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

3.4.8.10 Setup A Screen

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

0 SETUP A <— status —>				
2				
3	RECIPE = ##			
4				
5	PRODUCTION MODE = ######			
6	FLUIDIC SETUP MODE = ######			
7	LOAD MODE = ######			
8	AUTO RETRIGGER = ######			
9	PRODUCTION DWELLS = ######			
10	FRONT PANEL LOCK = ######			
11	POWER-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		

	Keylock/Supervisor	I/O Test	Operator
----- Displays the Controller Module Status	D	D	D
----- Displays the current recipe	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
----- Display/change the auto retrigger setting	D	D	C
----- Display/change the production dwells setting	D	D	C
----- Display/change the front panel lock setting .	D	D	*
----- 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.			
Agitate	P	P	P
Get Recipe	P	P	P
Save Recipe	P	P	P
Bubble Clear	P	P	P
Prime	P	P	P
Setup B	P	P	P
Dispense	P	P	P
Meter	P	P	P
Change Permission	P	P	P

*** D for Supervisor**
C for Keylock

NOTE

Field 3 will display PRIME SCREEN when in Prime mode or AGITATE SCREEN when in Agitate mode.

When Fluidic Setup Mode is disabled, Field 3 will display DISPENSE SCREEN when in Dispense mode or METER SCREEN when in Meter mode.

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.

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 3.3.8.12.

Production Dwells - Refer to Section 3.3.8.13.

Front Panel Lock - The Front Panel Lock locks certain functions based on the selection. The following list shows the available settings and locked function(s).

Settings	Locked Function
DISABLED	Nothing
RS	Recipe Save
RS, VC	Recipe Save, Value Change
RS, VC, PD	Recipe Save, Value Change, Prime Direction
RS&G, VC	Recipe Save and Get, Value Change
RS&G, VC, PD	Recipe Save and Get, Value Change, Prime Direction
RS&G, VC, PD, S	Recipe Save and Get, Value Change, Prime Direction, Start & Stop

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 3.2.7.8.

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.

3.4.8.11 Setup B Screen

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

```
0 SETUP B                          <— status —>

2          AUX OUT 1 = ######
3          AUX OUT 2 = ######
4           OUTPUT 1 = ######
5           OUTPUT 2 = ######
6           OUTPUT 3 = ######
7           OUTPUT 4 = ######
8          INPUT CC 1 = ######
9          INPUT CC 2 = ######
10            INPUT 1 = ######
11            INPUT 2 = ######
12            INPUT 3 = ######
13            INPUT 4 = ######
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
```

	Keylock/Supervisor Operator	I/O Test	
----- Displays the Controller Module Status	D	D	D
----- Display/change the aux out 1 setting.....	D	D	C
----- Display/change the aux out 2 setting.....	D	D	C
----- Display/change the output 1 setting	D	D	C
----- Display/change the output 2 setting	D	D	C
----- Display/change the output 3 setting	D	D	C
----- Display/change the output 4 setting	D	D	C
----- Display/change the input CC 1 setting	D	D	C
----- Display/change the input CC 2 setting	D	D	C
----- Display/change the input 1 setting.....	D	D	C
----- Display/change the input 2 setting.....	D	D	C
----- Display/change the input 3 setting.....	D	D	C
----- Display/change the input 4 setting.....	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 the lOGIC I/O settings and allows a user with Supervisor permission to change the parameters. The current permission level determines which push-buttons are available as shown.

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

Aux Out 1 & 2 - Aux Out 1 & 2 setting selects the signal type **(in bold)** and condition for an additional output signal. The output signal can either be DISABLED or provide information about the system as shown below.

Outputs 1 - 4 - Outputs 1 – 4 setting selects the signal type **(in bold)** and condition for an additional output signal. The output signal can either be DISABLED or provide information about the system as shown below.

BUSY	**READY**	**STATUS**	**SUCCESS**	**LINK**
DISCHARGE	IDLE	FAULT	LAST	WITH INPUT
PRODUCTION OPS	PRODUCTION	LOAD	PULSE	
FLUIDIC SETUP OPS		REFERENCE		
PROD & FLUIDIC OPS				
PORT				
ALL OPS				

Input CC 1 & 2 - The Input CC 1 & 2 setting selects the signal type **(in bold)** and condition for an additional input signal. The input signal can either be DISABLED or provide information about the system as shown below.

Inputs 1 - 4 - Inputs 1 – 4 setting selects the signal type **(in bold)** and condition for an additional input signal. The input signal can either be DISABLED or provide information about the system as shown below.

TRIGGER	**LOCK**	**LINK**
PRODUCTION OPS	MOTION	WITH OUTPUT
FLUIDIC OPS	FRONT PANEL	
LOAD		
FLT CLEAR & REF		
PARK PORT		

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.

3.4.8.12 Setup C Screen

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

```
0 SETUP C                          <— status —>

2
3                    PUMP = ##############
4  PUMP CHAMBER VOLUME = ############
5
6                 ENCODER = ############
7   PUMP 90 DEG OFFSET = ############
8             ACTIVE PORT = ################
9           VALVING SPEED = ################
10                 TORQUE = #################
11           ACCELERATION = ##################
12            INITIAL RATE = ##################
13
if configured and NOT faulted and NOT reference required
14      SETUP B      SETUP D    REFERENCE      CLEAR
15      SCREEN       SCREEN                    TOTALIZER

OR if faulted
14      SETUP B      SETUP D                     FAULT
15      SCREEN       SCREEN       SCREEN       TOTALIZER

OR if NOT configured
14      SETUP B      SETUP D
15      SCREEN       SCREEN                    TOTALIZER

OR if reference required
14      SETUP B      SETUP D                   REFERENCE
15      SCREEN       SCREEN      REQUIRED      TOTALIZER

OR if permission less than supervisor
14      SETUP B      SETUP D          REFERENCE
15      SCREEN       SCREEN
```

	Keylock/Supervisor	I/O Test	Operator
----- Displays the Controller Module Status	D	D	D
----- Display/change the pump size.....	D	D	C
----- Displays the pump chamber volume	D	D	D
----- Switches to the encoder screen	D	D	C
----- Display/change the pump 90 degree offset.	D	D	D
----- Display/change the active port	D	D	D
----- Display/change the valving speed	D	D	C
----- Display/change the torque	D	D	C
----- Display/change the acceleration.....	D	D	C
----- Display/change the initial Rate	D	D	C
The following screens are accessible from this screen based on the system status.			
CLEAR Setup B	P	P	P
System Info	P	P	P
CLEAR Clear Totalizer.....	P	P	P
Fault ..... CLEAR	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.

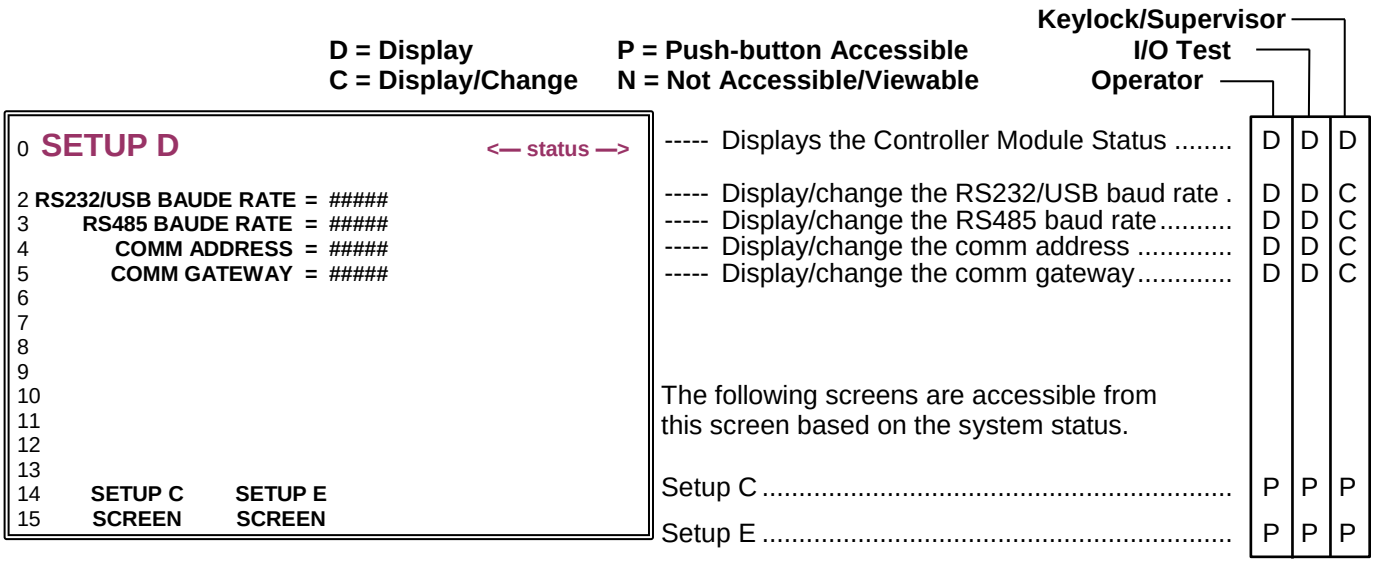
Acceleration - Acceleration determines how fast the motor gets up to full speed when first started. The acceleration can either be Slow, Medium, Standard and Fast. Standard acceleration should work for most applications and is the system default value. Faster acceleration values, if combined with larger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

Initial Rate - The initial rate determines the speed at which acceleration starts. Increasing the initial rate may decrease the overall dispense cycle time. Decreasing the initial rate may help overcome stalling with larger motors. Typically, this is left at the default value. The Initial Rate can either be Low, Medium, or High.

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.

3.4.8.13 Setup D Screen



Setup D Screen Description - The Setup D 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.

RS232/USB Baud Rate - The RS232/USB Baud Rate determines the number of signals transferred in one second of the RS232 and USB network. The baud rate can either be 9600, 19200, 38400 or 57600.

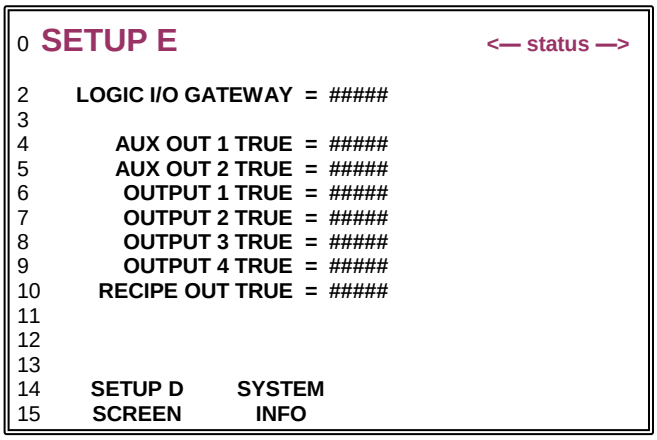
RS485 Baud Rate - The RS485 Baud Rate determines the number of signals transferred in one second of the RS485 network. The baud rate can either be 9600, 19200, 38400 or 57600.

Comm Address - The Comm Address is the serial address of this Controller Module. The Comm Address can be between 1 and 99.

Comm Gateway - The Comm Gateway allows communication between the RS232/USB and RS485 networks. The Comm Gateway can either be Enabled or Disabled.

3.4.8.14 Setup E Screen

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



	Keylock/Supervisor Operator	I/O Test	
----- Displays the Controller Module Status	D	D	D
----- Display/change LOGIC I/O gateway setting	D	D	C
----- Display/change the aux out 1 true setting ...	D	D	C
----- Display/change the aux out 2 true setting ...	D	D	C
----- Display/change the output 1 true setting	D	D	C
----- Display/change the output 2 true setting	D	D	C
----- Display/change the output 3 true setting	D	D	C
----- Display/change the output 4 true setting	D	D	C
----- Display/change the recipe out true setting ..	D	D	C
The following screens are accessible from this screen based on the system status.			
Setup D	P	P	P
System Info	P	P	P

Setup E Screen Description - The Setup E 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.

LOGIC I/O Gateway - The LOGIC I/O Gateway when Enabled does not allow starts when a Link indicates Busy or fault. The LOGIC I/O Gateway can either be Enabled or Disabled.

Aux Out 1 True - The Aux Out 1 True determines the conducting state of the Aux Out 1 signal. The output can either be Conducting or Not Conducting when the output signal is True.

Aux Out 2 True - The Aux Out 2 True determines the conducting state of the Aux Out 2 signal. The output can either be Conducting or Not Conducting when the output signal is True.

