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3. DIGISPENSE® 4000BT CONTROLLER MODULE

3.1 DESCRIPTION

The Digispense® 4000BT Controller Module, hereafter referred to as the Controller Module, contains all the control, monitoring, and interface components for fluidic dispensing operations. The operator indicators are located on the front panel, the Communications Interface, Logic I/O, Contact Closure, Auxiliary Outputs, 4-20 mA In, 4-20mA Out, Liquid Eye and Power connectors are located the rear panel. The Controller Module measures 146.9mm (5.8”) tall, 206.6mm (8.1”) wide and 282.5mm (11.1”) deep and weighs approximately 4.3kg (9.5lbs).

3.1.1 Front Panel Detail (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

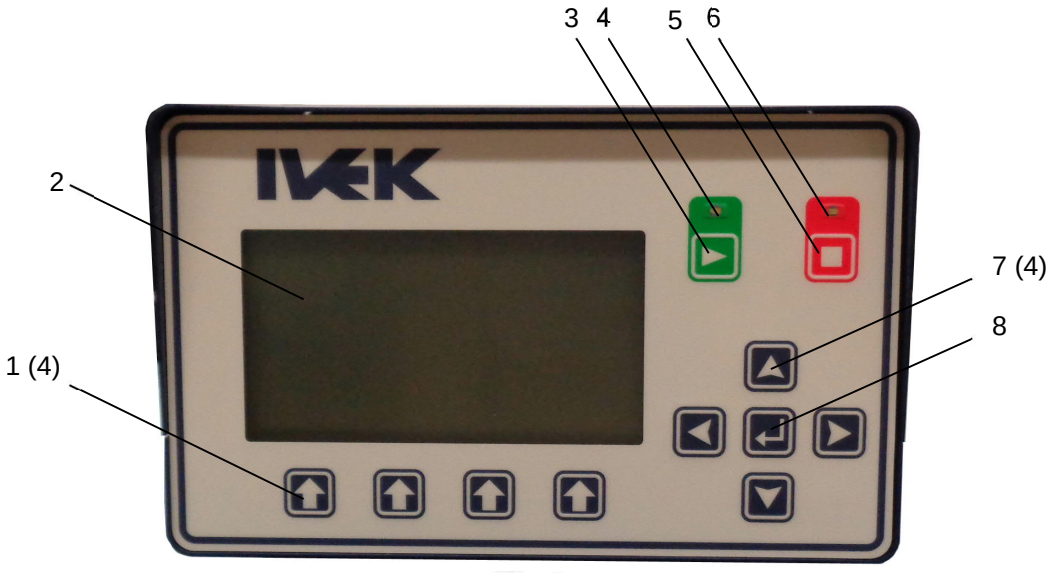


Figure 3.1 – Digispense® 4000BT Controller Module Front Panel

3.1.1.1 Function Push-buttons (Figure 3.1 Item 1)

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

3.1.1.2 Display (Figure 3.1 Item 2)

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

3.1.1.3 Start Push-button (Figure 3.1 Item 3)

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

operating.

3.1.1.4 Active/Start Indicator (Figure 3.1 Item 4)

The Active Indicator illuminates when the pump is operating and blinks while a fault is present.

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 and blinks while an alert is present.

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. LOGIC AND ANALOG I/O Connector
4. MOTOR Connector
5. FIELDBUS Module
6. LIQUID EYE Connector
7. CC TRIG IN AUX OUT Connector
8. 24 VDC 1.5A OUT Connector

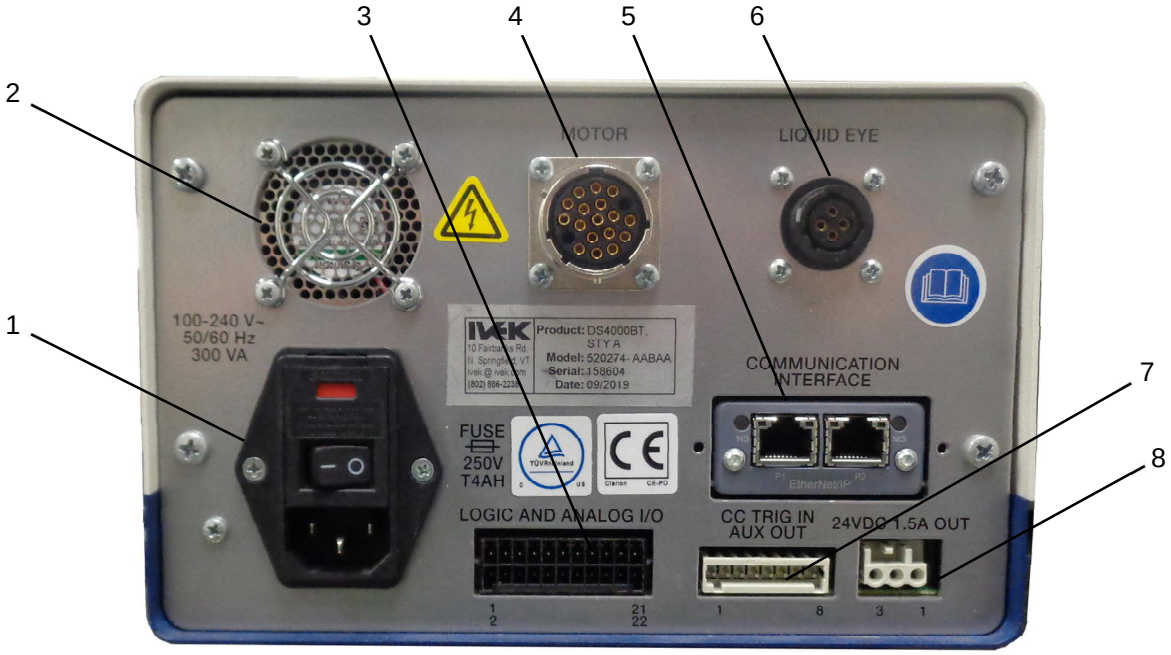


Figure 3.2 – Digispense® 4000BT Controller Module Rear Panel

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 LOGIC AND ANALOG I/O Connector (Figure 3.2 Item 3)

The Logic and Analog I/O provide connections to various external components such as PLCs and 4-20mA sensors/actuators. All signal pairs are bipolar. All signal pairs are isolated from each other and from earth ground by either optical or galvanic methods. The connector configuration is shown below.

Pin	Description	Group Ref
1	Earth Ground	Functional Earth Ground
2	Earth Ground	
3	Analog Input A	4-20mA Analog Input
4	Analog Input B	
5	Analog Output A	4-20mA Analog Output
6	Analog Output B	
7	Isolated Input 1A	Isolated Input 1
8	Isolated Input 1B	
9	Isolated Input 2A	Isolated Input 2
10	Isolated Input 2B	
11	Isolated Input 3A	Isolated Input 3
12	Isolated Input 3B	

Pin	Description	Group Ref
13	Isolated Input 4A	Isolated Input 4
14	Isolated Input 4B	
15	Isolated Output 1A	Isolated Output 1
16	Isolated Output 1B	
17	Isolated Output 2A	Isolated Output 2
18	Isolated Output 2B	
19	Isolated Output 3A	Isolated Output 3
20	Isolated Output 3B	
21	Isolated Output 4A	Isolated Output 4
22	Isolated Output 4B	

3.1.2.4 MOTOR Connector (Figure 3.2 Item 4)

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

CAUTION

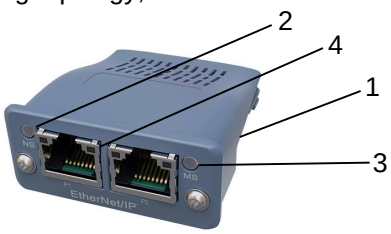
Never connect or disconnect the cable from this connector while power is on. Damage to the equipment may result.

3.1.2.5 FIELDBUS Module (Figure 3.2 Item 5)

The Fieldbus Module will only be present when one of the five fieldbus module options are selected. The five fieldbus module options are: EtherNet/IP, PROFINET, EtherCAT, RS-232 and USB.

3.1.2.5.1 EtherNet/IP

The EtherNet/IP fieldbus module (item 1 in the image below) contains two RJ45 connectors (item 4 in the image below) used to connect the Controller Module to the PLC Interface, Network, or additional Controller Modules. The two connectors are switched so either connector can be used. For star topology, use either connector. For either a linear or ring topology, use both connectors.



The NS indicator (item 2) indicates the EtherNet/IP Network Status.

Color	Description
Off	No power, no IP address
Red	Duplicate IP Address or Fatal error
Red, Flashing	Either a Class 1 or Class 3 connection timed out
Green	Network active, one or more Class 1 or Class 3 connections established
Green, Flashing	Network active but no Class 1 or Class 3 connections established

The MS indicator (item 3) indicates the EtherNet/IP Module Status.

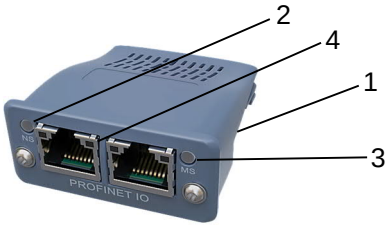
Color	Description
Off	No power
Red	Major fault
Red, Flashing	Recoverable fault
Green	Controlled by a Scanner, Run state
Green, Flashing	Not configured or Scanner, Idle state

The Ethernet Data indicators (leds on item 4) indicate the status of data transmission and connectivity on the physical Ethernet link.

Color	Description
Off	No link, no activity
Green	Link Active (100 Mbit/s)
Green, flickering	Data Activity (100 Mbit/s)
Yellow	Link Active (10 Mbit/s)
Yellow, flickering	Data Activity (10 Mbit/s)

3.1.2.5.2 PROFINET

The PROFINET fieldbus module (item 1 in the image below) contains two RJ45 connectors (item 4 in the image below) used to connect the Controller Module to the PLC Interface, Network, or additional Controller Modules. One connector is designated as P1 and the other as P2.



The NS indicator (item 2) indicates the PROFINET Network Status.

Color	Description
Off	No power, no communication with IO Controller
Red	Major internal error (combined with a red module status LED)
Red, 1 flash	Station Name not configured
Red, 2 flashes	IP address not configured
Red, 3 flashes	The Expected Identification does not match the Real Identification
Green	Connection with an I/O Controller established and in the RUN state
Green, 1 flash	Connection with I/O Controller established but I/O Controller is either in a STOP state, or the I/O data is bad
Green, blinking	Engineering tools initiate for identification purposes

The MS indicator (item 3) indicates the PROFINET Module Status.

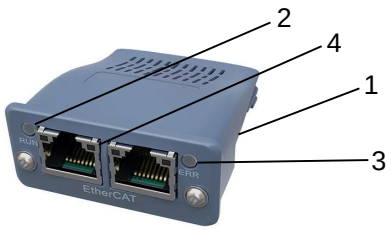
Color	Description
Off	No power, or module is in the SETUP or NW_INIT state
Red	Module is in the EXCEPTION state, or a Major internal error (combined with a red NS LED)
Alternating Red/Green	Firmware upgrade is in process – do not turn off the controller until this sequence has completed
Green	Module is in the ACTIVE state
Green, 1 flash	A Diagnostic event(s) is present

The Ethernet Data indicators (leds on item 4) indicate the status of data transmission and connectivity on the physical Ethernet link.

Color	Description
Off	No link, not communicating
Green	Ethernet link established, not communicating
Green, flickering	Ethernet link established, communicating

3.1.2.5.3 EtherCAT

The EtherCAT fieldbus module (item 1 in the image below) contains two RJ45 connectors (item 4 in the image below) used to connect the Controller Module to the PLC Interface, Network, or additional Controller Modules. One connector is designated as IN and the other as OUT.



The RUN indicator (item 2) indicates the status of the EtherCAT state machine.

Color	Description
Off	Device is in the INIT operational state
Green	Device is in the OP state
Green, blinking	Device is in the PRE-OP state
Green, single flash	Device is in the SAFE-OP state
Flickering	Device is in the BOOT state
Red	When both the RUN and ERR indicators are red, a fatal event has occurred.

The ERR indicator (item 3) indicates the EtherCAT communication error status.

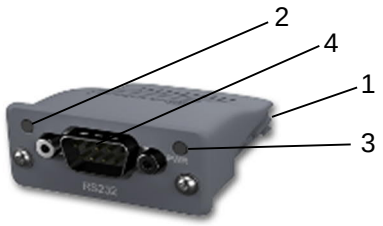
Color	Description
Off	No error
Red, blinking	A state change is not possible due to an invalid configuration setting.
Red, single flash	The EtherCAT state changed by the device application unexpectedly.
Red, double flash	There was a timeout of the Sync Manager watchdog.
Red	There is an exception with the module. If both RUN and ERR indicators are red, a fatal event has occurred.
Flickering	Error detected during booting.