Output 1 True - The Output 1 True determines the conducting state of the Output 1 signal. The output can either be Conducting or Not Conducting when the output signal is True.

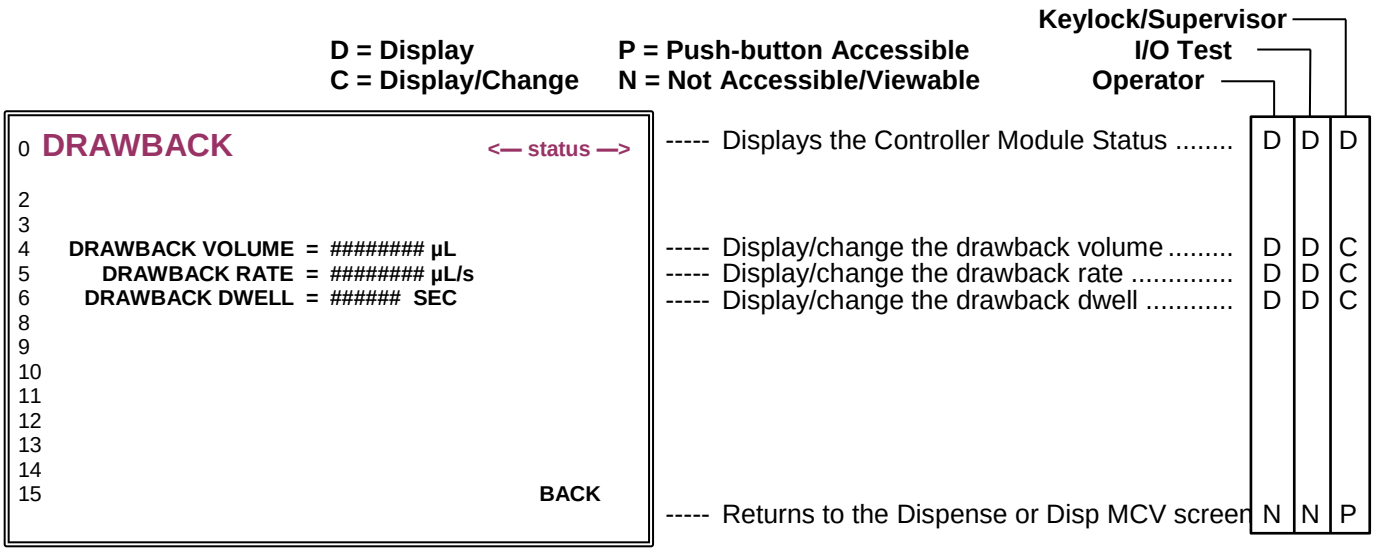
Output 2 True - The Output 2 True determines the conducting state of the Output 2 signal. The output can either be Conducting or Not Conducting when the output signal is True.

Output 3 True - The Output 3 True determines the conducting state of the Output 3 signal. The output can either be Conducting or Not Conducting when the output signal is True.

Output 4 True - The Output 4 True determines the conducting state of the Output 4 signal. The output can either be Conducting or Not Conducting when the output signal is True.

Recipe Out True - The Recipe Out True determines the conducting state of the Recipe Out signals. The outputs can either be Conducting or Not Conducting when the output signal are True.

3.4.8.15 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;

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

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

7. 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.

8. Press the Enter push-button.

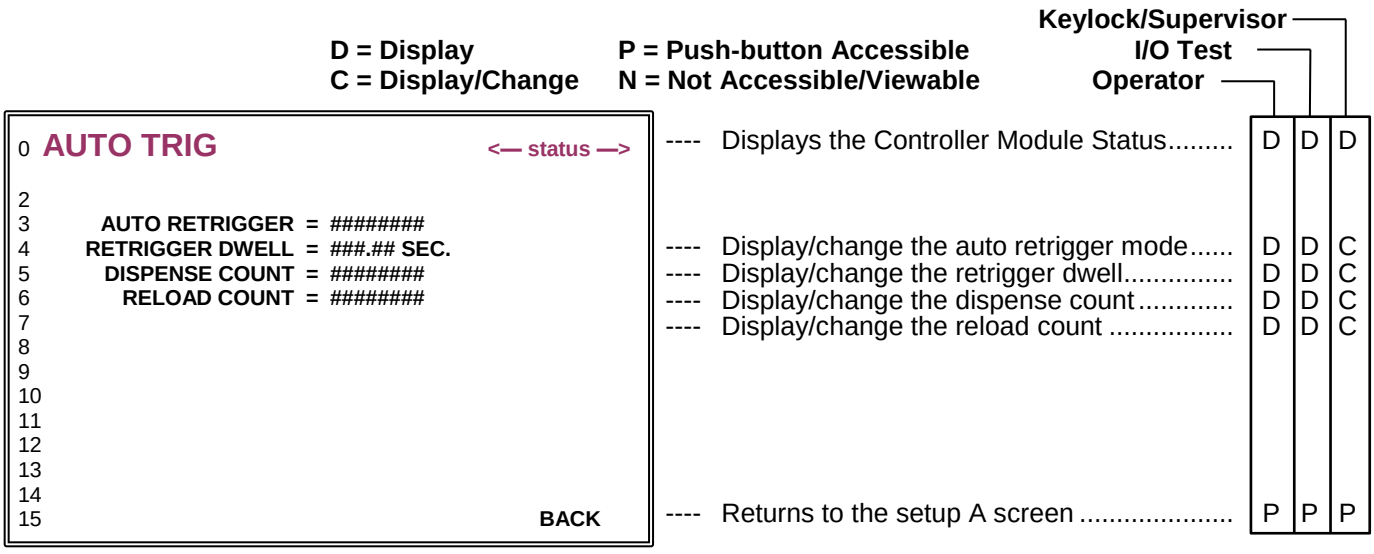
Drawback Minimum/Maximum Chart

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

NOTE

Changing Drawback Volume, Drawback Rate or Drawback Dwell affects the drawback settings for both Dispense and Meter modes. The drawback settings do not affect Prime or Agitate modes as these modes do not provide Drawback.

3.4.8.16 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 10000000 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)

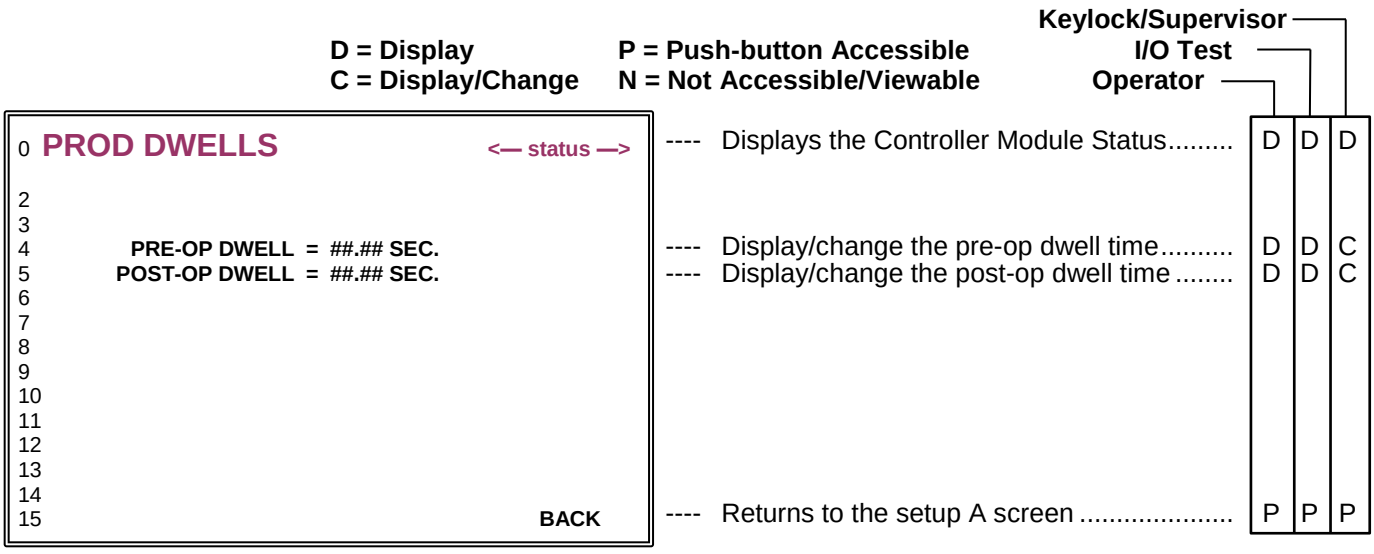
To change a value;

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.

NOTE

Auto Trig settings only affect Dispense Mode operation. Auto Trig settings do not affect Meter Mode, Prime Mode, or Agitate Mode operation.

3.4.8.17 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 3.3.8 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 60.00 seconds with an increment value of 0.01. (Refer to section 3.3.1.4)

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 60.00 seconds with an increment value of 0.01. (Refer to section 3.3.1.4)

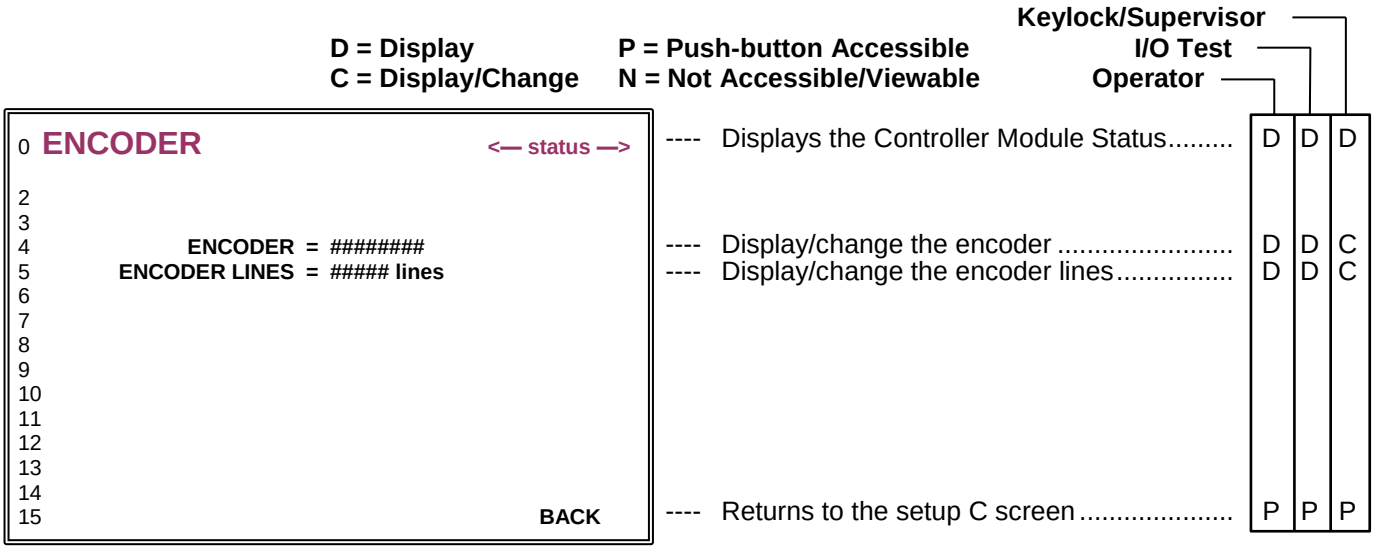
To change a value;

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.

NOTE

Production Dwell settings only affect Dispense Mode and Meter Mode operations. Production Dwell settings do not affect Prime Mode or Agitate Mode operation.

3.4.8.18 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.

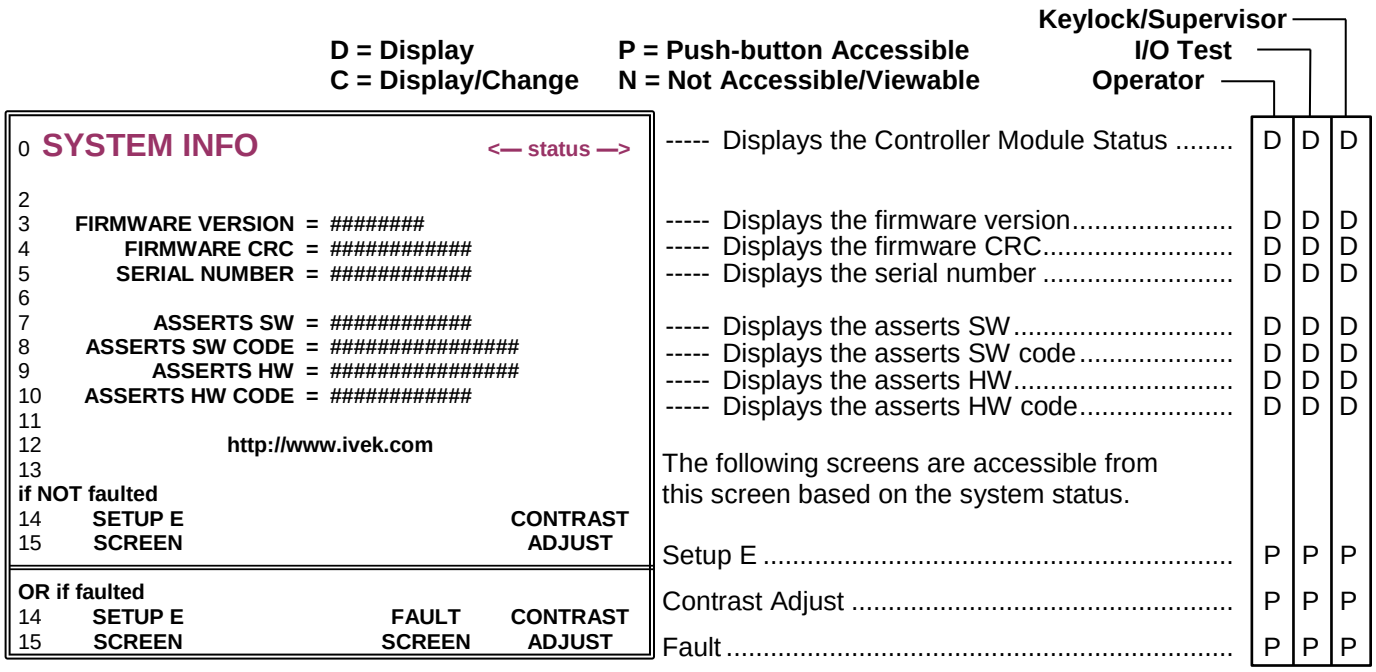
Encoder - The Encoder provides a feedback signal when the motor is operating. The setting can either be Disabled (if no encoder option purchased on the Actuator Module) or Enabled (if encoder option purchased on the Actuator Module).

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.

3.4.8.19 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 3.3.8 for an explanation of each status type.

Firmware Version - The Firmware Version displays the current version of firmware 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.

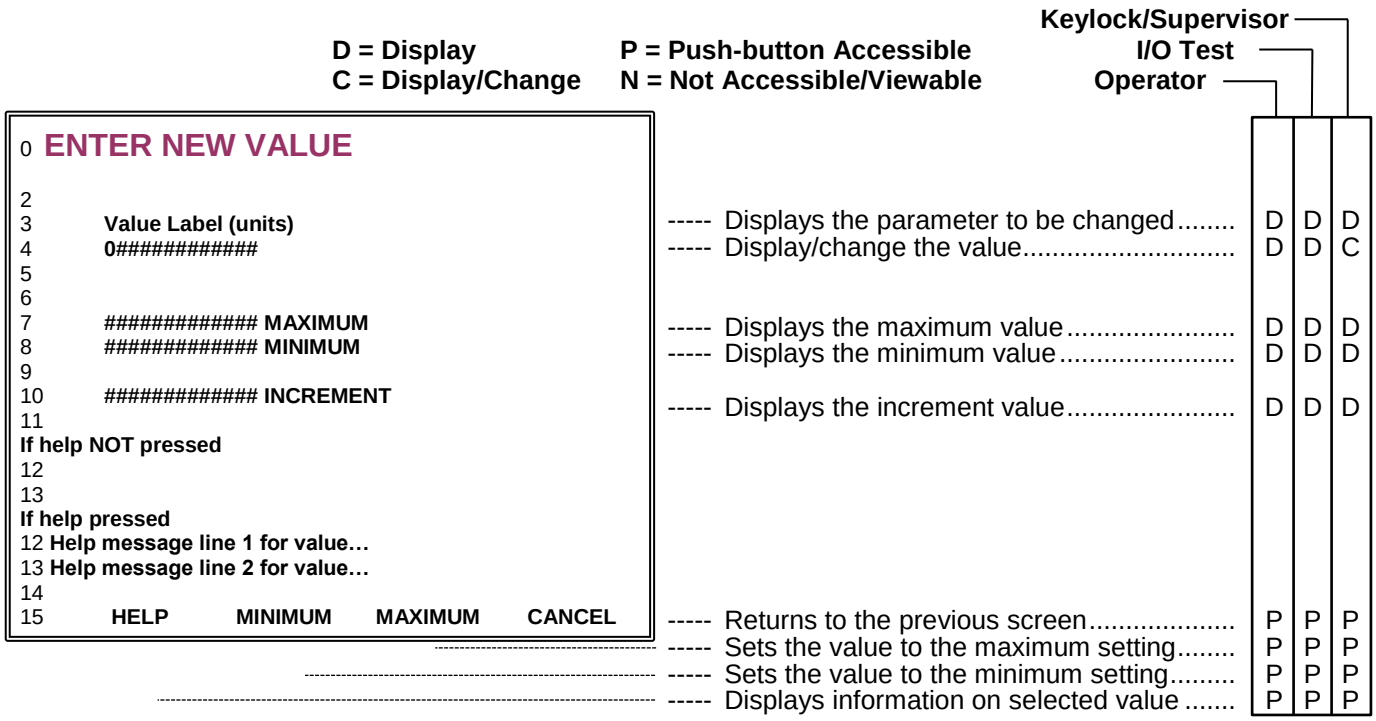
Asserts SW Code - For IVEK use only.

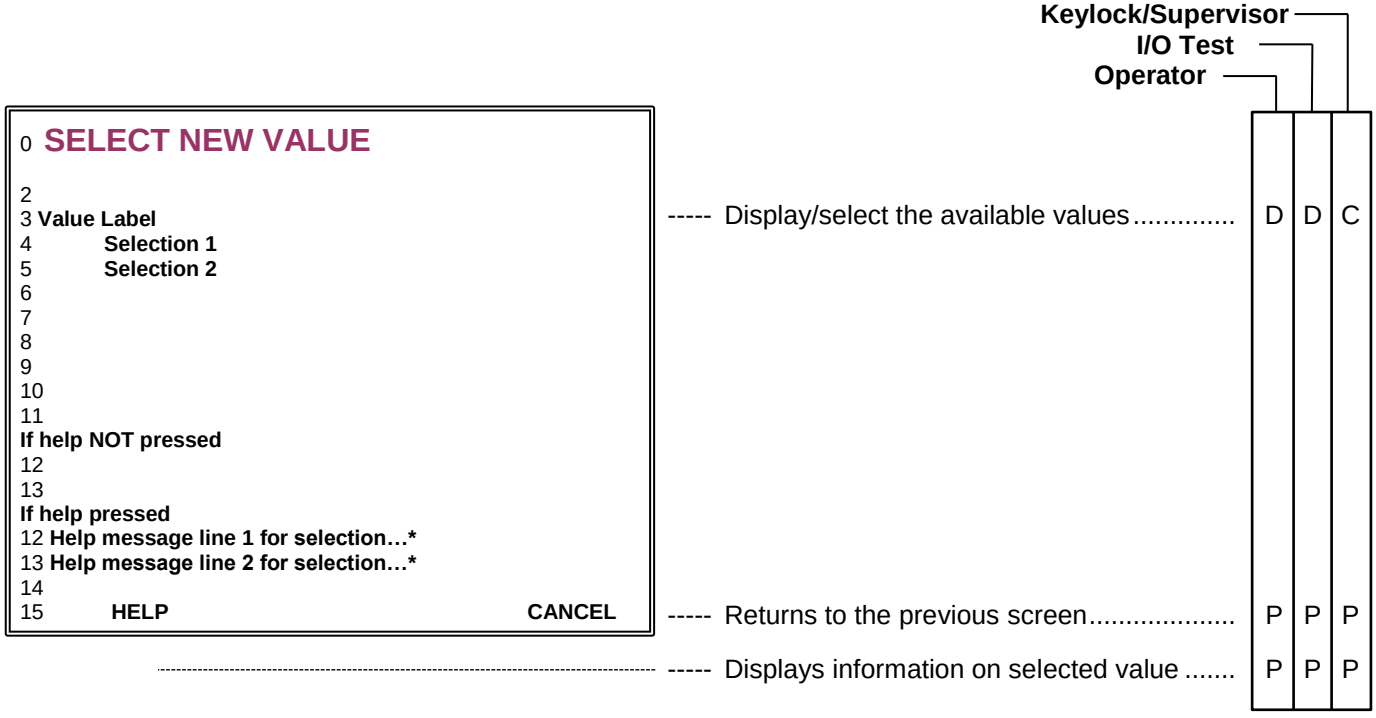
Asserts HW - For IVEK use only.

Assert HW Code - For IVEK use only.

3.4.8.20 Select New Value and Enter New Value Screens

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





*** Indicated the list is too long to fit on the screen, the rest of the list can be accessed by using the Up or Down buttons to scroll.**

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 possible value for the parameter.

Minimum - Displays the minimum possible value for the parameter.

Increment - Displays the incremental value for the parameter.

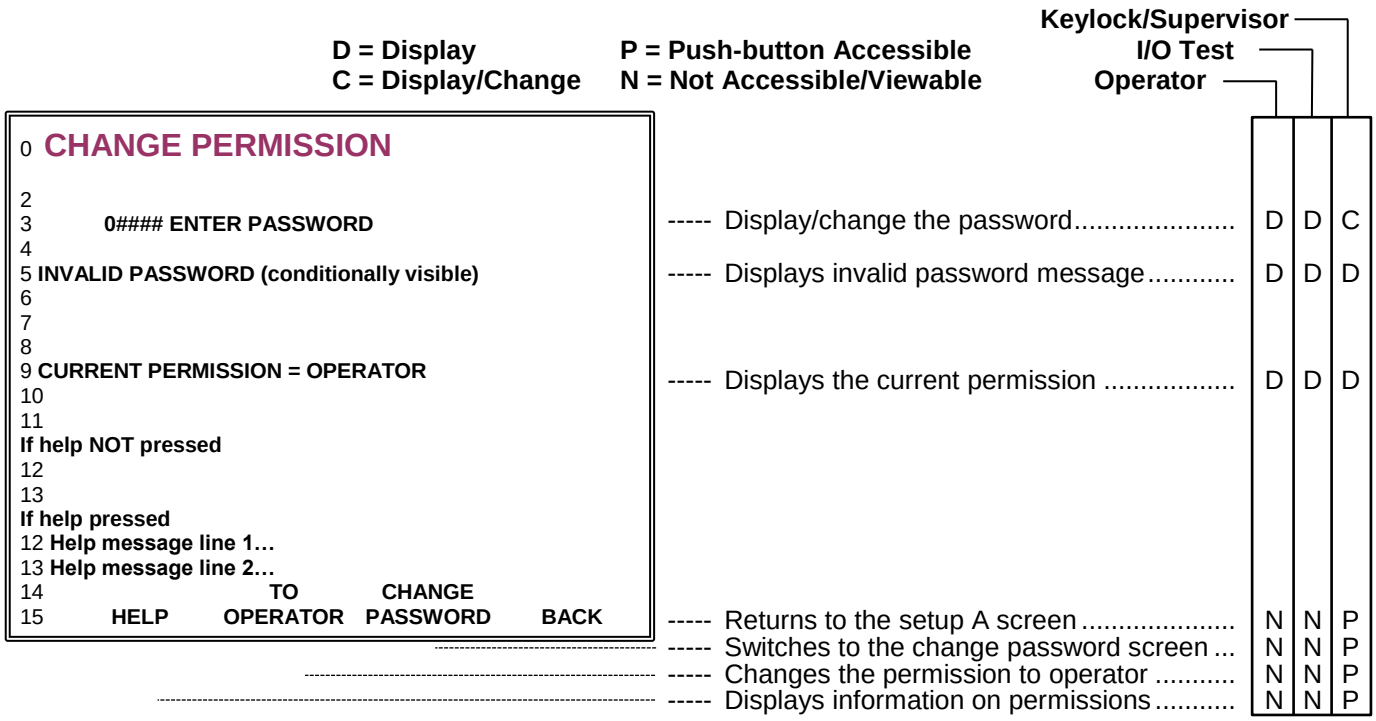
Select New Value Screen Description - The Select New Value screen selects a value from a list of values. This screen is only accessible with Supervisor permission.