The Ethernet Data indicators (leds on item 4) indicate the status of data transmission and connectivity on the physical EtherCAT link.

Color	Description
Off	No link, no activity
Green	Link Active
Green, flickering	Link Active, Data activity

3.1.2.5.4 RS-232

The RS-232 fieldbus module (item 1 in the image below) contains a DSUB-9 connector (item 4 in the image below) and provides point-to-point communication with either a PLC or PC using IVEK's custom ascii protocol. Refer to section 3.4.2 for additional information.



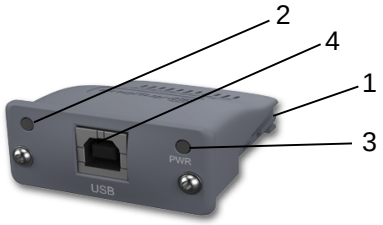
The left indicator (item 2) is not used.

The PWR indicator (item 3) indicates the power status of the module.

Color	Description
Off	No power
Green	Fieldbus module is powered

3.1.2.5.5 USB

The USB fieldbus module (item 1 in the image below) provides a USB Type B connector (item 4 in the image below) and provides point-to-point communication with either a PLC or PC using IVEK's custom ascii protocol. The USB port requires drivers for the operating system and functions as a Virtual COM port. Refer to section 3.4.2 for additional information.



The USB Status indicator (item 2) indicates whether the Controller is connected to a USB host.

Color	Description
Off	No power, or not connected to USB host
Green	Fieldbus module is powered and connected to USB host

The PWR indicator (item 3) indicates the power status of the module.

Color	Description
Off	No power
Green	Fieldbus module is powered

3.1.2.6 Liquid Eye Connector (Figure 3.2 Item 6)

The liquid eye detector connector is a 4-pin female circular plastic connector. The optional liquid eye detector cable plugs into this connector. Refer to section 3.8 for additional information.

3.1.2.7 CC TRIG IN AUX OUT Connector (Figure 3.2 Item 7)

The CC TRIG IN (Contact Closure) provides inputs and a common for triggering a variety of functions. The AUX OUT (Auxiliary) Connector provides two outputs for triggering a variety of functions. The Auxiliary Outputs are bipolar signals and are isolated from each other and from the Contact Closures by either galvanic or optical methods. The Contact Closure Inputs share a common signal and are not isolated from each other. The connector configuration is shown below.

NOTE

Do not connect power to the Contact Closure inputs, doing so may result in damage to the circuits.

Pin	Description	Group Ref
1	Auxiliary Output 1B	Auxiliary Output 1
2	Auxiliary Output 1A	
3	Auxiliary Output 2B	Auxiliary Output 2
4	Auxiliary Output 2A	
5	Contact Closure Input 1+	Contact Closure Input 1
6	Isolated Ground (for Contact Closure Inputs	
7	Contact Closure Input 2+	Contact Closure Input 2
8	Isolated Ground (for Contact Closure Inputs	

3.1.2.8 24 VDC 1.5A OUT (Figure 3.2 Item 8)

The 24 VDC 1.5A OUT signal provides a 24 Volt output with a maximum current of 1.5A. This power supply can be used to power auxiliary equipment such as the 4-20mA circuits, Logic I/O, etc. The connector configuration is shown below.

Pin	Description
1	+24Vdc
2	Functional Earth Ground
3	24V Return

3.2 OPERATION

The Controller Module provides the controls for producing liquid flow via a positive displacement pumping mechanism. The system utilizes 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.

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

The Controller Module supports two different motor/pump types: rotary and linear. A rotary pump type uses a mechanical displacement mechanism to modify the amount of liquid moved during each full stroke of the piston. A linear pump type uses electromechanical methods to control the amount of liquid moved during each operation.

The profile of the movement of liquid through these two pump types is determined by, and changeable through, the use of Parameters. Various Parameters that impact the motion profile of the pump as well as the operating sequence determine the resulting fluid flow through the fluidic path. In order to achieve desired fluidic behavior in a specific application, it is important to determine the proper values for various Parameters, in combination with proper fluidic components (reservoir, tubing, tips, etc.).

It is important to note that some Parameters only apply to a specific pump type (e.g., rotary vs. linear) or a specific operating mode (e.g., Dispense vs. Meter). Description of all Parameters available in the Controller Module are listed in section 3.3 and also Appendix A.

Controller Modules that contain a front panel HMI (e.g., DS4000BT) provides access to the Parameters via screens and buttons. Controller Modules that contain a Fieldbus option provide access to the Parameters via the fieldbus register

map or protocol. If the Fieldbus option is an Ethernet based fieldbus, then a web server provides access to the Parameters via web pages. If the Fieldbus option is either RS232 or USB, then an ASCII based protocol provides access to the Parameters.

Most Parameters are stored in non-volatile memory. Parameters that modify the behavior of either the pump, Production mode, or Fluidic Mode, are stored in recipes in non-volatile memory. These recipes may be saved and retrieved (up to 32 recipes possible) to facilitate fluidic profile changes. Other Parameters that modify the behavior of the overall system (e.g., Contrast, Input/Output configuration, etc.) are not stored in recipes but are stored in non-volatile memory. There are also a few Parameters that are volatile, most of these contain status information.

3.2.1 Fluidic Setup Operations

Fluidic Setup operations are used to prepare the fluidic path (i.e., pump, tubing, and tip) for Production operations and include four possible modes: Prime, Prime Reverse, Agitate and Bubble Clear. The Fluidic Setup mode is selected using the Fluidic Setup parameter.

There are Parameters for Fluidic Setup operations that are similar to certain Parameters for Production operations. However, these similar Parameters are kept independent to allow for different pumping profiles when preparing the fluidic path compared to Production operation (e.g., it is common to prime the tubing at a faster discharge rate than during Production operations).

3.2.1.1 Prime (Volumetric based and Time based)

Prime Mode is the most typically used Fluidic Setup operation and is used to prime the fluidic tubing and components from the reservoir through to the tip before a Production operation. The amount of fluid moved during a Prime operation is determined by the Discharge Volume. There are also independent rates available to control the flow rate of the fluid movement.

Prime Timed mode is identical to Prime mode, the only different being that Prime Timed is a time-based priming method whereas Prime mode is a volumetric base priming method, as outlined in the paragraph above.

NOTES

It is important to remove all air from the fluidic path, including the tubing and the pump chamber, during a Prime operation. Air bubbles in either the tubing or pump chamber may cause inaccuracies in Dispense volumes.

It is recommended to perform one or more "Waste" operations in the desired Production operation mode after a Prime operation in order to properly setup the fluid path in order to achieve repeatable Dispense volumes.

3.2.1.2 Prime Reverse (Volumetric based and Time based)

Prime Reverse Mode is similar to Prime Mode but moves fluid in the opposite direction. The purpose of this mode is to remove the fluid (purge) from the tip and components back to the reservoir.

Prime Reverse Timed mode is similar to Prime Reverse mode, the only different being that Prime Reverse Timed is a time-based priming method whereas Prime Reverse mode is a volumetric base priming method, as outlined in the paragraph above.

3.2.1.3 Bubble Clear (Linear pump types only)

Bubble Clear Mode is useful for attempting to clear bubbles from the pump chamber (linear pump types only). It consists of a sequence of dispensing the fluid out of the chamber through the Discharge Port, followed by creating a vacuum inside the chamber, followed by a dwell at the Discharge 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 Discharge Port, which allows fluid to flow into the port and for any bubbles in the chamber to migrate to the Discharge Port (it is recommended that the Discharge Port is elevated relative to the Intake 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.

NOTES

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 do not already exist. Therefore, positive results are not always attained.

It is recommended to perform one or more "Waste" operations in the desired Production operation mode after a Bubble Clear operation in order to properly setup the fluid path in order to achieve repeatable Dispense volumes.

3.2.1.4 Agitate

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 times the pump chamber volume.

The Agitation portion consists of four states: 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. After the dwell, the direction changes and the Agitate Volume is moved back in the Forward direction. After the Agitate Volume is moved forward, another dwell occurs. 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 in preparation for the next Production operation.

NOTE

It is recommended to perform one or more "Waste" operations in the desired Production operation mode after an Agitate operation in order to properly setup the fluid path in order to achieve repeatable Dispense volumes.

3.2.2 Production Operations

Production operations are used to dispense fluid in a controlled manner once the fluidic path has been properly setup and includes four possible modes: Dispense, Meter, Feeder and Maintainer.

There are Parameters for Production operations that are similar to certain Parameters for Fluidic Setup operations. However, these similar Parameters are kept independent to allow for different pumping profiles when preparing the fluidic path compared to Production operation (e.g., it is common to prime the tubing at a faster discharge rate than during Production operations).

3.2.2.1 Dispense

Dispense Mode is the typical operating mode to use when dispensing fixed amounts of fluids. A configured volume of fluid is dispensed upon each Production Start command. The amount of fluid to dispense is determined by the Dispense Volume. The repeatability of the dispense volume is dependent on many factors including: tubing setup, selected tip, fluid characteristics, pump characteristics, calibration (rotary pumps only), 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.

For rotary pump types, the actual dispense volume depends on mechanical calibration. Physically changing the angle of the pump increases or decreases the volume dispensed. The pump angle needs to be adjusted until the desired calibrated volume is achieved. Once calibrated, the volume will be dispensed every rotation of the motor (stroke of the pump). This volume should be entered into the Pump Chamber Volume parameter so that other volume and rate Parameters will correspond to the calibrated volume.

For linear pump types, the actual dispense volume is determined by the Dispense Volume parameter. The maximum Dispense Volume possible in a single operation is determined by the Chamber Mode.

3.2.2.2 Meter

Meter Mode allows for varying volumes of fluid movement per operation. The volume is determined by a combination of the Dispense Rate and the length of time of the Meter operation. The time of the Meter operation is controlled by the Production Start and Stop commands, or the Production Gate signal. Once started, fluid will move until stopped (or the end of the pump chamber is reached when the pump is a linear type and in Single Chamber Mode). If Drawback is enabled, it will be performed upon the Stop command.

With a Rotary pump, there are two stop modes available in Meter Mode: Stop Position and Stop Immediate.

Stop Position is the most typical mode used when the Motor/Base is single-ended (i.e., contains only one pump) and ensures that upon a stop command, the pump continues moving until the configured Stop Position is reached (which places the piston position in the middle of the intake cycle). This implies that a Meter operation will always dispense an integer multiple of calibrated chamber volumes.

Stop Immediate is the most typical mode used when the Motor/Base is double-ended (i.e., contains two pumps) and will cause the pump to stop immediately upon receiving the stop command (plus a little movement required for de-acceleration). This implies that the volume dispensed will not be a multiple of the calibrated chamber volume. Since volume totalizers do not increment until a full rotation is achieved, the totalizers may not always correspond to the actual dispensed volume when using this Stop mode.

3.2.2.3 Feeder

Feeder Mode is similar to Meter Mode but allows the discharge rate to change during the operation. The operation time is controlled by the Production Start and Stop commands, or the Production Gate signal. Once started, the fluid will move until stopped. If Drawback is enabled, it will be performed upon the Stop Command. With a Rotary pump, there are two stop modes available (same as Meter Mode): Stop Position and Stop Immediate.

There are several sources available to control the discharge rate of the pump. If fixed rate operation is desired, configure the Feeder Rate for the desired rate and do not change the value during the operation. If variable rate operation is desired, changing the Feeder Rate during operation will affect the discharge rate of the pump. Another source for the rate is the 4-20mA Analog Input. Configuring this input to control the Feeder Setpoint allows an external 4-20mA signal to control the actual discharge rate of the pump. For all sources, the discharge rate will be bounded by the Min and Max Discharge Rate parameters.

When the 4-20mA Analog Input is used to control the discharge rate, the following equation determines the rate at any given moment:

Feeder Discharge Rate = ((Max Discharge Rate - Min Discharge Rate) * (Feeder Setpoint)) + Min Discharge Rate,

where Feeder Setpoint is a scalar value between 0 and 1 determined by the 4-20mA Analog Input (input <= 4mA = 0.000, input >=20mA = 1.000).

Feeder Mode may also be used with two or more linear pumps to achieve a continuous linear fluid flow (requires Chamber Mode to be Synchronous). This is accomplished by having one pump load while the other dispenses. A critical moment in this sequence is the point at which one pump starts loading and the other pump starts dispensing (called the Crossover point). A Crossover Volume parameter determines at what point the dispensing pump's controller should signal the other pump's controller that it is about to load, indicating that the other pump needs to start dispensing. Due to fluid dynamics and acceleration/deceleration of the motor, it is expected that there may need to be some overlap of time during which both pumps dispense. Each application will need to adjust the Crossover Volume parameter to achieve the optimal linear fluid dispensing profile.