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.

3.4.8.21 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.

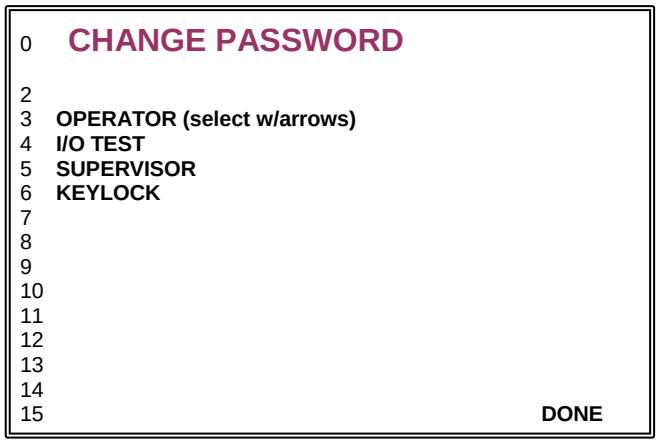
Enter Password - This field is used to enter the password for the desired permission level. Each permission level has a unique password to prevent unauthorized access to certain parameters. The permission level can either be Operator, I/O Test or Supervisor. Use the left and right arrow push-buttons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

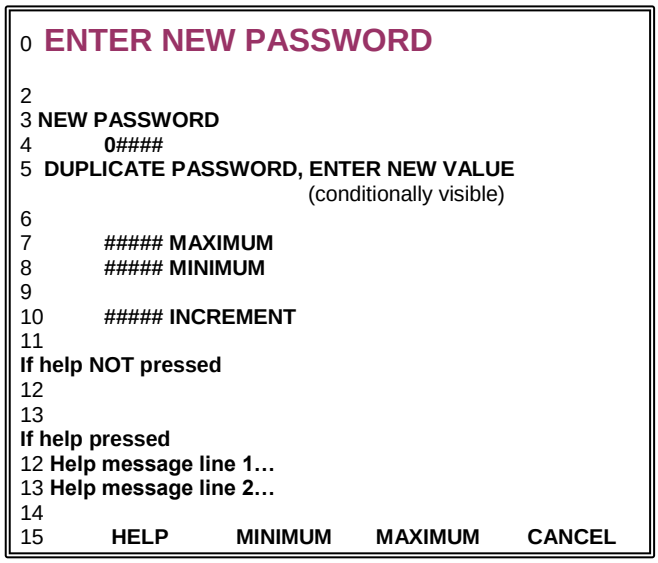
Entering a password causes the password field to reset to the minimum value.

3.4.8.22 Change Password and Enter New Password Screens

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



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



	Keylock/Supervisor Operator	I/O Test	Operator
----- Display/change the password.....	D	D	C
----- Displays error message	D	D	D
----- Displays the maximum value	D	D	D
----- Displays the minimum value	D	D	D
----- Displays the increment value.....	D	D	D
----- Returns to the change password screen	N	N	P
----- Sets the value to the maximum setting.....	N	N	P
----- Sets the value to the minimum setting.....	N	N	P
----- Displays password help information	N	N	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 possible value for the password. The minimum value is 10.

Maximum - Displays the maximum possible 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;

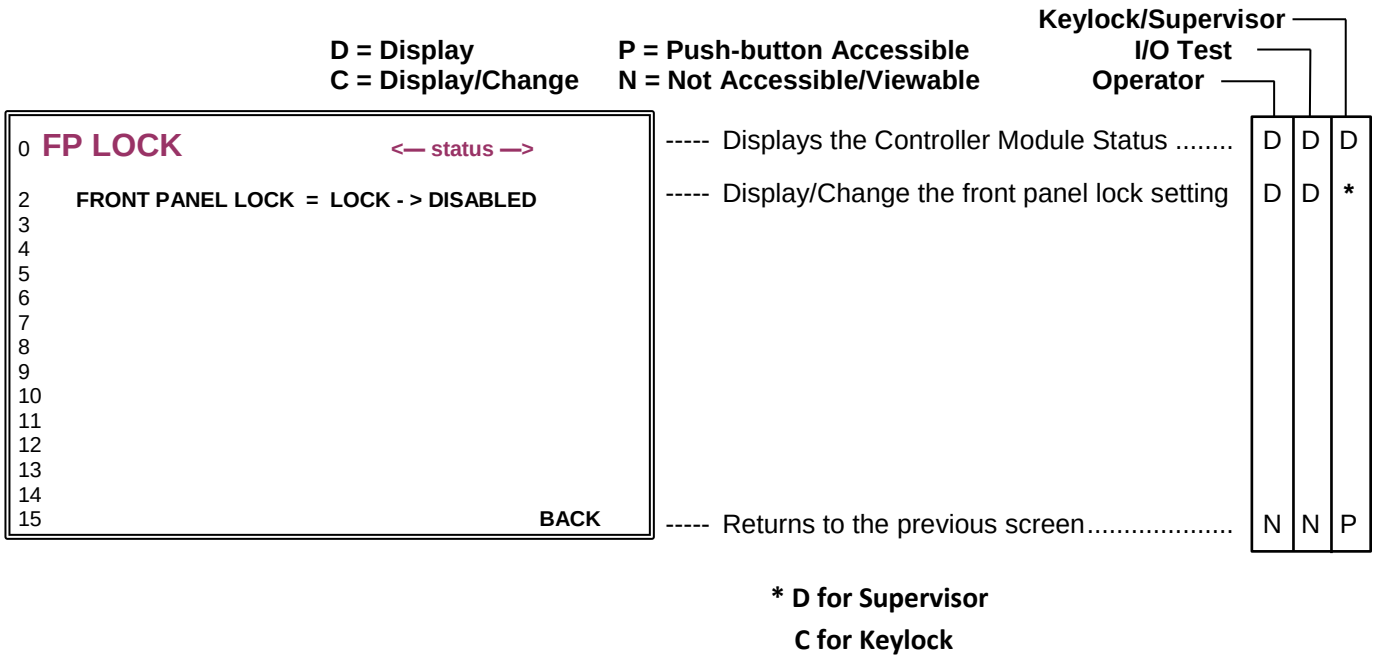
1. Use the up and down arrow push-buttons to select the permission.
2. Press the Enter push-button to bring up the Enter New Password screen.
3. Press the Minimum or Maximum push-buttons to select the desired value or use the left and right arrow push-buttons to select the digit and the up and down arrow 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 3.3.8.28.

3.4.8.23 Front Panel Lock Screen



*** D for Supervisor**
C for Keylock

Front Panel Lock Screen Description - The Front Panel Lock screen allows a user with Keylock permission to lock certain function on the front. The current permission level determines which push-buttons are available as shown.

Status - The status indicates the operational state of the system. Refer to section 3.3.8 for an explanation of each status type.

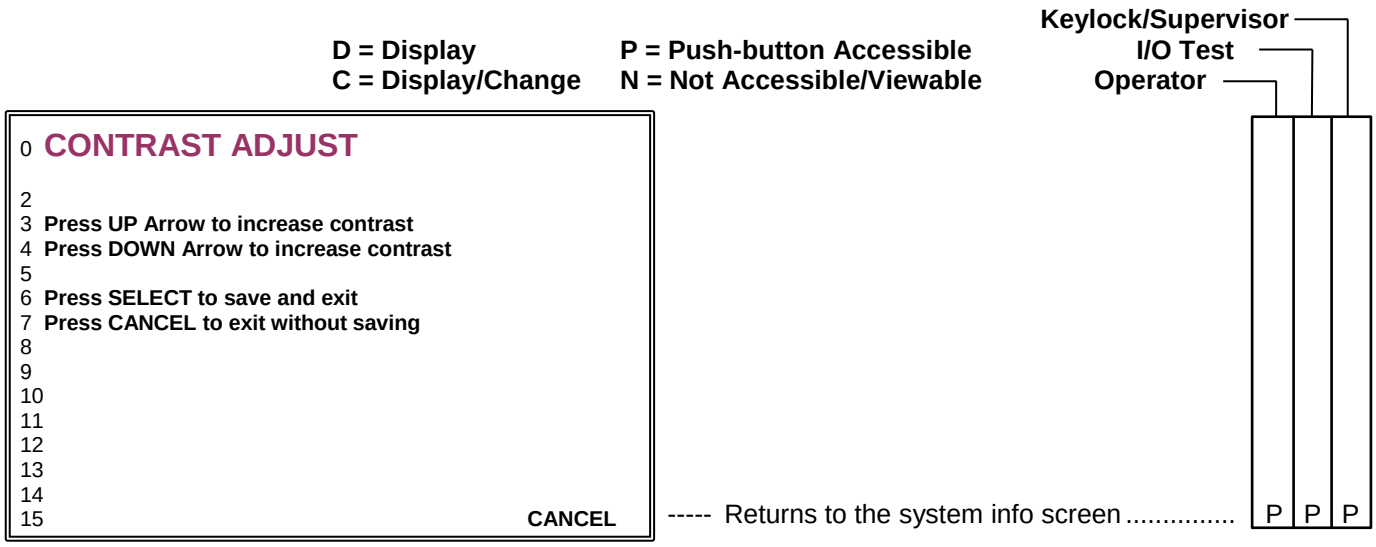
Front Panel Lock - The Front Panel Lock locks certain functions based on the selection. The following list shows the available settings and locked function(s).

Settings	Locked Function
DISABLED	Nothing
RS	Recipe Save
RS, VC	Recipe Save, Value Change
RS, VC, PD	Recipe Save, Value Change, Prime Direction
RS&G, VC	Recipe Save and Get, Value Change
RS&G, VC, PD	Recipe Save and Get, Value Change, Prime Direction
RS&G, VC, PD, S	Recipe Save and Get, Value Change, Prime Direction, Start & Stop

To change a value;

5. Press the Arrow push-buttons to highlight the parameter.
6. Press the Enter push-button to bring up either the Select New Value or Enter New Value screen.
7. 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.
8. Press the Enter push-button.

3.4.8.24 Contrast Adjust Screen



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.

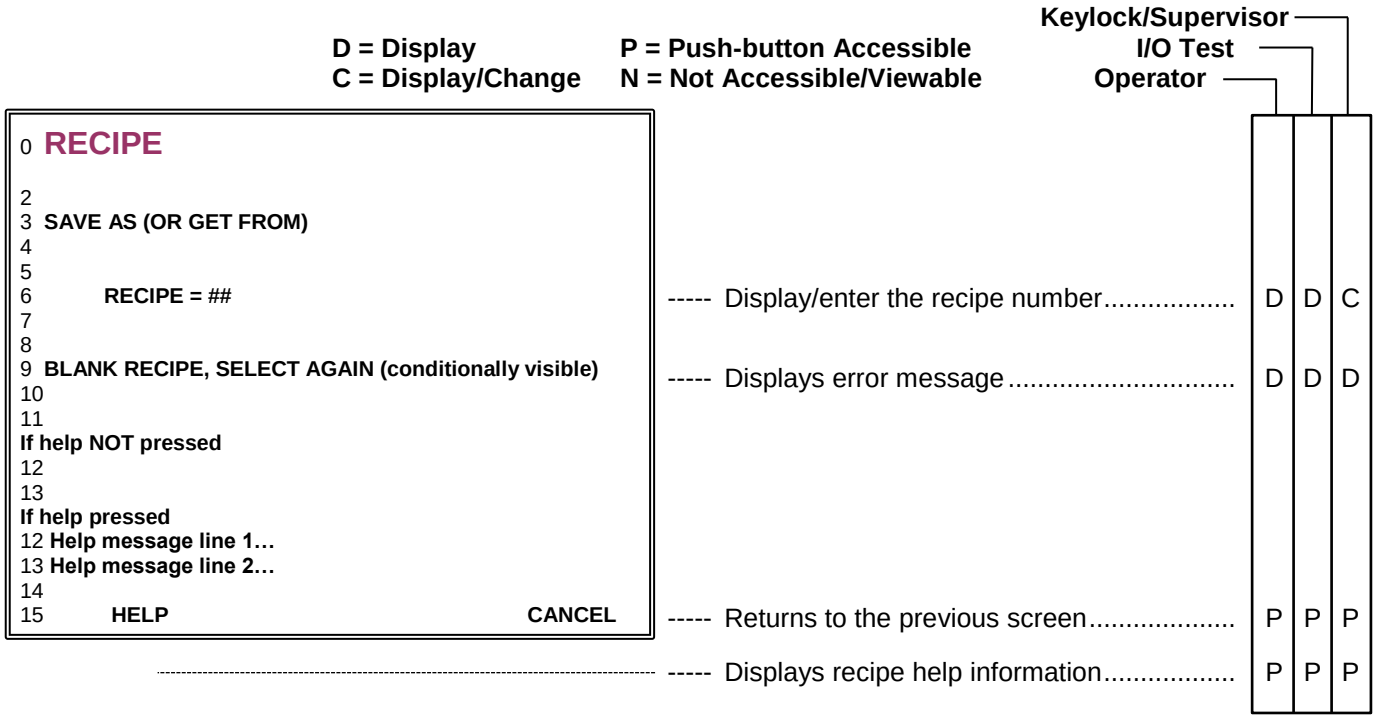
The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

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.

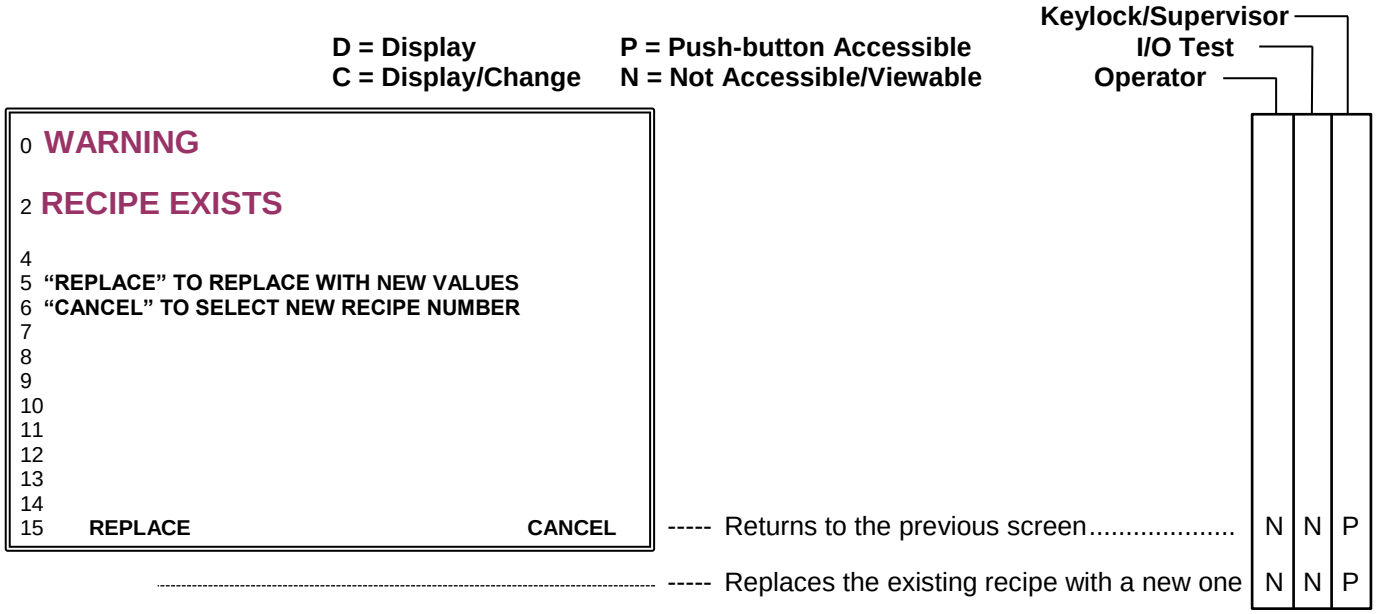
NOTE

The contrast may change with temperature.

3.4.8.25 Recipe Screen



3.4.8.26 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.

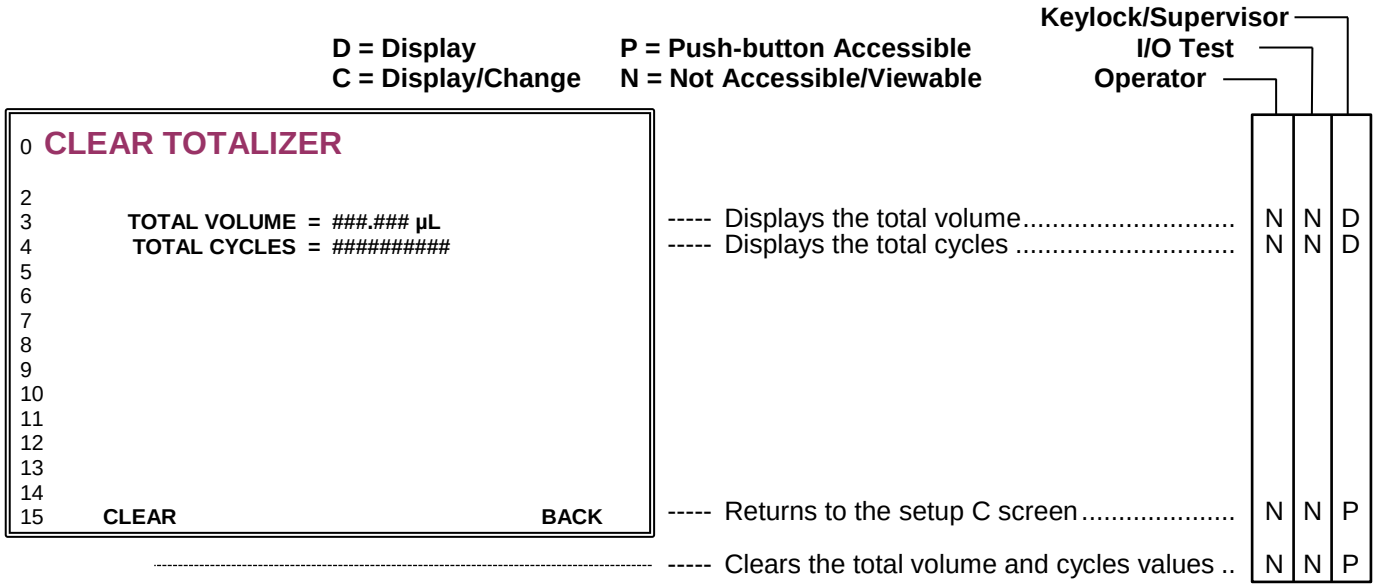
NOTE

The supervisor permission level is the only level allowed for saving recipes. Any permission level may get recipes.

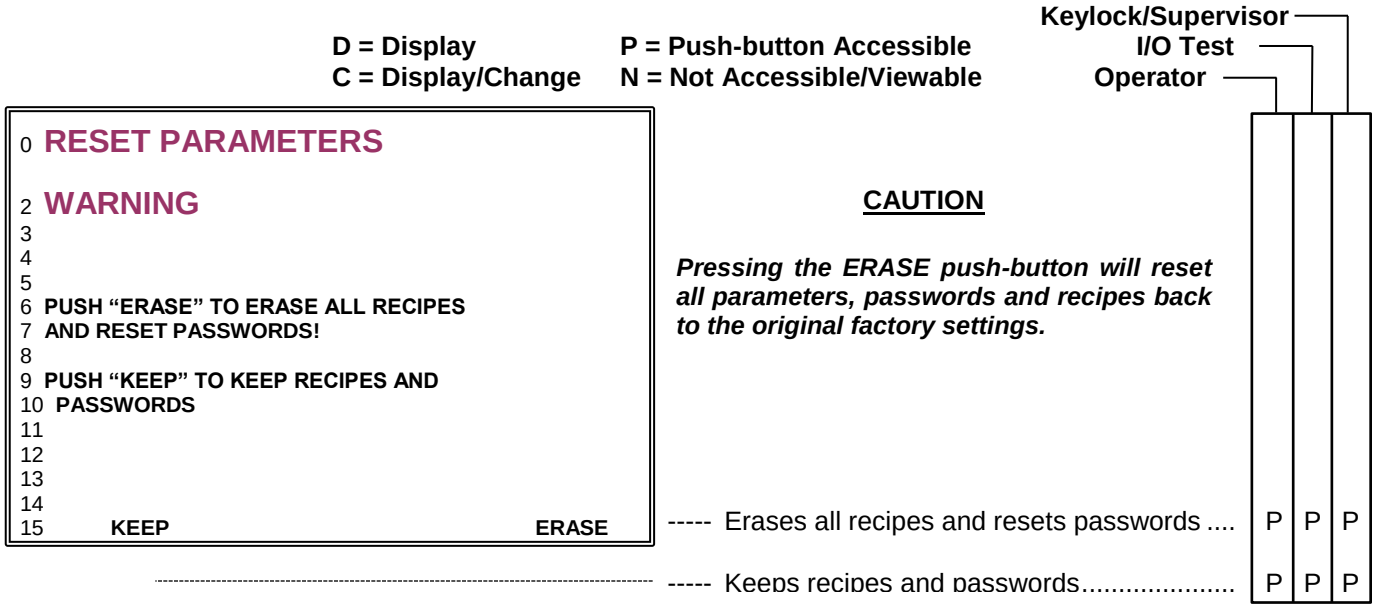
Warning Recipe Exists Screen Description - The Warning Recipe Exists screen is intended to prevent accidently overwriting an existing recipe. This screen will appear and offer a choice of either replacing the existing recipe or canceling and not replacing the existing recipe. The current permission level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

3.4.8.27 Clear Totalizer Screen



3.4.8.28 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.

3.4.8.29 Fault Screen

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

		Keylock/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.

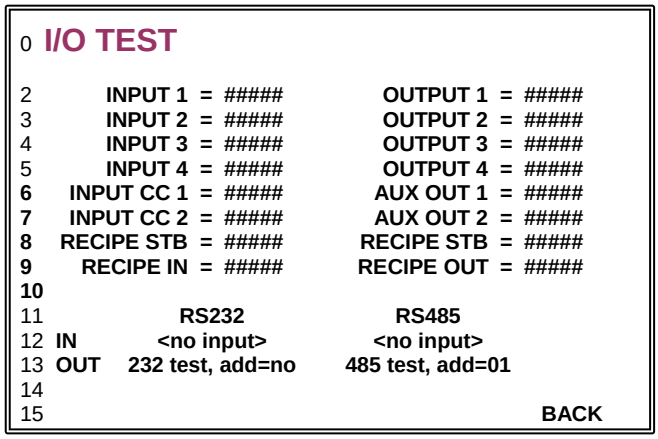
The Start push-button is not functional, but the Stop push-button is functional while this screen is visible.

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.

3.4.8.30 I/O Test Screen

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



		Keylock/Supervisor	I/O Test	Operator
-----	Display input 1–Display/Change output 1 ...	N	C	C
-----	Display input 2–Display/Change output 2 ...	N	C	C
-----	Display input 3–Display/Change output 3 ...	N	C	C
-----	Display input 4–Display/Change output 4 ...	N	C	C
-----	Display input CC 1–Disp/Change aux out 1	N	C	C
-----	Display input CC 2–Disp/Change aux out 2	N	C	C
-----	Display recipe stb–Disp/Change recipe stb	N	C	C
-----	Display recipe in–Disp/Change recipe 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 and Stop push-buttons are not functional with this screen. The screen will not affect the inputs and outputs while an operation is in progress. Therefore, any operations in progress must be stopped before testing the inputs and outputs.

Input 1, Input 2, Input 3, Input 4, Input CC 1, Input CC 2, Recipe STB - The status of the input signals are displayed here. The status will be either FALSE if no external signal is applied or TRUE if a signal is applied.

Recipe In - The Recipe In signal displays an integer representation of the Recipe In bits.

Output 1, Output 2, Output 3, Output 4, Aux Out 1, Aux Out 2, Recipe STB - The status of the output signals are displayed and changed here. A status of TRUE sets the output to the conduction level as configured on the Setup E screen.

Recipe Out - The Recipe Out signal allows the user to change the recipe output signals. An integer value determines which bits are conducting or not conducting. When the recipe is 0 all bits are FALSE. When the recipe is 31 all bits are TRUE. The conduction level for TRUE is configured on the Setup E screen.

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 In displays data being received through the interface, "<no input>" appears and scrolls off as characters are received. The text "485 test" flashes on the screen at RS485 Out as the text is sent through the interface.

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.