3.2.2.4 Maintainer

Maintainer Mode provides the ability to control the flow rate of the pump based on an equation defined by several set-points. The basic function of the Maintainer mode is to meter a quantity of fluid at a flow rate that is proportional to the differential between the set-point value and an analog process signal. In this manner, the fluid will be pumped at a rate which maintains the process signal from the sensing transducer at the set-point value. This system is often used to maintain pH or conductivity at a desired level.

The Maintainer mode is typically used with a sensor that provides a 4-20mA output that is proportional to the process variable. This signal is connected to the 4-20mA Analog Input of the Controller Module, and the Analog Input is configured for Maintainer Setpoint. Along with proper configuration of the setpoints, proportional control of a process variable is achieved.

The setpoints can be modified to achieve 4 different categories of Maintainer operation: Feeder, Inverse Feeder, Direct Maintainer, Inverse Maintainer. Each category produces different behavior during the Maintainer operation. Feeder and Inverse Feeder provide nearly identical pumping profiles as Feeder Mode operations; however, using different Parameters and rate sources. Direct Maintainer and Inverse Maintainer operation attempt to drive fluid flow to zero when a measured setpoint is reached and are the most typical configurations for Maintainer Mode.

Four graphs below show some examples of how setpoints may be modified to achieve the four categories of operation. The overall maximum rate is limited by the Max Discharge Rate parameter. The overall minimum rate is limited by the Min Discharge Rate parameter (all 4 graphs shown with Min Discharge Rate set to zero). Otherwise, the rate of operation is determined by setpoints. The resulting discharge rate is defined by the equation:

Maintainer Discharge Rate = ((Max Discharge Rate - Min Discharge Rate) * (ABS(Dynamic Setpoint - Setpoint Min)/ABS(Setpoint Max – Setpoint Min))) + Min Discharge Rate,

where ABS() is the absolute value of the difference.

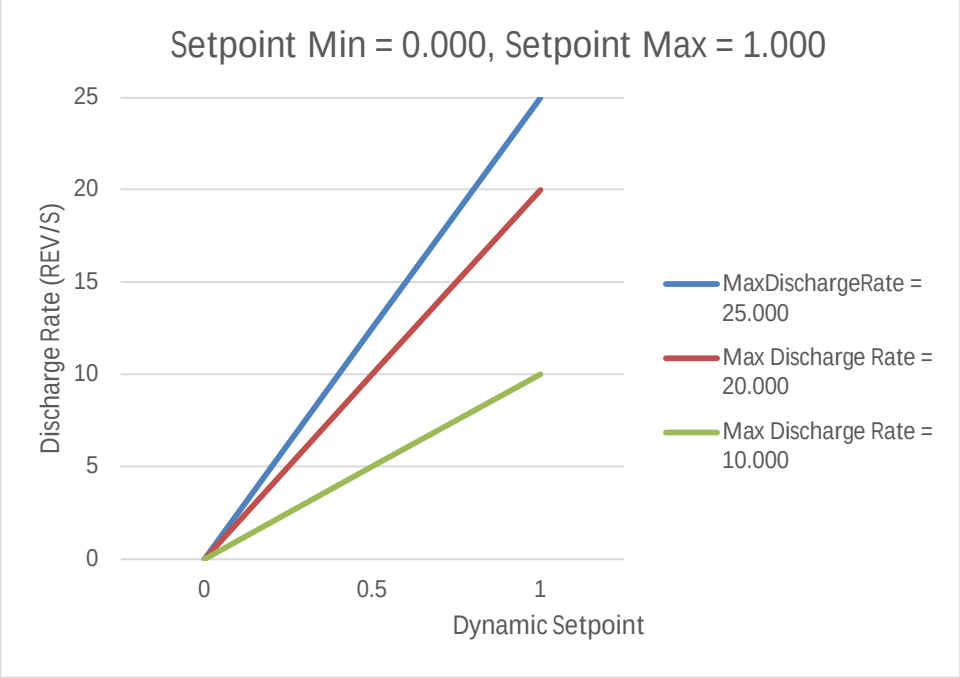


Figure 3.3 – Feeder Operation

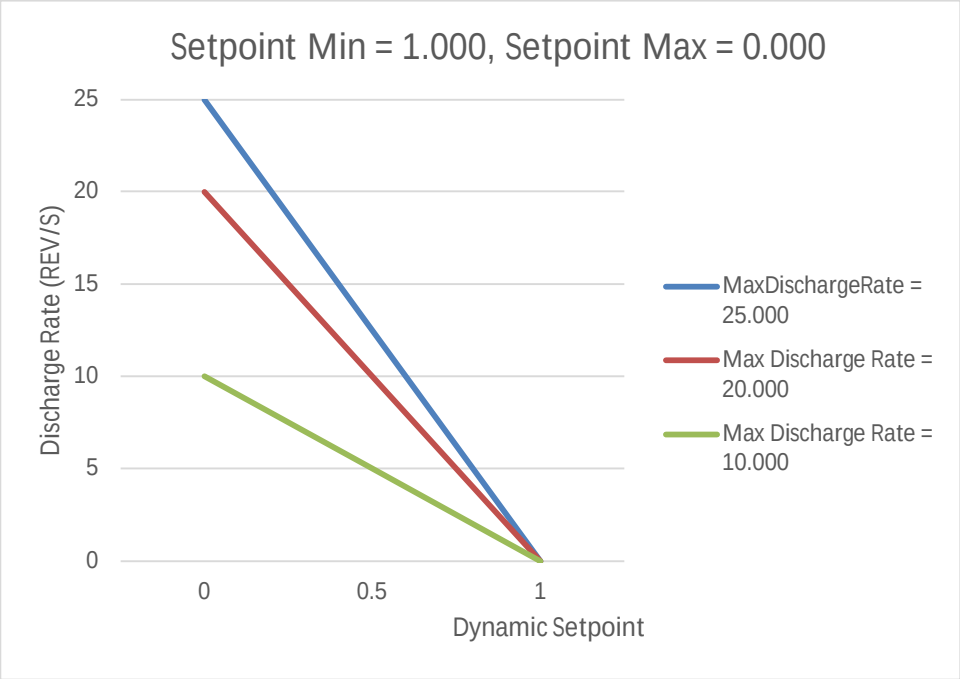


Figure 3.4 – Inverse Feeder Operation

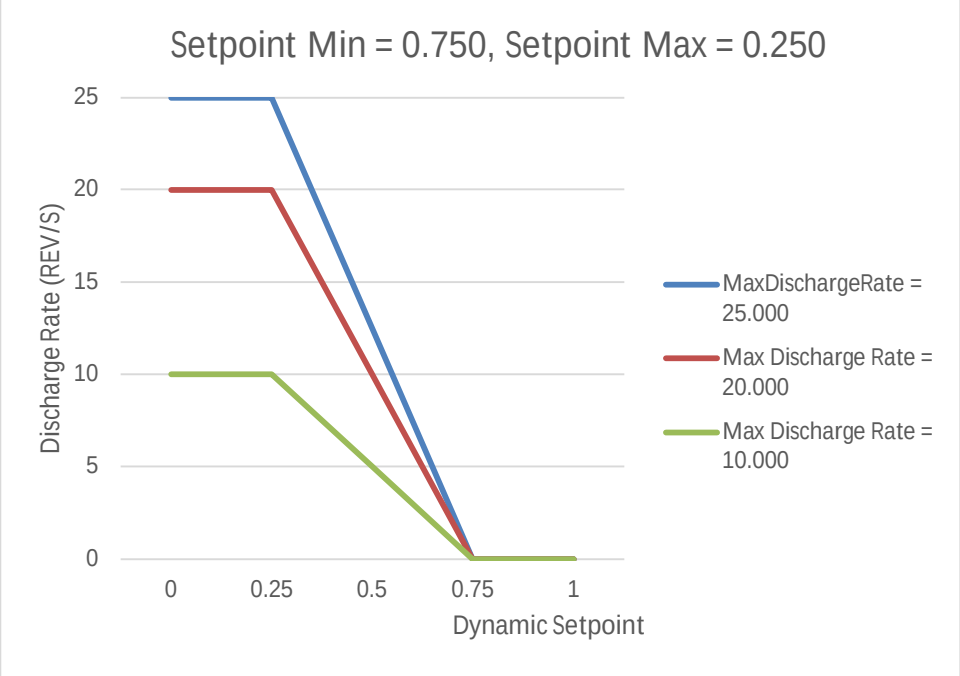


Figure 3.5 – Direct Maintainer Operation

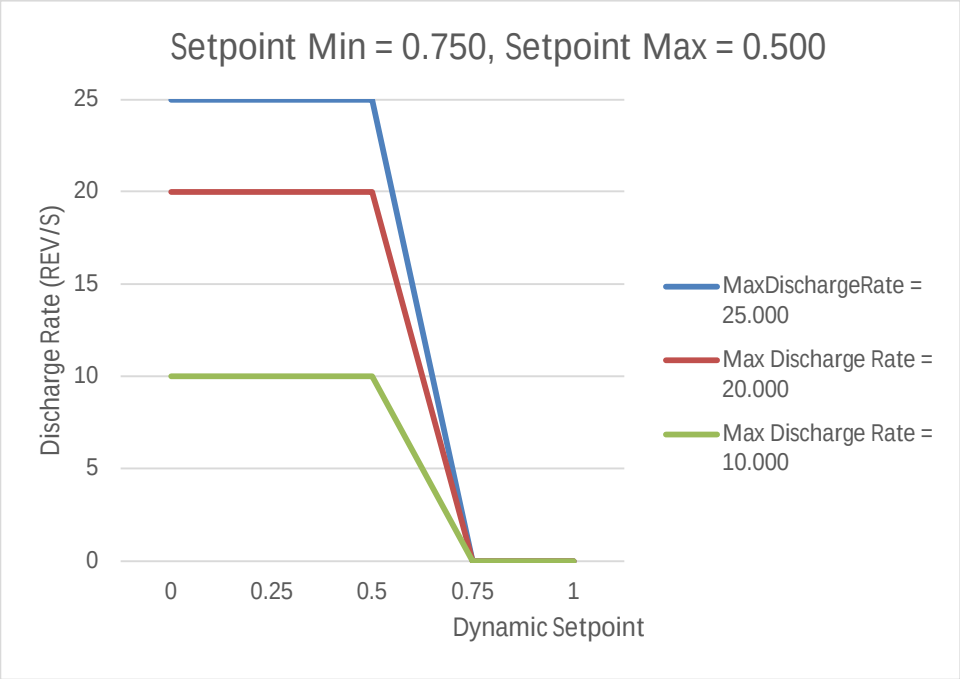


Figure 3.6 – Direct Maintainer Operation

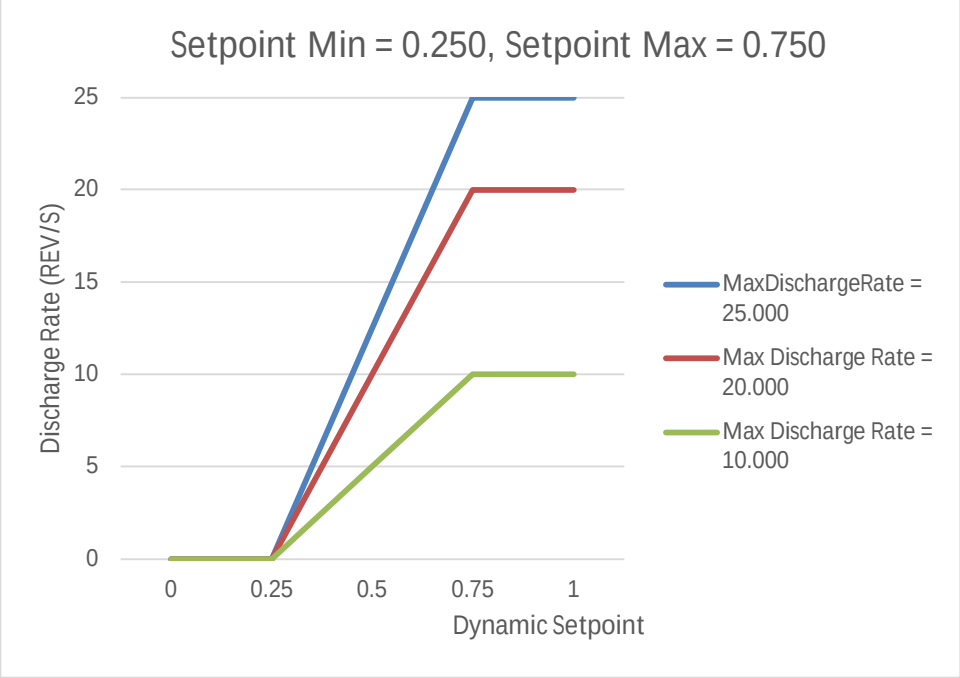


Figure 3.7 – Inverse Maintainer Operation

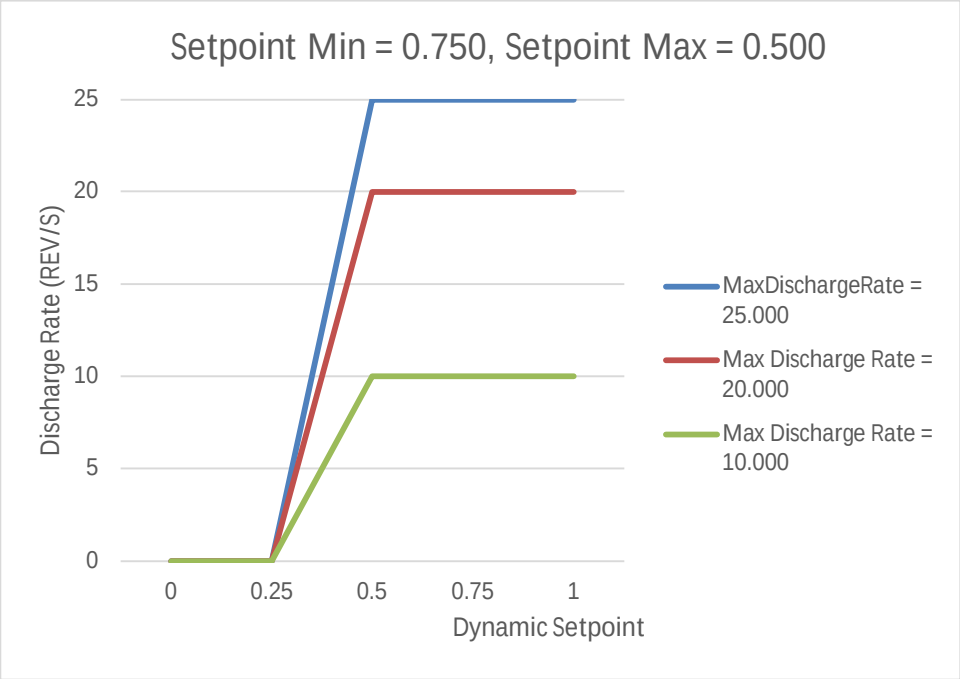


Figure 3.8 – Inverse Maintainer Operation

3.2.3 Other Operations

3.2.3.1 Reference

A Reference operation is required when the pump is in an unknown position. This occurs after power-up as well as after a fault condition. The referencing sequence consists of moving the motor, and hence the pump, in the necessary sequence to detect the motor/base or actuator sensors. The Reference Start command initiates the Reference operation.

Rotary Reference - the Reference operation of a rotary pump turns the motor, and hence the piston until the rotary home sensor is detected. The reference operation will then continue moving the motor and piston until the pump is in the configured Stop Position.

NOTES

As part of the referencing process the motor will move back and forth as it detects both edges of the sensor flag. This results in a slight back and forth rotary motion, and not a sign of a malfunction.

Linear Reference - the Reference operation will first engage the Clutch and turn the motor, and hence the valve, until the rotary home sensor is detected. The reference operation will then continue moving the motor and valve to the Intake Port position. The reference operation will then disengage the Clutch, engage the Brake, and move the motor, and hence the piston, out of and into the linear home sensor and stop in the Piston Home position. Next, the reference operation will disengage the Brake, engage the Clutch, and move the motor, and hence the valve, to the Discharge Port position. Finally, the reference operation will disengage the Clutch and engage the Brake in preparation for the next operation. If the Load Mode is set to Empty or Every, a load operation automatically occurs at the end of the Reference operation, if necessary.

NOTES

When a linear pump type is selected, the Controller Module will not perform any other operations until a reference operation is successfully completed.

If the fluidic path is full of fluid, a reference operation may cause fluid to discharge from the dispense tip.

3.2.3.2 Load (Linear pump types only)

A Load operation loads the pump chamber with fluid from the reservoir in preparation for the next Production operation. In MCV Chamber modes, the volume to load, and hence the resulting Load position of the piston, is determined by the MCV Volume parameter. In all other modes, the volume to load and the resulting load position is the full chamber volume of the pump.

There are three Load Modes available: Manual, Empty, and Every. The configured Load Mode determines both when a Load is required, and whether a Load automatically occurs at the end of a Production operation, Fluidic operation, or Reference operation. Load operations use Production operation parameters (e.g., Load Rate), however. Load operations may be initiated either by a Production operation or independently from a Production operation using the Load Start command. Both Load Manual mode and Load Empty mode require a load only when there is not enough fluid remaining in the pump chamber for the next Production operation. Load Every mode, however, requires a load when the pump chamber is not in the fully loaded position.

NOTE

Load Mode does not affect the intake portion of a multichamber operation (Multichamber = more than one load cycle for a dispense).

Manual Load Mode disables all automatic loading of the pump chamber at the end of the Production operation. If there is not enough fluid in the pump chamber to perform the next Production operation (indicated by a status of Reference Required), a manual initiation of a Load, using the Load Start command, will be required before the next Production operation may start.

Empty Load Mode causes an automatic loading of the pump chamber at the end of a Production operation when there is not enough fluid remaining in the pump chamber to perform the next Production operation. If any other condition results in an insufficient pump chamber volume (for example, changing of the Dispense Volume or Load Threshold), a Load will be required before the next Production Mode operation, but will not be automatically initiated. In this case, a manual initiation using the Load Start command is required. Empty mode also causes an automatic loading of the pump chamber at the end of a Prime operation and after a Referenced operation, if necessary.

Every Load mode causes an automatic loading of the pump chamber after every Production operation. In Every mode, the pump must have a full chamber before a Production operation is allowed. If any other condition results in a non-full pump chamber volume (for example, changing the Chamber Mode), a Load will be required before the next Production Mode operation, but will not be automatically initiated. In this case, a manual initiation using the Load Start command is required. Every mode also causes an automatic loading of the pump chamber at the end of a Prime operation and after a Reference operation, if necessary.

3.2.3.3 Park Port (Linear pump types only)

A Port Park operation places the valve in the Park Position which fully shuts off the Discharge Port. Parking the valve at the port helps reduce the natural fluid slippage due to pressure imbalances across the pump head due to either a pressurized reservoir or gravity. Limiting fluid slippage is most effective when the piston is first moved to the most forward position (i.e., empty chamber position) before parking the port.

The Port Park operation is initiated by a Port Park Start command. While the port is parked, other operations are unable to be initiated. The Port Park operation is stopped by the Port Unpark Start command, which returns the port to the Discharge Port position.

3.2.3.4 Drawback

Drawback is a controlled reverse flow at the end of a dispense or meter operation to improve volume repeatability when 'stringy' fluids are being dispensed. If no drawback is required, the drawback volume is simply set to "0". When drawback is used in Dispense mode, the dispense volume specifies the net fluid dispensed, the actual forward stroke is the sum of the specified dispense volume and the drawback volume. The flow rate during drawback and the dwell (time between the forward and reverse portions of the cycle) are also configurable.

NOTE

After priming the fluid system, the first dispense will produce an incorrect volume when drawback is used.

3.2.3.5 Chamber Mode (Linear Pump types only)

Chamber Mode modifies the Production operations (i.e., Dispense, Meter, Feeder, Maintainer) when using linear pump types. The possible Chamber Modes include: Single; MCV, Push Inlet; MCV, Push Outlet; Multiple; Synchronous; and Synchronous, Primary. Each of these modes determine the maximum possible volume of fluid that may be dispensed during a Production operation.

Single Chamber Mode is the default setting and allows Production operations to dispense fluid up to a maximum of a single chamber volume. In Dispense operations, the actual volume dispensed per operation is determined by the Dispense Volume parameter. In Meter, Feeder, and Maintainer modes, the actual volume dispensed is determined by the time between the start and stop signals and the discharge rate. In this mode, the Load Threshold determines the point at which a Load is required (Load Modes of Manual or Empty). The Load Threshold is relative to the amount of fluid dispensed, rather than the amount of fluid remaining (e.g., a Load Threshold of 10uL will require a Load operation after 10uL or more of fluid has been dispensed).

In Single Chamber Mode, the piston load position is equivalent to the Reference Position (full chamber position).

In Single Chamber Mode, MCV Volume and Crossover Volume are ignored.

MCV, Push Inlet and MCV, Push Outlet Chamber Modes allow Production operations to dispense fluid up to a maximum volume that is less than the single chamber volume. This is achieved by loading in less than the maximum possible chamber volume, which moves the piston starting position closer to the end of the chamber. In some applications this helps increase the fluidic path between inlet and outlet which reduces fluid slippage (i.e., fluid that moves through the pump due to pressure differentials) during times of pump inactivity.

In MCV Chamber Mode, the piston load position is determined by the MCV Volume. The piston will load back to the position in the pump chamber that causes the MCV Volume of fluid to be loaded into the pump (relative to the empty chamber position). If the MCV Volume is less than the full chamber volume, then a load operation will be required after a Reference operation (may automatically occur if Load Mode is set to either Empty or Every).

When a Load operation is necessary after a Reference operation (or due to a change in MCV Volume), the “extra” fluid in the pump chamber needs to be pushed out of the pump chamber and either back to the reservoir or out of the discharge tip. Two different Chamber Modes allow for the selection of fluid flow during this scenario. If the reservoir is pressurized, MCV, Push Outlet mode must be selected, which will force any excess fluid out of the discharge tip. If the reservoir is not pressurized, and it is desired to not “waste” the fluid, then MCV, Push Inlet mode should be selected which will push “excess” fluid back to the reservoir.

In MCV Chamber Mode, Load Threshold and Crossover Volume are ignored.

NOTES

An MCV Linear Actuator is recommended for operating in MCV Chamber Mode. The MCV Linear Actuator positions the linear sensor at the empty chamber position, thereby allowing the controller to eliminate start position drift.

Though a Standard Linear Actuator may operate in MCV Chamber Mode, it's starting (home) position drifts while operating in this mode and requires periodic referencing (due to the linear sensor being at the full chamber position). While the amount of drift is dependent on the specific actuator and application, typical recommendation is to reference once per shift, or once per every 24 hours. Using this feature with Standard Linear Actuators is retained for legacy applications.

Multiple Chamber Mode allows Production operations to dispense volume greater than a single chamber volume. For Dispense operations, the maximum possible volume is 100 chamber volumes. For Meter, Feeder, and Maintainer operations, the maximum volume is unlimited (once started, the pump will continue to pump until the stop signal is received). During Meter, Feeder, and Maintainer operations, an intake cycle is initiated when the piston reaches the

empty chamber position. An intake cycle is similar to a Load operation in that it fills the pump chamber with fluid from the reservoir. In this mode, the Load Threshold determines the point at which a Load is required (Load Modes of Manual or Empty). The Load Threshold is relative to the amount of fluid dispensed out of the pump chamber, rather than the amount of fluid remaining (e.g., a Load Threshold of 10uL will require a Load operation after 10uL or more of fluid has been dispensed from the pump chamber).

In Multiple Chamber Mode, the piston load position is equivalent to the Reference Position (full chamber position).

In Multiple Chamber Mode, MCV Volume and Crossover Volume are ignored.

Synchronous and Synchronous, Primary Chamber Modes allows Production operations to dispense volume greater than a single chamber volume with coordination occurring between two or more pumps. The purpose of this is to try and achieve continuous flow and eliminate the gaps caused by the intake cycle.

For Dispense operations, the maximum possible volume is 100 chamber volumes per pump. For Meter, Feeder, and Maintainer operations, the maximum volume is unlimited (once started, the pumps will continue to pump until the stop signal is received). During Meter, Feeder, and Maintainer operations, an intake cycle is initiated when the piston reaches the empty chamber position. An intake cycle is similar to a Load operation in that it fills the pump chamber with fluid from the reservoir. In this mode, the Crossover Volume determines the point at which one pump signals the next pump to start dispensing fluid. The Crossover Volume determines the volume of fluid the pumps will dispense simultaneously. This value is most useful in striping applications to remove either bulges or hour glasses that occur when transitioning from one pump to the next. If a bulge is occurring, reduce the Crossover Volume. If an hourglass is occurring, increase the Crossover Volume.

In Synchronous Chamber Mode, the piston load position is equivalent to the Reference Position (full chamber position).

In Synchronous Chamber Mode, MCV Volume and Linear Threshold are ignored.

One of the pumps must be configured as the Primary pump (Synchronous, Primary). The Primary pump is the first pump that will dispense when the start signal is received. There must be exactly one Primary pump in the system.

NOTE

Synchronous Mode requires two or more pumps/controllers for proper operation. Do not use either of the Synchronous Chamber modes with a single pump/controller. Also, for proper operation, the two controllers must communicate using the Crossover signals.