3.4.9 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, Disp Mult, Disp MCV, Drawback, Meter, Meter Mult, Setup A, Auto Trig, Setup B, Setup C, Setup D, Setup E, Encoder, Auto Trig, Prod Dwells, Keylock, 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
NOT CONFIGURED	Pump selection is set to 0
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.

3.4.10 Rear Panel Interfaces

The rear panel has six interface connectors. These interfaces provide a variety of functions for controlling and monitoring the Controller Module. The interfaces are CC Triggers, Aux 1 Aux 2, Logic I/O, USB, RS232 and RS485.

3.4.10.1 CC TRIGGERS Connector

The CC TRIGGERS connector provides two configurable input signals (Input CC 1 and input CC2) configurable in the Setup B screen (see 3.3.8.11). The two inputs can be configured as Disabled or a Trigger, Lock or Link input. Do not connect an external power source to this connector. The internal power source for this signal is optically isolated from the internal control electronics (isolated power shared with RS232 Serial Interface). Refer to Table 3.4 for signal descriptions.

3.4.10.2 AUX1 AUX2 Connector

The AUX1 AUX2 connector provides two configurable output signals (Aux Out 1 and Aux Out 2) configurable in the Setup B screen (see 3.3.8.11). The two outputs can be configured as Disabled or a Busy, Ready, Status, Success or Link output. This signal will switch an externally-powered device.. Refer to Table 3.5 for signal descriptions.

Table 3.4 Input 1 – Input 4, Input CC 1 and Input CC 2 Signal Description

Type	Condition	True Function	False Function
<DISABLED>		Ignore.	Ignore.
<TRIGR>	**PRODUCTION OPS**	Start Dispense, Meter, or Autotrigger Operation	Stop Meter or Autotrigger Operation.
	FLUIDIC OPS	Start Prime, Agitate, Operation	Stop Prime or Agitate Operation
	LOAD	Initiate Load operation	Ignore (no function)
	FLT CLEAR & REF	Clear Fault and start Reference Operation	Ignore (no function)
	PARK PORT	Port Park activated	Port Park deactivated
<LOCK>	**MOTION**	Unlock (allow) motion to occur	Lock (prohibit) motion from occurring
	FRONT PANEL	Unlock (allow) changes via the front panel	Lock (prohibit) changes via the front panel.
<LINK>	**WITH OUTPUT**	Depends on output configuration	Depends on output configuration

3.4.10.3 LOGIC 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. Refer to Tables 3.4 and 3.5 for signal descriptions.

Signal Functions

Isolated Inputs 1 - 4 - The Isolated Inputs 1 – 4 provide four configurable input signals (Input 1, Input 2, Input 3 and input 4) configurable in the Setup B screen (see 3.3.8.11). The four inputs can be configured as Disabled or a Trigger, Lock or Link input.

Isolated Outputs 1 - 4 - The Isolated Outputs 1 – 4 provide four configurable output signals (Output 1, Output 2, Output 3 and Output 4) configurable in the Setup B screen (see 3.3.8.11). The four outputs can be configured as Disabled or a Busy, Ready, Status, Success or Link output.

Recipe In Bits 0 – 4, Recipe In Bit Strobe and Recipe In Bit Common - The Recipe In Signals provide the ability to change the present recipe of the controller. The Recipe In Bits should be configured to the desired recipe number and then the Recipe In Bit Strobe should be set true to latch in the recipe. To select recipe 32 all bits should be false and then set true the Recipe In Bit Strobe. It is not possible to select recipe 0. All Recipe In Bits are optically isolated from the internal control electronics. The Recipe In Bits and Recipe In Bit Strobe share the Recipe Out Bit Common.

Recipe Out Bits 0 – 4, Recipe Out Bit Strobe and Recipe Out Bit Common - The Recipe Out Signals provide the ability to monitor the present recipe of the controller. The recipe bits only indicate a valid recipe when the Recipe Out Bit Strobe is true. When the present recipe is 32 all Recipe Out Bits will be false and the Recipe Out Bit Strobe will be true. When the present recipe is 0 all Recipe Out Bits will be false and the Recipe Out Bit Strobe will be true. The Recipe Out Bits and Recipe Out Bit Strobe share the Recipe Out Bit Common.

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.

Table 3.5 Output 1 – Output 4, AUX Out 1 and Aux Out 2 Signal Description (18 characters maximum)

Operating States STATUS (indicated in upper-right-hand corner of LCD)	<DISABLED>	<BUSY> DISCHARGE	<BUSY> PRD OP	<BUSY> FLD OP	<BUSY> PRD+FLD OPS	<BUSY> ALL OPS	<READY> IDLE	<READY> PRODUCTION	<SUCCESS> LAST	<SUCCESS> PULSE	<STATUS> FAULT	<STATUS> REFERENCE	<STATUS> LOAD	<BUSY> PORT	<STATUS> RECIPE	<LINK> WITH INPUT
No Operation																
INITIALIZING (power-up)																
IDLE							T	T	T[3]							
IDLE (production mode disabled)							T		T[3]							
IDLE (fluid mode disabled)							T	T	T[3]							
NOT CONFIGURED									T[3]							
MOTION LOCKED									T[3]							
AUTOTRIG IDLE									T[3]							
FAULTED											T					
CLEARING FAULT											T					
Reference Operation																
REFERENCING						T						T				
REFERENCE REQUIRED (DS3020 recommended)							T	T[2]	T[3]			T				
Load Operation																
LOADING						T							T			
LOAD REQUIRED							T		T[3]				T			
Port Operation																
CHANGING PORT						T								T		
PARKING PORT						T								T		
UNPARKING PORT						T								T		
PORT PARKED						T	T							T		
Fluidic Setup Mode Operation																
PRIMING				T	T	T										
Agitate Operation																
ISOLATING				T	T	T										
AGITATING				T	T	T										
AGITATE DWELL				T	T	T										
RETURNING				T	T	T										
Production Mode Operation																
PRE-OP DWELL			T		T	T										
DISPENSING or METERING		T	T		T	T										
DRAWBACK DWELL			T		T	T										
DRAWBACK			T		T	T										
POST-OP DWELL			T		T	T				T						
Setup E Screen (D = default setting)																
OUTPUT AUX 1 TRUE = CONDUCTING	D															
OUTPUT AUX 2 TRUE = CONDUCTING	D															
OUTPUT 1 TRUE = CONDUCTING								D								
OUTPUT 2 TRUE = NOT CONDUCTING											D					
OUTPUT 3 TRUE = CONDUCTING		D														
OUTPUT 4 TRUE = CONDUCTING												D				

Notes

T[1] - AP Prime will not go "TRUE" until 2nd rotation of prime operation

T[2] - on DS3020 only, will show "TRUE" if a reference is recommended

T[3] - Only "T" if last production operation completed without fault.

Each output is configurable for TRUE = CONDUCTING or NOT CONDUCTING

Signal Levels

The conduction level of each output is configurable in the Setup E screen. By default, Output 2 is configured as a <STATUS> FAULT signal with the conduction level set to not conducting when 'true'. While this may be reconfigured, using this configuration allows a broken connection in this signal path to appear as a FAULT condition to the monitoring equipment. Outputs can switch a signal of up to 24 VDC and 20mA.

For further description of the input and output electrical characteristics and wiring please see Technical Bulletin 134 (TB-134).

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 3.6 shows the connector pin layout.

Table 3.6 LOGIC I/O Interface

PIN	SIGNAL	PIN	SIGNAL
1	ISOLATED INPUT 1 +	19	Future Use
2	ISOLATED INPUT 1 -	20	Future Use
3	ISOLATED INPUT 2 +	21	Future Use
4	ISOLATED INPUT 2 -	22	Future Use
5	ISOLATED INPUT 3 +	23	Key
6	ISOLATED INPUT 3 -	24	RECIPE IN BIT 0 +
7	ISOLATED INPUT 4 +	25	RECIPE IN BIT 1 +
8	ISOLATED INPUT 4 -	26	RECIPE IN BIT 2 +
9	Key	27	RECIPE IN BIT 3 +
10	ISOLATED OUTPUT 1 +	28	RECIPE IN BIT 4 +
11	ISOLATED OUTPUT 1 -	29	RECIPE IN BIT STROBE
12	ISOLATED OUTPUT 2 +	30	RECIPE IN BIT COMMON -
13	ISOLATED OUTPUT 2 -	31	RECIPE OUT BIT 0 +
14	ISOLATED OUTPUT 3 +	32	RECIPE OUT BIT 1 +
15	ISOLATED OUTPUT 3 -	33	RECIPE OUT BIT 2 +
16	ISOLATED OUTPUT 4 +	34	RECIPE OUT BIT 3 +
17	ISOLATED OUTPUT 4 -	35	RECIPE OUT BIT 4 +
18	Key	36	RECIPE OUT BIT STROBE
		37	RECIPE OUT BIT COMMON -

3.4.10.4 RS232, RS485 and USB Interfaces

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 and RS485). The hardware is configured as RS232 Data Communications Equipment (DCE) standard with the pin configuration shown in Table 3.7.

The USB is an alternate for the RS232 interface. The USB connector is a type B connector. The USB connection is a device connection. The connection between the USB and the PC is a virtual serial port. The driver for the USB is included with the most recent versions of Windows.

The RS485 is similar to the RS232. The RS485 allows multi-drop configuration (RS232 is point-to-point), which means multiple devices may be on the same wiring network. 5V power is provided on the connector (limited to 20mA). There is also a connection for the shield of the cable. The cable shield should only be connected at one end.

Table 3.7 RS232 and RS485 Connections (DCE, 9 pin D-sub female)

RS232			RS485	
Pin	**Signal**	**Direction**	**Pin**	**Signal**
1	NC	not connected	1	5V Power
2	TD	To Controller Module	2	DATA A
3	RD	From Controller Module	3	DATA B
4	NC	not connected	4	COMMON
5	GND		5	FUNCTIONAL GROUND (Cable shield)
6	DSR	From controller Module		
7-9	NC	not connected		

No hardware signals are currently used for handshaking. The DSR signal is available to provide limited power for some RS232 translator devices (10mA max).

The parameters of the communications interface are as follows.

- 9600, 19200, 38400, 57600 BAUD (Configurable on Setup D screen (3.3.8.13)
- 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 protocol is a query/response protocol. The interface does not 'broadcast' messages, such as fault conditions, but only responds when it receives a command.

COMM GATEWAY – When configured for a COMM GATEWAY, uses addresses on RS232 and provides a bridge between RS232 and RS485 communication.

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.

<address>	The address of the Controller Module (not needed when communicating via RS232 or USB unless COMM GATEWAY=ENABLED). When enabled, the address must match the address of the unit (Configurable via Setup D screen), or the broadcast address (address 0).
<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:

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

<address> Address
The first numerical character seen in the command string will be evaluated as the address. The RS232 and USB do not use addressing unless the COMM GATEWAY setting is ENABLED. RS485 always uses an address. The address of the unit is configurable via the Setup D screen and is an integer between 1 and 99. Also, all devices listen to the broadcast address, address 0.

<cmd> Command

After the address, the first alphabetic character seen in the command string will be evaluated as the command character.
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: <address><cmd><value1>,<value2>,<value3><CR>

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 3.8 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 3.8 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>	Returns current Autotrigger Mode setting.
a2, <value2>	a2,<value2>	Autotrigger Mode. <value2>: 0 = Disabled (default) 1 = Count 2 = Infinite
a3	a3,<value2>	Returns current Autotrigger Count setting.
a3, <value2>	a3,<value2>	Autotrigger Count. <value2>: 2 = minimum (default) 10000000 = maximum
a4	a4,<value2>	
a4,<value2>	a4,<value2>	Returns current Autoreload Count setting. Autoreload Count. <value2>: 0 = minimum (default) 65535 = maximum
b => BEGIN		
b or b0	b0,0	Initiates a Production Mode operation.
b1	b1,0	Initiates a Fluidic Setup Mode operation.
c => CLEAR FAULTS		
c or c0	c0,<value2>	Clears all faults and reference pumps.
d => DIRECTION		
d or d0	d0,<value2>	Returns current Production Mode fluid direction setting.
d0,<value2>	d0,<value2>	Sets the Production Mode fluid direction. <value2>: 0 = Reverse 1 = Forward (default)
d1	d1,<value2>	Returns current Fluidic Mode direction setting.
d1,<value2>	d1,<value2>	Sets the Fluidic Mode direction. <value2>: 0 = Reverse 1 = Forward (default)
e => END		
e or e0	e0	Ends the current pumping cycle. In Prime mode, will continue until piston has reached the stop position.