3.2.4 Front Panel

The Front Panel 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 present operating mode and system status are shown on the screen. The front panel contains multiple interface screens each providing information to the operator.

The Front Panel display (Figure 3.9) is divided into six fields as shown. Following is a description of what will be displayed in each field:

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

Field 2 - This field displays 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. (P114)

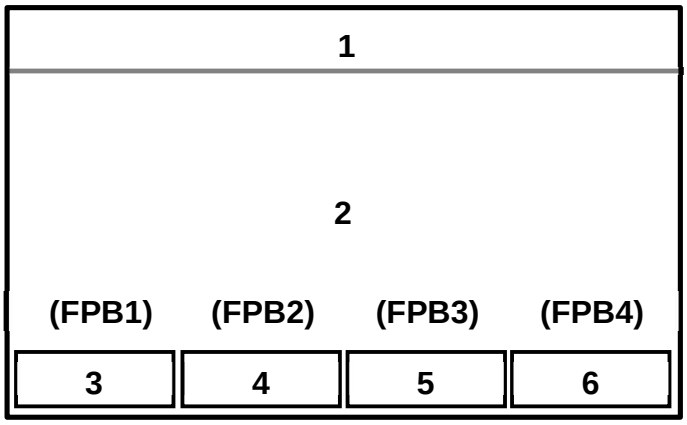


Figure 3.9 – Front Panel Display

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).

3.2.5 Help

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

3.2.6 Permission Levels and Front Panel Lock

There are four levels of permission (listed from lowest to highest); Operator, I/O Test, Supervisor and Keylock. Each level allows access authority to certain items on the display. The permission level can be changed in the Change Permission screen (P114).

The typical use case for permissions is to modify the parameters while at the Supervisor permission level and afterwards limiting modification of those parameters by lowering the permission level to Operator. This reduces the possibility that an Operator will modify a parameter while giving the operator the ability to initiate operations.

If further limitations of front panel access is desired, the Front Panel Config parameter allows for specific functions/parameters to be further limited on the Front Panel. For example, setting the Front Panel Lock to “LOCK->RS&G, VC, PD, S” limits the ability to perform the following via the front panel: recipe save & get, value changes, prime direction changes, start and stop. This is the most restrictive setting and effectively restricts front panel usage to displaying parameters only. The Front Panel Config may only be changed when the permission level is at Keylock.

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.

3.2.7 Screens

There are thirty-two screens used to configure and control the system. Table 3.1lists each screen alphabetically and provides a brief overview of its function. Figure 3.3 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
Backlight	Changes the backlight settings
Calibrate	Provides parameters to calibrate the 4-20mA Analog In/Out circuits
Change Password	Allows the user to enter a password to change the permission level
Contrast	Changes the contrast level

Fault Log	Displays the fault log
Fluidic 1	Sets operating parameters for either Prime, Prime Reverse, Agitate or Bubble Clear Mode
I/O Test	Test the I/O inputs and outputs
Main	Startup screen and provides access to all screens
New Password	Changes an existing password
Permission	Changes the permission level
Production 1	Sets operating parameters for either Dispense, Meter, Feeder or Maintainer Mode
Production 2	Sets operating parameters for either Dispense, Meter, Feeder or Maintainer Mode
Production 3	Sets operating parameters for either Dispense, Meter, Feeder or Maintainer Mode
Pump 1	Sets pump parameters
Pump 2	Sets pump parameters
Recipe	Used for saving a new recipe or retrieving an existing recipe
Reset Log	Erases the fault log
Statistics 1	Displays information relating to the system status
Statistics 2	Displays information relating to the system status
Statistics 3	Displays information relating to the system status
Statistics 4	Displays information relating to the system status
Statistics 5	Displays information relating to the system status
System 1	Sets operational system parameters
System 2	Sets operational system parameters
System 3	Sets operational system parameters
System 4	Sets operational system parameters
System 5	Sets operational system parameters
System 6	Sets operational system parameters
System 7	Sets operational system parameters
Totalizers	Clears the pump volume and cycle counters

Table 3.1 - Screen Descriptions

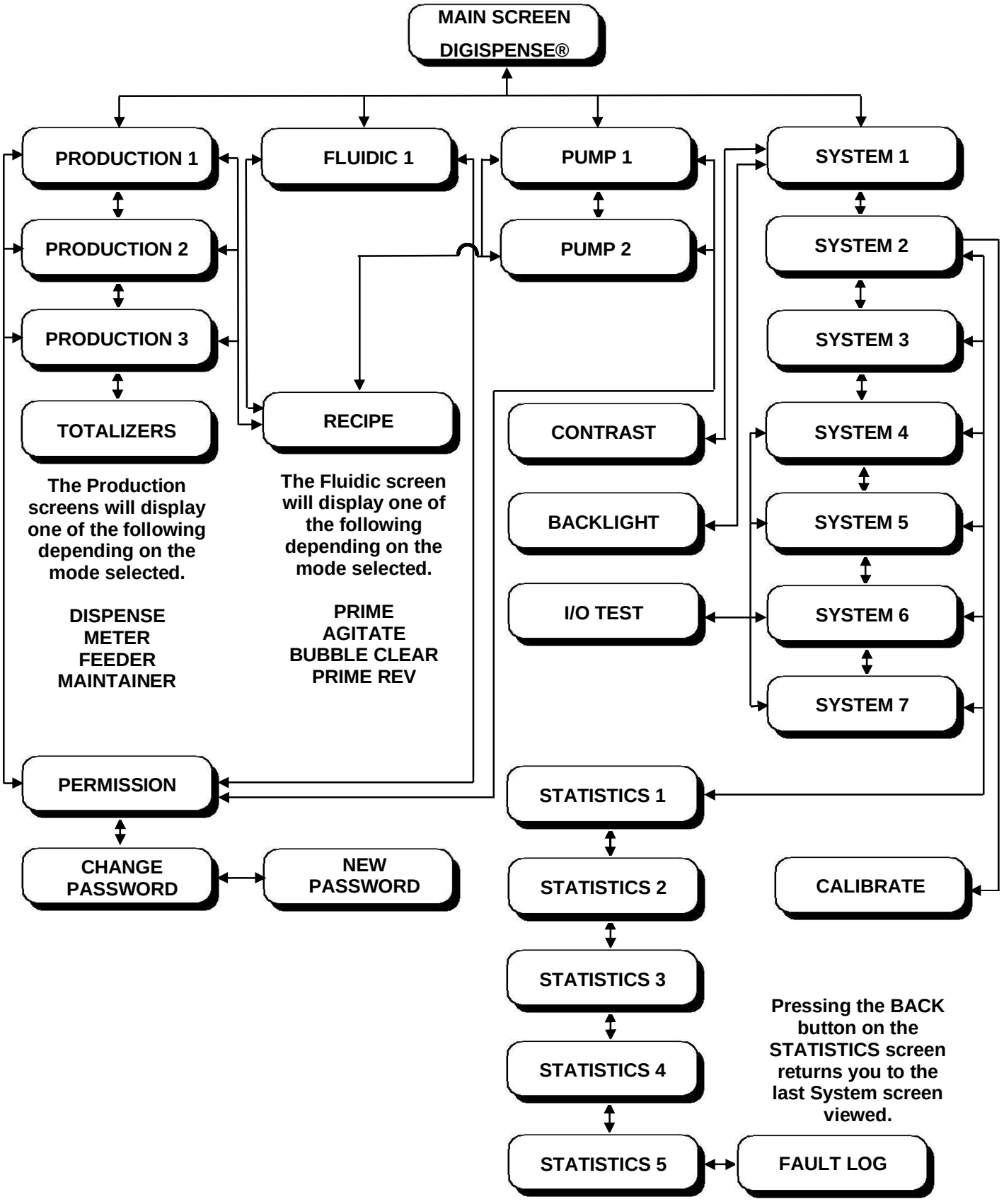
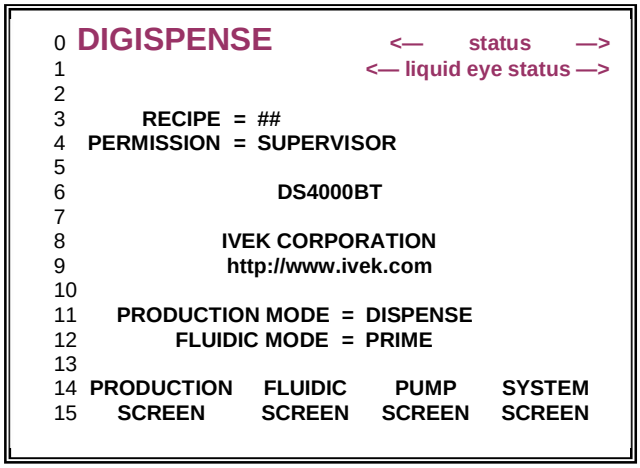
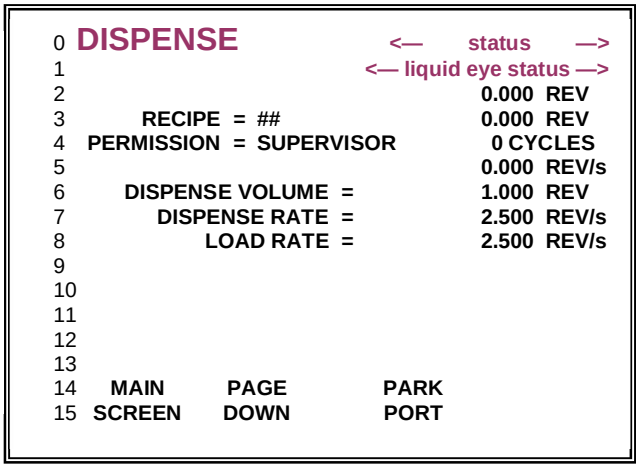


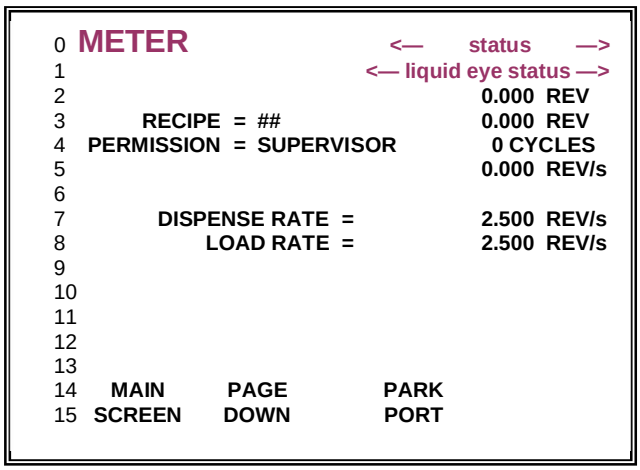
Figure 3.10 Screen Navigation



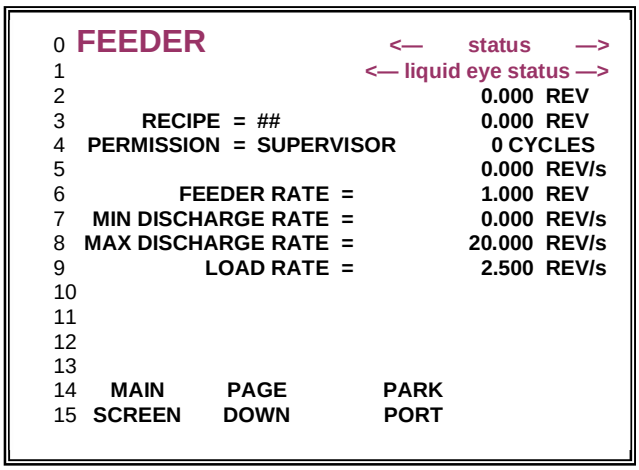
MAIN



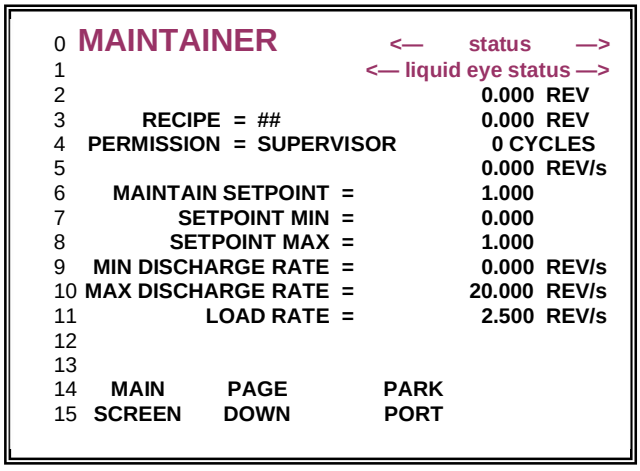
PRODUCTION 1 - DISPENSE (Linear Pump)



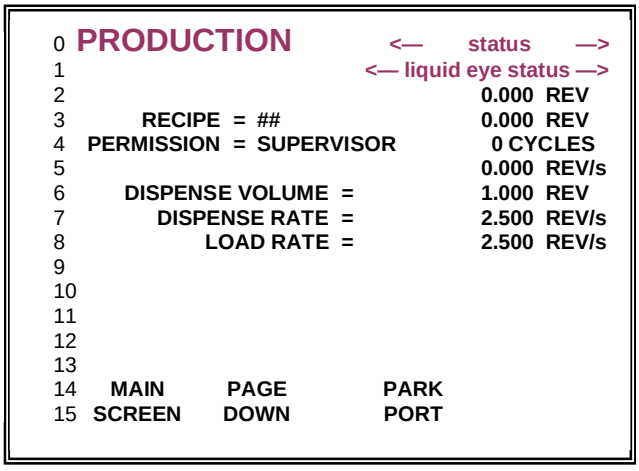
PRODUCTION 1 - METER (Linear Pump)



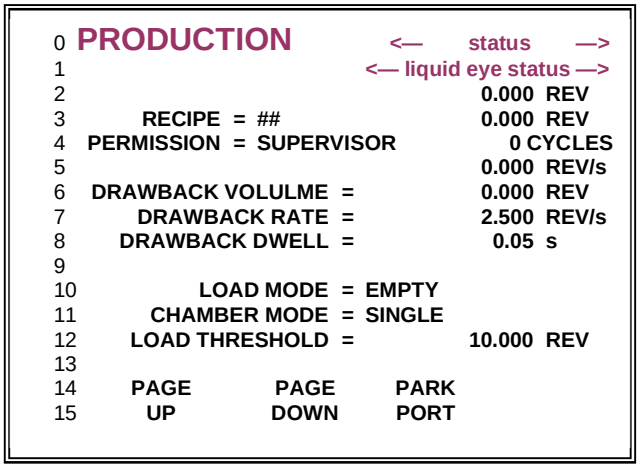
PRODUCTION 1 – FEEDER (Linear Pump)



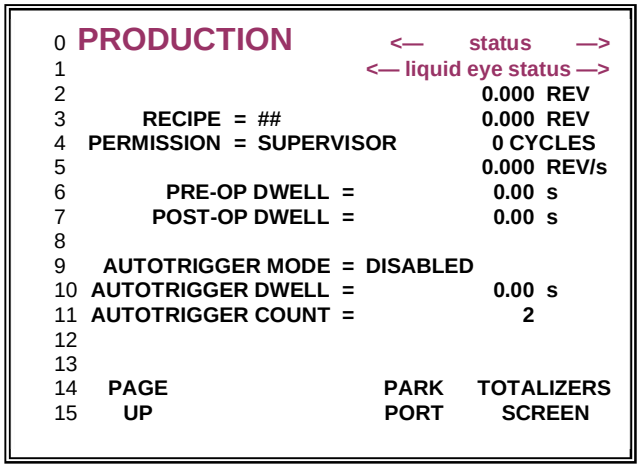
PRODUCTION 1 – MAINTAINER (Linear Pump)



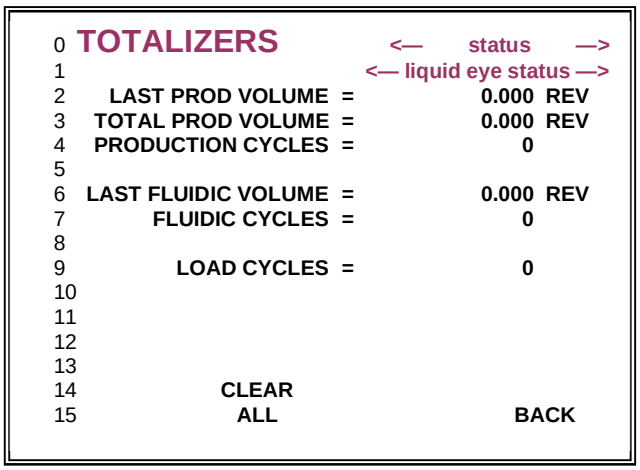
PRODUCTION 1 – DISABLED (Linear Pump)



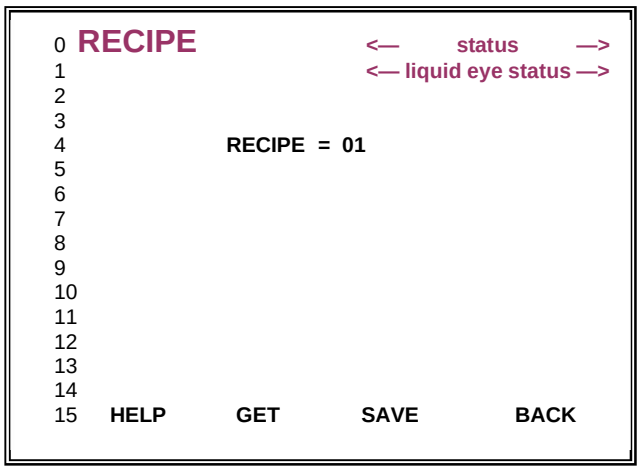
PRODUCTION 2 (Linear Pump)



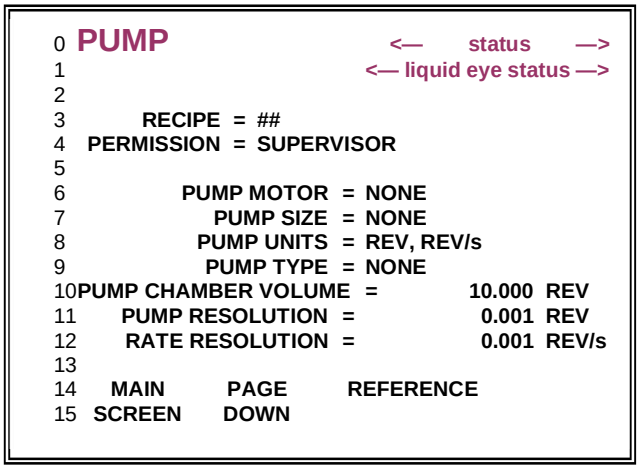
PRODUCTION 3 (Linear Pump)



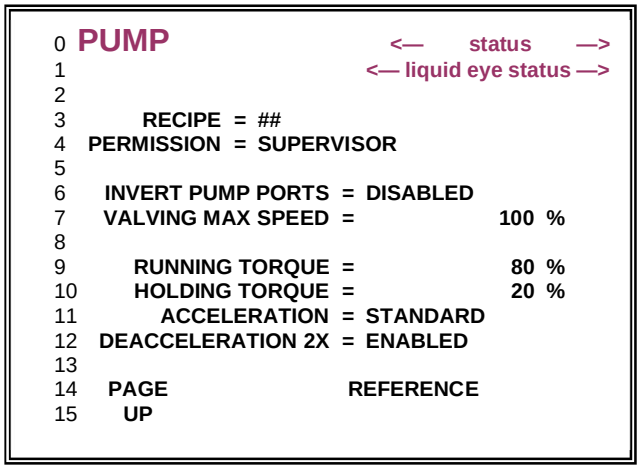
TOTALIZERS



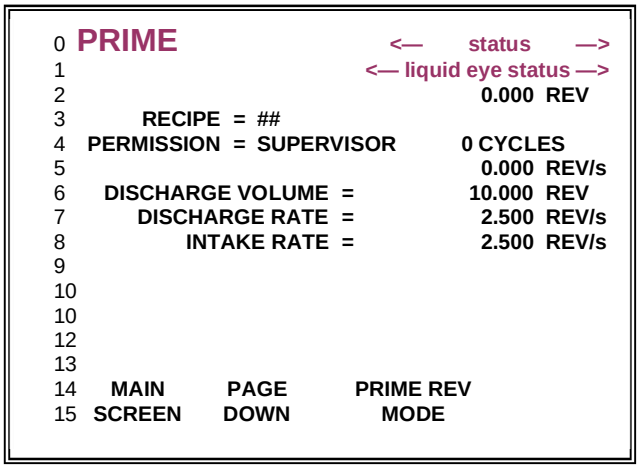
RECIPE



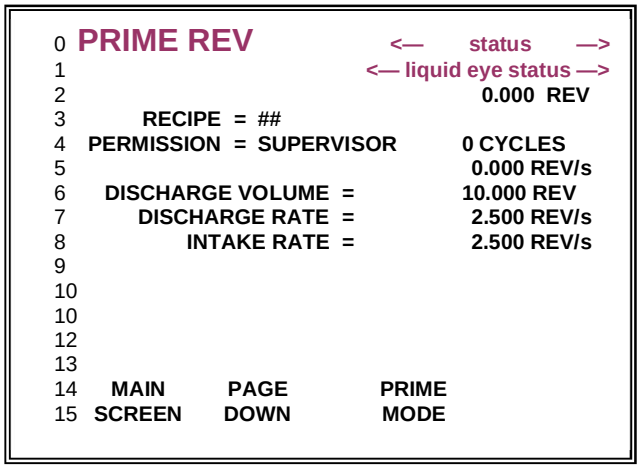
PUMP 1



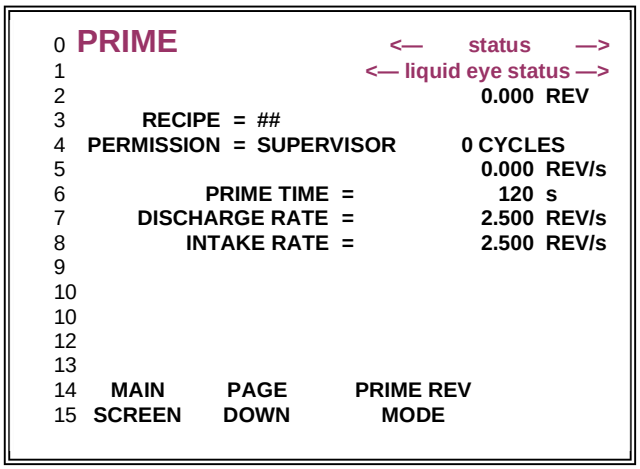
PUMP 2 (Linear Pump)



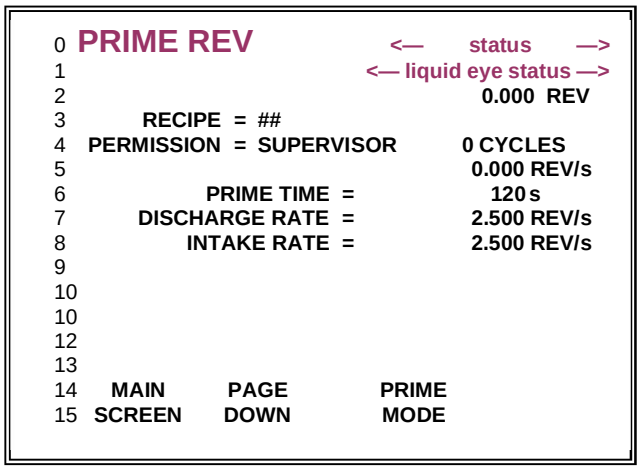
FLUIDIC 1 – PRIME (Linear Pump)



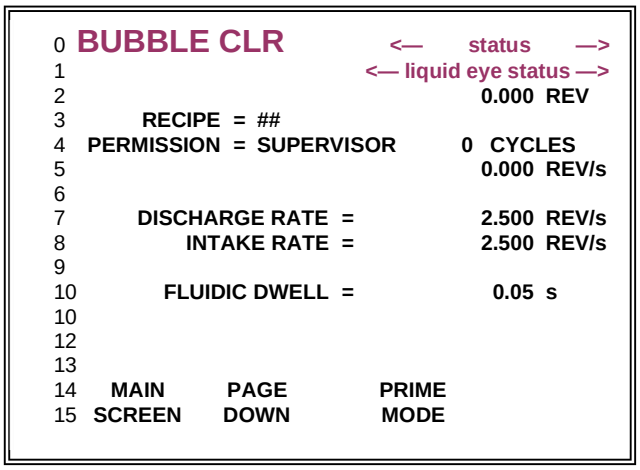
FLUIDIC 1 – PRIME REV (Linear Pump)



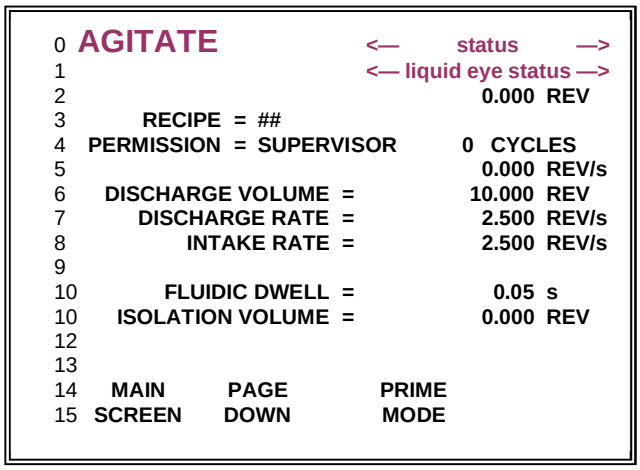
FLUIDIC 1 – PRIME TIMED (Linear Pump)