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 totalizer value to 0. <value2>: 0 = Resets the totalizer value to zero.
g1	g1,<value2>	Returns the totalizer value in number of Cycles.
g1,<value2>	g1,<value2>	Resets the totalizer value 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

h1	h1,<value2>	Returns the Controller address for serial interface setting.
h1,<value2>	h1,<value2>	Sets the Controller address for serial interface configuration. <value2> 1 = Minimum (default) 99 = Maximum
h2,<value2>	h2,<value2>	Sets the contrast percentage. <value2> 30 = Minimum 50 = (default) 70 = Maximum
h3,<value2>	h3,<value2>	Enables/Disables Comm Gateway mode. <value2> 0 = Disabled (default) 1 = Enabled)
h4,<value2>	h4,<value2>	Enabled/Disabled Logic I/O Gateway mode. <value2> 0 = Disabled (default) 1 = Enabled
h5,<value2>	h5,<value2>	Configures the conduction level for Recipe Outputs when 'true'.. <value2> 0 = Recipe Outputs conducting when 'true'. 1 = Recipe Outputs non-conducting when 'true'.
h10	h10,<value2>	Returns the Input CC 1 setting.
h10,<value2>	h10,<value2>	Sets the Input CC 1 configuration. <value2> 0 = <TRIGGER> Fault Clear & Reference 1 = <TRIGGER> Fluidic Operations 2 = <LOCK> Motion 3-8 = <LOCK> Front Panel 9 = (TRIGGER> Load 10 = Port Park 11 = <TRIGGER> Production Operations (default) 12 = <LINK> With Output 13 = <DISABLED>
h11	h11,<value2>	Returns the Input 1 setting.
h11,<value2>	h11,<value2>	Sets the Input 1 configuration. <value2> 0 = Same as h10, default = <TRIGGER> Production Ops
h12	h12,<value2>	Returns the Input 2 setting.
h12,<value2>	h12,<value2>	Sets the Input 2 configuration.

		<value2>
		Same as h10, default = <TRIGGER> Fluidic Ops
h13	h13,<value2>	Returns the Input 3 setting.
h13,<value2>	h13,<value2>	Sets the Input 3 configuration.
		<value2>
		Same as h10, default = <TRIGGER> Clear Fault & Reference
h14	h14,<value2>	Returns the input 4 setting.
h14,<value2>	h14,<value2>	Sets the input 4 configuration.
		<value2>
		Same as h10, default = <DISABLED>
h19	h19,<value2>	Returns the input CC 2 setting.
h19,<value2>	h19,<value2>	Sets the Input CC 2 configuration.
		<value2>
		Same as h10, default = <DISABLED>
h20	h20,<value2>	Returns the Aux Out 1 setting.
h20,<value2>	h20,<value2>	Sets the Aux Out 1 configuration.
		<value2>
		0 - <DISABLED> (default)
		1 - <BUSY> Discharge
		2 - <BUSY> Production Operations
		3 - <BUSY> All Operations
		4 - <READY> Idle
		5 - <READY> Production
		6 - <STATUS> Reference
		7 – Load Required
		8 – Port Park
		9 - <BUSY> Fluidic Operations
		10 - <BUSY> Production & Fluidic Operations
		11 - <SUCCESS> Last
		12 - <SUCCESS> Pulse
		13 - <LINK> With Input
		14 - Reserved
		16 - <STATUS> Fault
h21	h21,<value2>	Returns the output 1 setting.
h21,<value2>	h21,<value2>	Sets the output 1 configuration.
		<value2>
		Same as h20, default = <READY> Production
h22	h22,<value2>	Returns the output 2 setting.
h22,<value2>	h22,<value2>	Sets the output 2 configuration.
		<value2>
		Same as h20, default = <STATUS> Fault
h23	h23,<value2>	Returns the output 3 setting.
h23,<value2>	h23,<value2>	Sets the output 3 configuration.
		<value2>
		Same as h20, default = <BUSY> Discharge
h24	h24,<value2>	Returns the Output 4 setting.
h24,<value2>	h24,<value2>	Sets the Output 4 configuration.
		<value2>
		Same as h20, default = <STATUS> Reference
h29	h29,<value2>	Returns the Aux Out 2 setting.
h29,<value2>	h29,<value2>	Sets the Aux Out 2 configuration.
		<value2>
		Same as h20, default = <DISABLED>
h40	h40,<value2>	Returns the Aux Out 1 True setting.
h40,<value2>	h40,<value2>	Sets the configuration.
		<value2>
		0 = Conducting (default)
		1 = Not Conducting

h41	h41,<value2>	Returns the Output 1 setting.
h41,<value2>	h41,<value2>	Sets the Output 1 configuration. <value2> 0 = Conducting (default) 1 = Not Conducting
h42	h42,<value2>	Returns the Output 2 setting.
h42,<value2>	h42,<value2>	Sets the Output 2 configuration. <value2> 0 = Conducting 1 = Not Conducting (default)
h43	h43,<value2>	Returns the Output 3 setting.
h43,<value2>	h43,<value2>	Sets the Output 3 configuration. <value2> 0 = Conducting (default) 1 = Not Conducting
h44	h44,<value2>	Returns the Output 4 setting.
h44,<value2>	h44,<value2>	Sets the Output 4 configuration. <value2> 0 = Conducting (default) 1 = Not Conducting
h49	h49,<value2>	Returns the Aux Out 2 setting.
h49,<value2>	h49,<value2>	Sets the Aux Out 2 configuration. <value2> 0 = Conducting (default) 1 = Not Conducting

k => KEYLOCK

k or k0	k0,<value2>	Returns the current Enable Motion setting.
k0,<value2>	k0,<value2>	Sets the Enable Motion configuration. <value2> 0 = Disable 1 = Enable (default)
k1	k1,<value2>	Returns the current Front Panel Lock setting.
k1,<value2>	k1,<value2>	Sets the Lock Front panel configuration. <value2> 0 = Enable All - Front Panel (default) 1 = Disable Recipe Save 2 = Disable Recipe Save & Value Change - Front Panel 3 = Disable Recipe Save, Value Change & Prime Direction - Front Panel 4 = Disable Recipe Save, Value Change & Recipe Get - Front Panel 5 = Disable Recipe Save, Value Change, Recipe Get & Prime Direction – Front Panel 6 = Disable Recipe Save, Value Change, Recipe Get Prime Direction & Start Stop - Front Panel
k2	k2,<value2>	Returns the current Change Permission level. <value2> 0 = Operator 1 = I/O Test 2 = Supervisor 3 = Keylock
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 ode. <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>: 1 - 32
n98,<value2>	n98,<value2>	Saves the current values to specified recipe if recipe number doesn't exist. <value2>: 1 - 32
n99,<value2>	n99,<value2>	Saves the current values to specified recipe and overwrites any existing recipe. <value2>:

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 state. <value2>: 1 - 32 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 = Post-op dwelling
17 = Porting (upon changing the active port setting)
18 = Agitate Dwelling
19 = Parking Port
20 = Port Parked
21 = Unparking Port
26 = A fault is being cleared

r => DISPENSE 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: 60.00
		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: 60.00
		Minimum: 0.00 (default)
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 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.
z1	z1,<value2>	Returns the Current device type (DS3020)
z2	z2,<value2>	Returns the firmware CRC

3.4.10.5 Linked Operation

Multiple DS3020 may be configured to operate together through the use of either the I/O signals and/or the RS485 communication link. This allows multiple pumps to be configured and dispensed synchronously, for example: at the command of an operator through the use of footswitch, at the request of a PLC through Logic I/O, or at the initiation of a PC through one of the serial links. The DS3020 provides the flexibility of many interfaces, which may be used together in various methods. Listed below are some typical configurations to illustrate the capabilities of the DS3020 interfaces.

NOTE: Due the flexible nature of the DS3020 interface, there are complex and diverse ways to configure the DS3020 to integrate with other equipment in dispensing applications. If help is needed configuring the DS3020 for a specific application please contact IVEK Technical Support.

Example 1 Operation of 3 Units by a Footswitch

Connections

The following table lists the connections to make between units:

Unit 1	**Unit 2**		**Unit 2**	**Unit 3**
AUX1+	CC_1+		AUX1+	CC_1+
AUX1-	CC_COM		AUX1-	CC_COM
CC_2+	AUX2+		CC_2+	AUX2+
CC_COM	AUX2_		CC_COM	AUX2-

If using a Footswitch, make the connection between CC_1+ and CC_COM from First Unit to the footswitch. If using a PLC, make a connection between a PLC output and a Logic I/O input (e.g., Input 1).

Configuration

First Unit Configuration (Unit 1)

The first unit in the DS3020 link needs to be configured as the Logic Gateway. The Logic Gateway checks the status of units down the link and only allows the trigger signal to propagate if all units are ready. Only one unit should be configured as a Logic Gateway.

Setup E Screen

- LOGIC GATEWAY = ENABLED

Setup B Screen

- INPUT CC 1 = <TRIGGER> PRODUCTION
- AUX OUT 1 = <LINK> WITH INPUT
- INPUT CC 2 = <LINK> WITH OUTPUT
- AUX OUT 2 = <READY> PRODUCTION

Middle Unit Configuration (Unit 2)

The middle units propagate Trigger signals down the link towards the last unit and propagate Ready signals up the link towards the first unit.

Setup E Screen

- LOGIC GATEWAY = DISABLED

Setup B Screen

- Same as First Unit

Last Unit Configuration (Unit 3)

The last unit needs special configuration relative to a middle unit only because there is not a unit propagating its Ready signal to the Input CC 2.

Setup E Screen

- LOGIC GATEWAY = DISABLED

Setup B Screen

Same as First Unit except:

- INPUT CC 2 = <DISABLED>

Operation

Connect the footswitch signal between the CC_1 and CC_COM inputs on the First Unit (Unit 1). Operation of the pump is initiated by activating the footswitch. If any unit is not ready (needs to be referenced, is faulted, etc.) operation will not be initiated by the footswitch activation. In order to continue operation, the unit

If using a footswitch, connect the footswitch between CC_1 and C_COM.

Example 2 Operation of 3 Units by a PLC using Logic I/O

Connections

Connect an output of the PLC to an input of the Logic I/O (e.g., Input 1); connect an input of the PLC to an output of the Logic I/O (e.g., Output 1). Operation of the pump is initiated by activating the output of the PLC. Before triggering, the PLC should monitor the Ready signal to determine whether the DS3020 link is ready to respond to a trigger. For more information about connecting PLC's to IVEK Controllers, pleas reference TB-134.

Configuration

All units should be configured in the same manner as for operation by a Footswitch.

Configure the following additional items on the DS3020:

Setup B Screen

- INPUT 1 = <TRIGGER> PRODUCTION
- OUTPUT 1 = <READY> PRODUCTION

Example 3 Operation of 3 Units by a PLC or PC using Serial Communication

Connections

USB or RS232 Connections

The USB connection on the back of the DS3020 is a USB 2.0 Type B device connection.

The RS232 connection on the back of the DS3020 is a DB-9, DCE connection.

The followings table lists the connections between units:

PLC or PC	Unit 1
USB or RS232	USB or RS232

RS485 Connections

RS485 cable (120 Ohm impedance) should be used to daisy chain the DS3020 units using the RS485 connector on the back of each DS3020 unit. To avoid ground loops, the shield wire of each cable segment should only be connected to one controller.

		Segment 1			Segment 2	
RS485 Signal		Unit 1	Unit 2		Unit 2	Unit 3
5V		NC	NC		NC	NC

A		2	2		2	2
B		3	3		3	3
Common		4	4		4	4
Shield		5	NC		5	NC

Configuration

PC or PLC

Either USB or RS232 may be used to communicate between either a PC or PLC and the DS3000. When USB is used, the DS3000 appears as a virtual serial port to the PC or PLC. For either case, the following settings are necessary on the PC or PLC:

- Baud Rate: 9600 (default, may be changed to a faster baud rate on the DS3000 Setup D screen).
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

Using a PC will require the use of either custom software or a terminal emulator program. For a recommendation and configuration of a terminal emulator, please reference TB-120.

First Unit Configuration (Unit 1)

The first unit in the RS485 link needs to be configured as the Comms Gateway. The Comms Gateway bridges the commands on either the USB or RS232 link to the RS485 link. Only one unit should be configured as a Comms Gateway. Each unit needs a unique address. It is recommended to give an address to each unit that represents the location of the unit in the daisy chain.