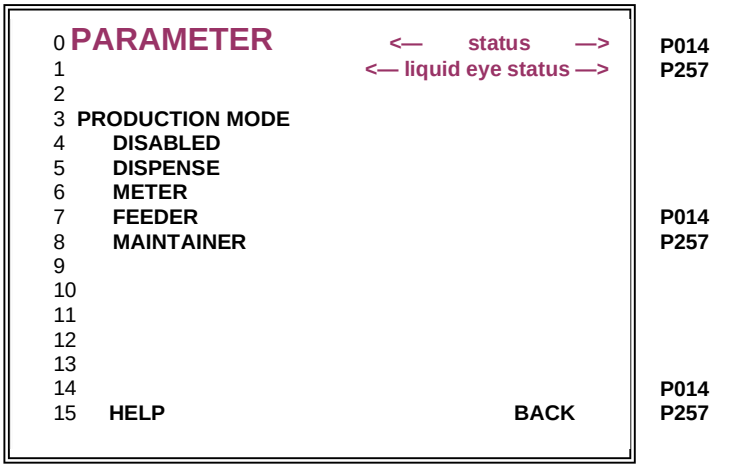
FLUIDIC 1 – PRIME TIMED REV (Linear Pump)



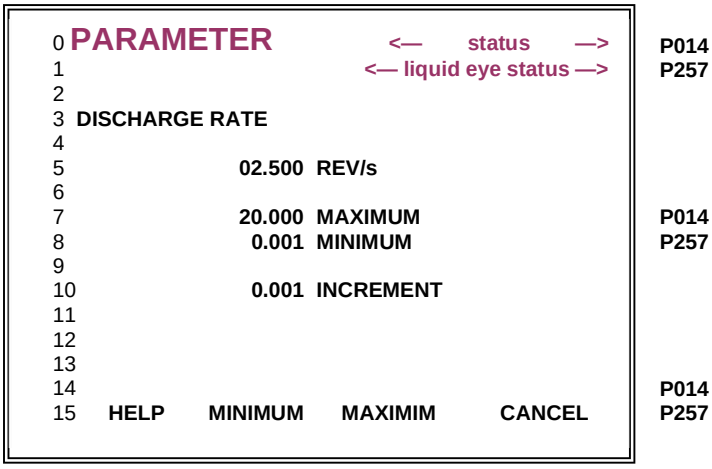
FLUIDIC 1 – BUBBLE CLEAR (Linear Pump)



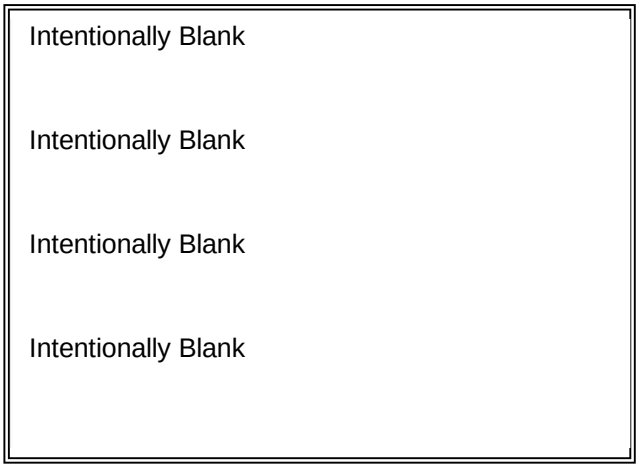
FLUIDIC 1 – AGITATE (Linear Pump)

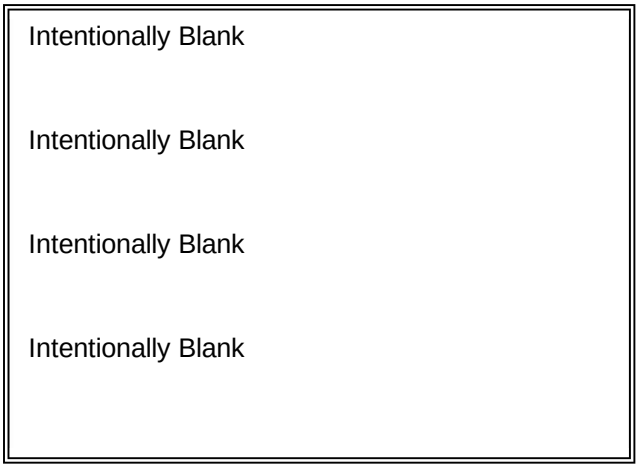


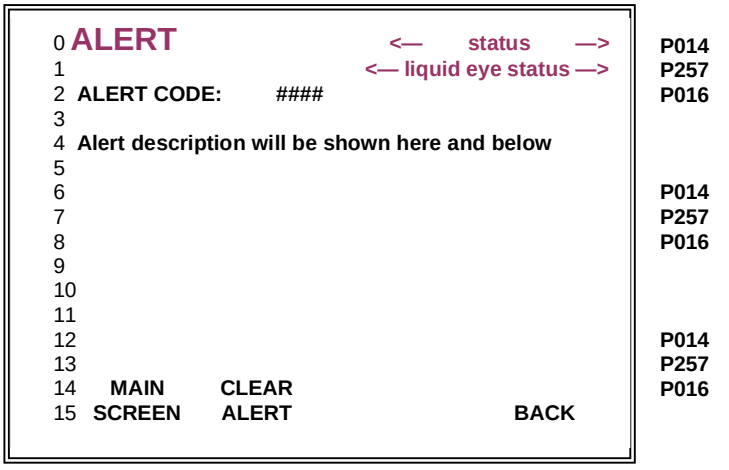
PARAMETER – LIST (e.g., Production Mode)



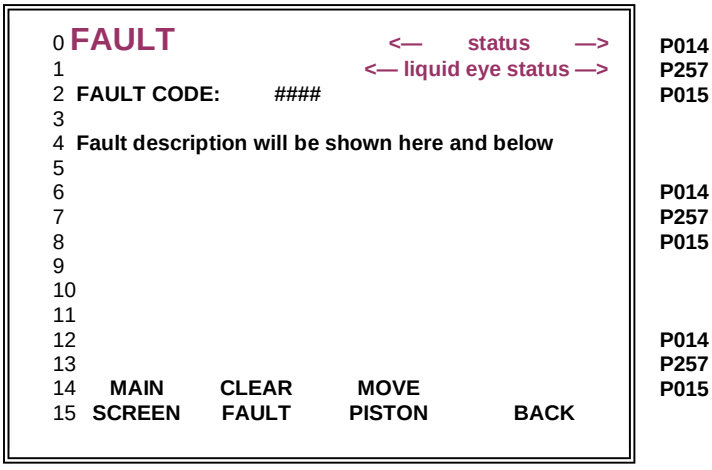
PARAMETER – VALUE (e.g., Discharge Rate)



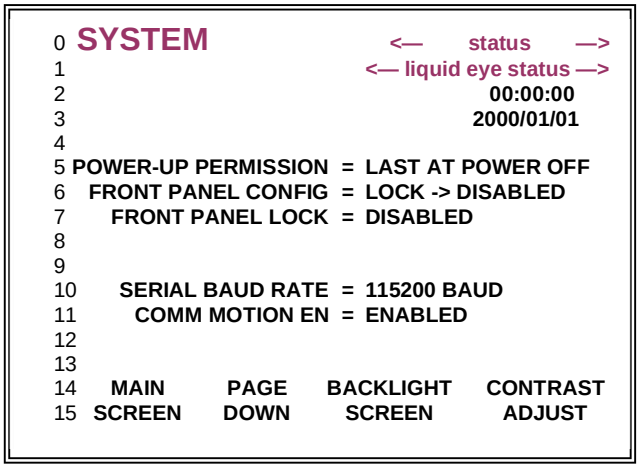




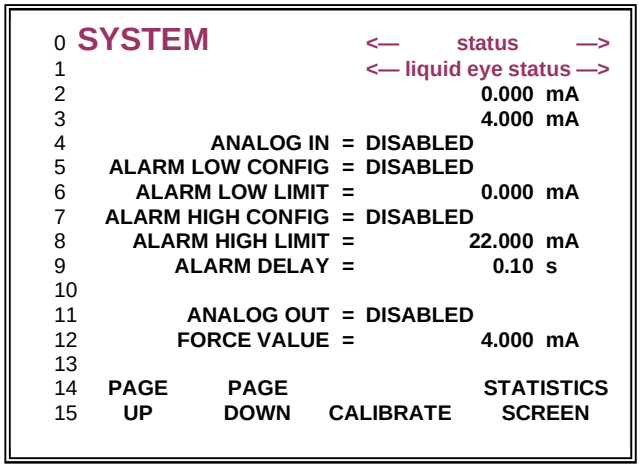
ALERT



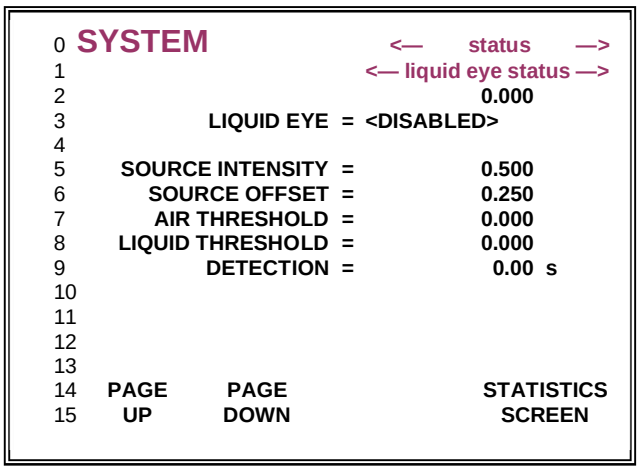
FAULT



SYSTEM 1



SYSTEM 2



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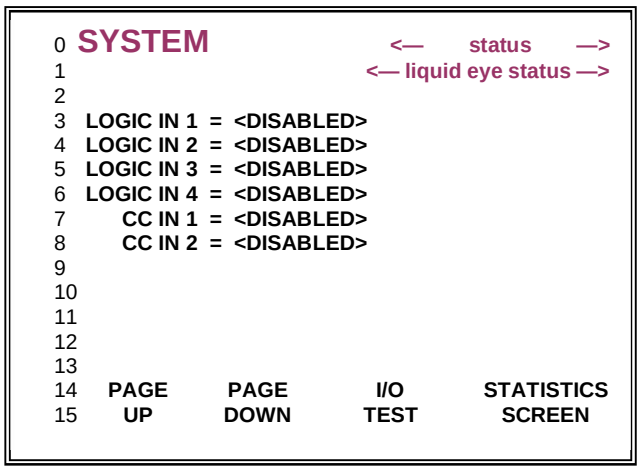

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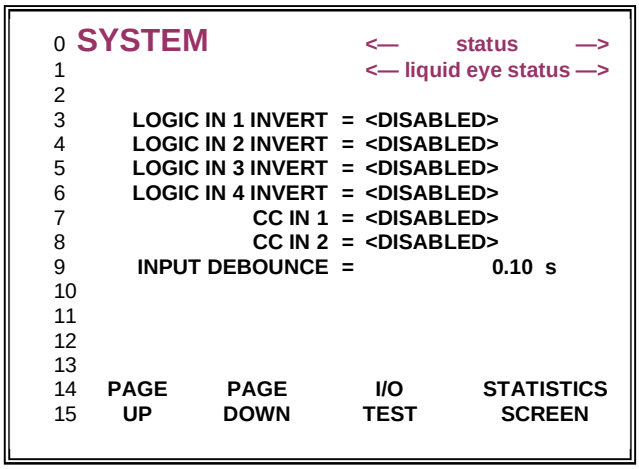

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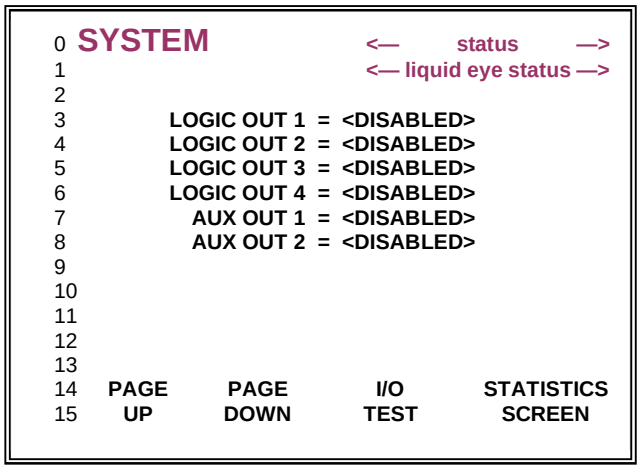