Setup D Screen

- COMMS GATEWAY = ENABLED
- COMMS ADDRESS = 1 (recommended)

Remaining Units Configuration (Unit 2, Unit 3, etc.)

Setup D Screen

- COMMS GATEWAY = DISABLED
- COMMS ADDRESS = X (X = location, e.g., 2, 3, etc.)

Operation

The valid commands to configure and control the DS3000 units are listed in section 3.3.10.4. All units may be configured and commanded synchronously using the global address (0). Individual units may be configured, commanded, and queried using the units specific address (1, 2, 3, etc.).

Once the units are configured to the desired settings (volumes, rates, etc), the begin command (0b1) may be used to trigger production operations and the status (Xq0) may be used to query the status of the units. While the units may be globally configured and commanded, querying is only available of individual units.

It is possible to perform a quasi-global query of all the units in a single command. Doing so requires linking and configuring all of the units per Example 1. Once connected, querying the status of the Inputs of Unit 1 (1s20) will indicate the Ready status of the entire link.

3.4.11 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 is 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 Disable 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 delimeter .
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 or port parked.
27 **Invalid Address Mode –** The communication command string uses an address mode that is inconsistent with the configuration for that communication channel.

3.4.12 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 Module Fault – The module that drives the motor has faulted.

1013 Non-Volatile Memory - Error in reading from or writing to the non-volatile memory (recipes and power-up values).
1014 Low Motor Voltage Fault – The voltage to the motor module is very low, possibly a blown fuse.
1015 Motor Control Hardware Fault - A fault in the hardware that sets the motor current threshold was detected.
1016 Internal Operation Fault - An internal software fault has occurred.
1017 Motion Disable during Operation - Either the Motion Enable signal or the serial command disabling motion occurred during an operation.

3.4.13 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.

3.4.13.1 Setup

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) switch is set to 0 (Off).
b. Connect the power cord to the Controller Module and the power source.
c. Connect the Motor Cable, the larger connector connects to the Controller Module.

2. On the Actuator Module

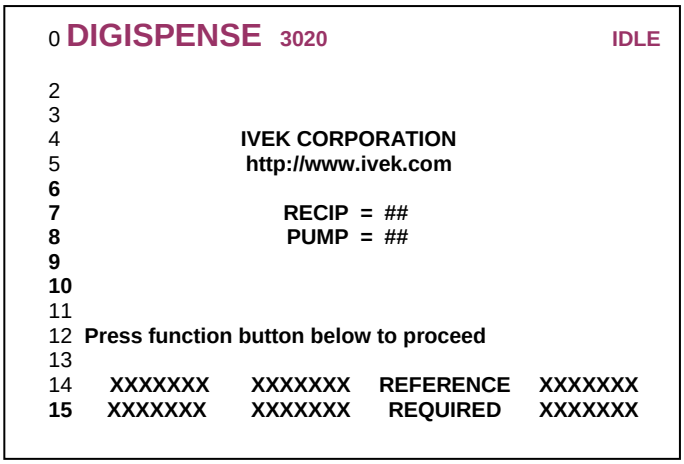
a. Connect the other end of the Motor Cable
b. Set the AP Style displacement adjust to 4.5 or
c. Set the Heavy Duty Style displacement adjust to 10

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



3.4.13.2 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.

NOTE

All controllers are sent in Supervisor Level.

3.4.13.3 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. Press the START push-button to begin priming.. The system will prime based on the Priming Rate and Prime Volume settings. Pressing the STOP push-button can stop the priming any time.

NOTE

To determine the correct inlet side, the motor connector must be located as shown in the following photos.

3.4.13.4 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 Threshold 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.

3.4.13.5 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.

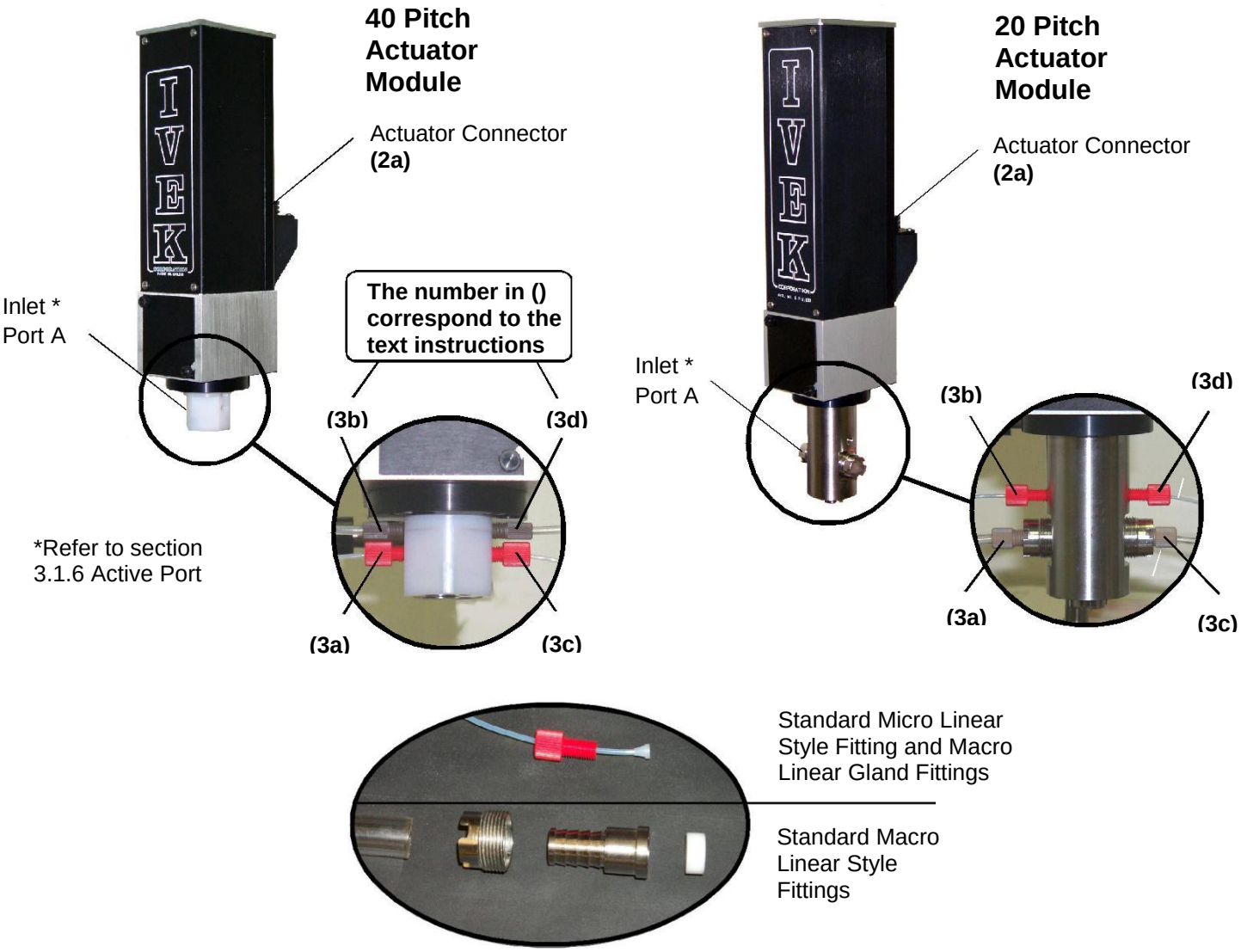
To start dispensing press the START button, enter a RS232 command or supply a trigger to the rear panel. The system will dispense based on the Direction, Volume, Rate, Load Rate, MCV Conserve Fluid and Drawback settings. Pressing the STOP push-button can stop the dispensing any time.

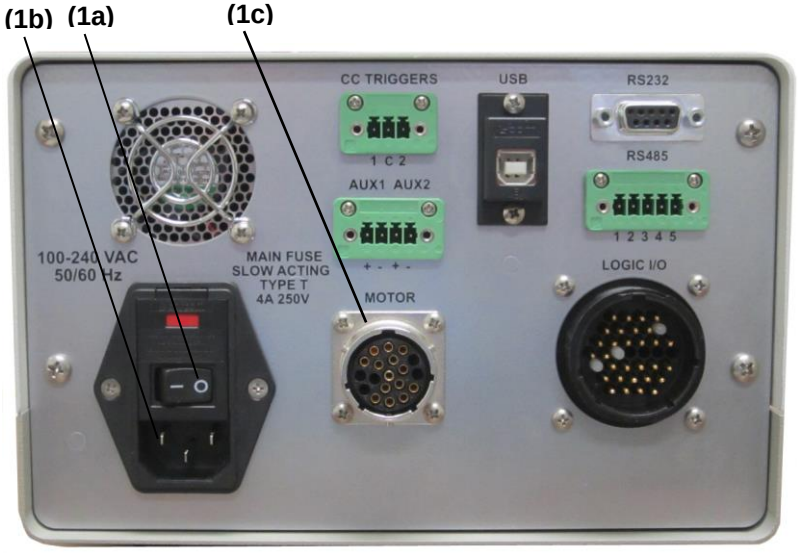
When drawback is enabled, the Volume setting specifies the net fluid displaced, the actual forward motion is the sum of the specified dispense volume and the drawback volume. The Drawback Rate during drawback and the Drawback Dwell (time between the forward and reverse portions of the cycle) settings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

3.4.13.6 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.


40 Pitch Actuator Module
Actuator Connector (2a)
Inlet * Port A
The number in () correspond to the text instructions
(3b)
(3d)
(3a)
(3c)
*Refer to section 3.1.6 Active Port
20 Pitch Actuator Module
Actuator Connector (2a)
Inlet * Port A
(3b)
(3d)
(3a)
(3c)
Standard Micro Linear Style Fitting and Macro Linear Gland Fittings
Standard Macro Linear Style Fittings


(1b)
(1a)
(1c)
CC TRIGGERS
1 C 2
AUX1 AUX2
+ - + -
USB
RS232
RS485
1 2 3 4 5
LOGIC I/O
MOTOR
100-240 VAC 50/60 Hz
MAIN FUSE SLOW ACTING TYPE T 4A 250V

3.4.13.7 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.

3.4.13.8 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.

3.5 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.

3.6 MAINTENANCE

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

3.6.1 Assembly/Disassembly Procedures

The Controller Module contains the following replaceable parts.

- Main Power Fuse

3.6.1.1 Main Power Fuses

The main power fuses are 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 fuses into the fuse tray and slide the tray in.
2. Close the power entry module's cover.
3. Connect the power cord.

3.7 PROBLEM GUIDE

Table 3.9 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.

3.8 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
LOGIC I/O Output Requirements:
Maximum external voltage: +24 VDC
Maximum current: 20mA

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

3.9 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.

520236 - # # # # #

Motor/Base
B - 1500 RPM 48 VDC @ 5A

Logic Interface
B - LOGIC I/O, Recipes, Dual CC & Aux.

Communications
B - RS232, RS485, USB

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

Line Cord & Agency Approval
A - US Cord & CE
B - International Cord (no plug) & CE
C - US Cord & CE, NRTL Certified
D - International Cord (no plug) & CE, NRTL Certified

3.10 ILLUSTRATED PARTS BREAKDOWN

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

Table 3.9 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 supplying100 - 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.
	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.

Table 3.9 Common Operational Problems And Solutions - Cont.

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
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.
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. CAUTION: 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.
Backup Recipe Fault	The recipe's backup copy is corrupted.	Re-save the recipe so that both copies will be updated and cycle power.

Table 3.9 Common Operational Problems And Solutions - Cont.

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
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.
Motor Stall Fault	Motor cable	Check cable connection between the Controller Module and the Actuator Module. Inspect cable and repair if necessary.
	Incorrect Pump selected	In SETUP C screen, change Pump Size to correct value per Table 3.2.
	Low torque setting	In SETUP C screen, adjust the torque setting.
	Slow acceleration setting	In SETUP C screen, adjust the acceleration setting.
	High Initial Rate Setting	Adjust Initial Rate setting in the Setup C screen.
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.
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 3.9 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.
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)
		If none of the above solves the problem, contact IVEK technical support for assistance.

CHAPTER REVISIONS

B	10/30/19	Per DCR/N 19500, Added section 3.2 and Updated Model # chart.
A	09/25/19	Per DCR/N 1926, updated table on page 113.
-	7/10/15	Original release.