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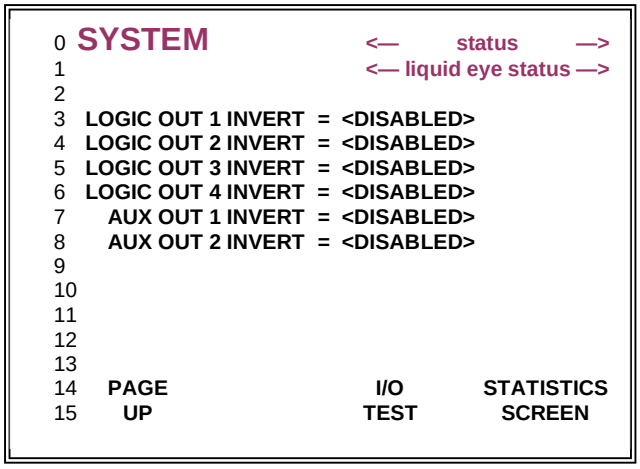

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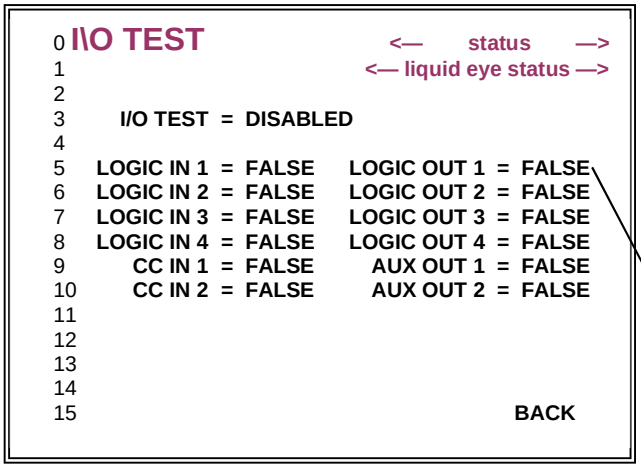
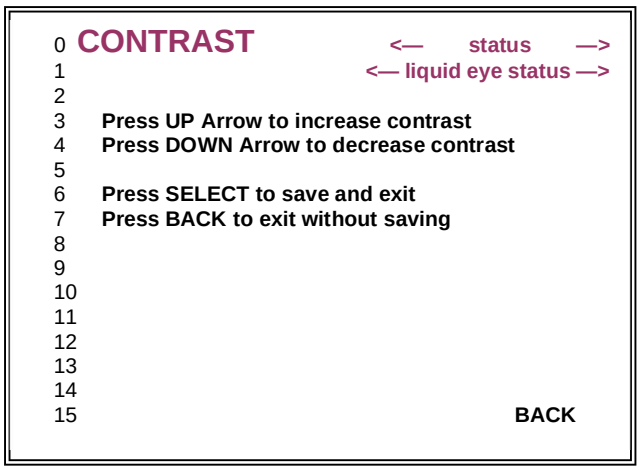
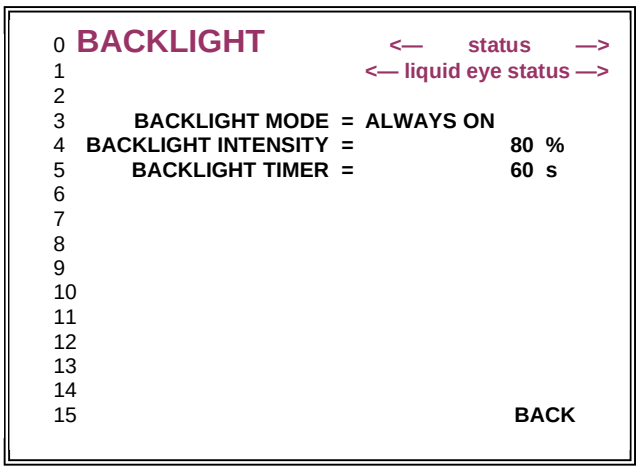


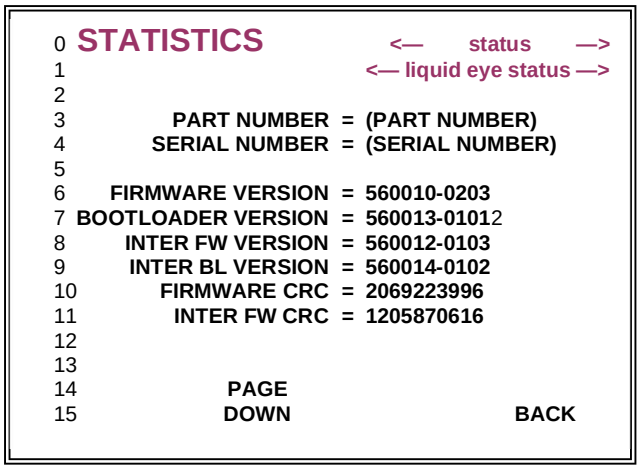
I/O TEST



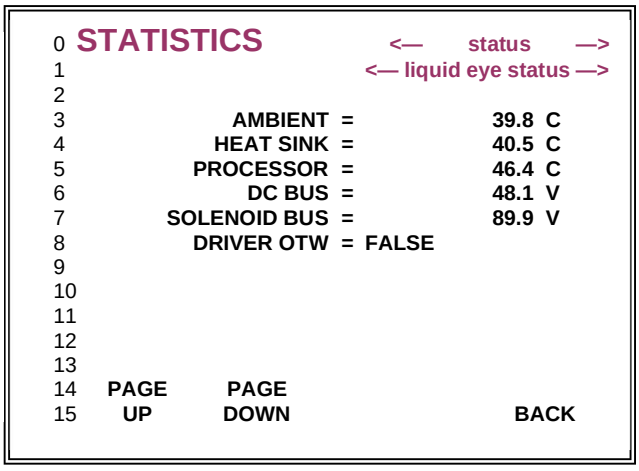
CONTRAST



BACKLIGHT



STATISTICS 1



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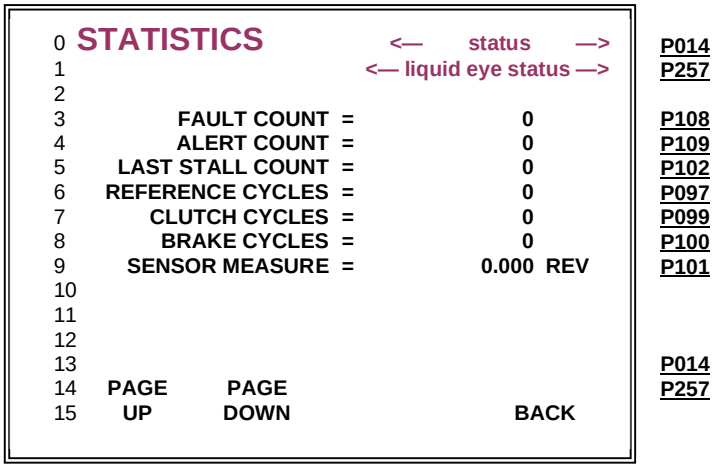

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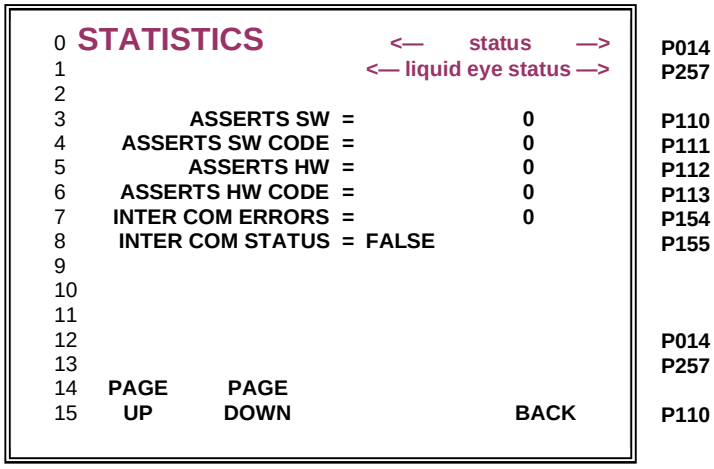

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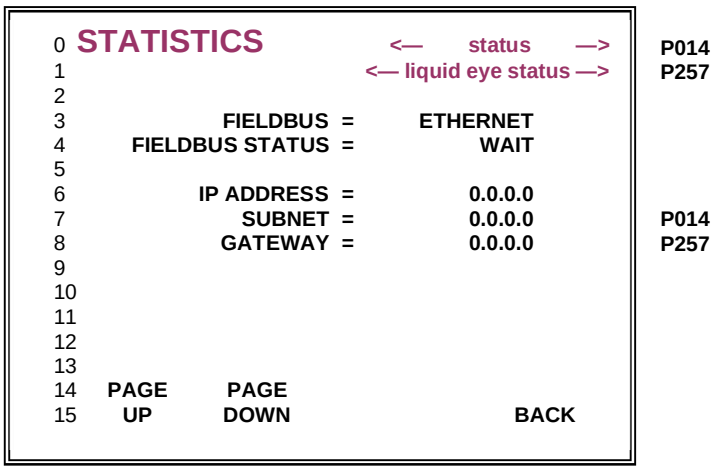
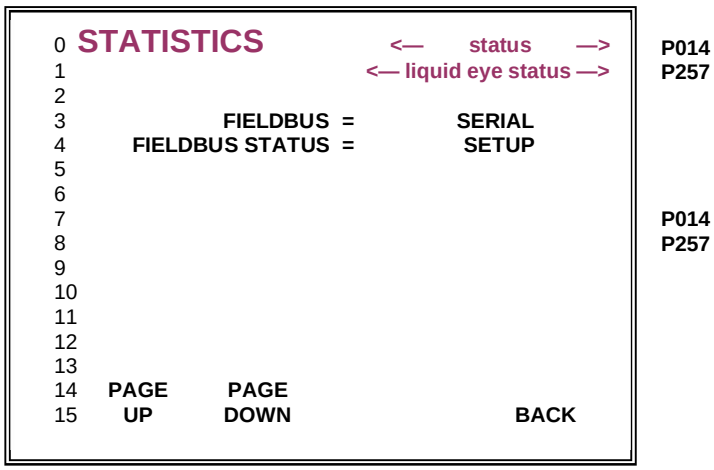
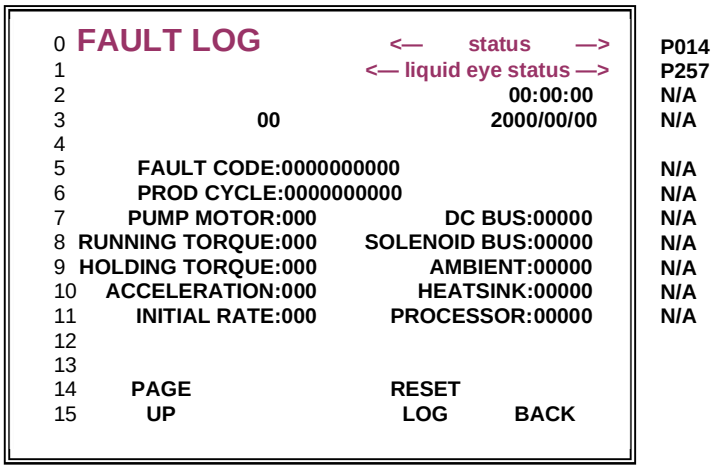


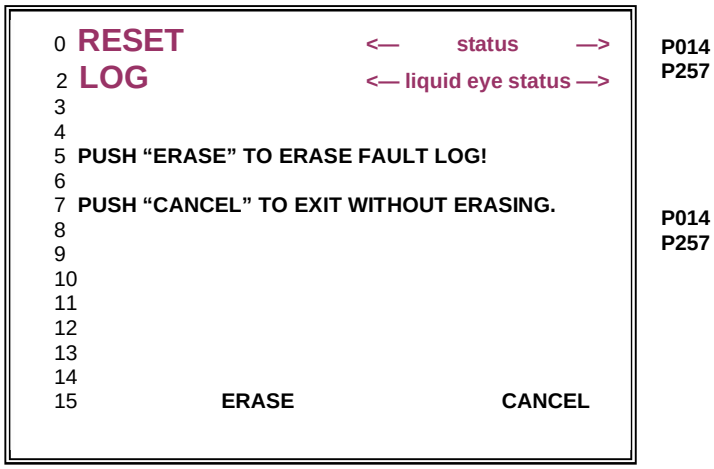
STATISTICS 5 – EtherNet/IP or EtherCAT



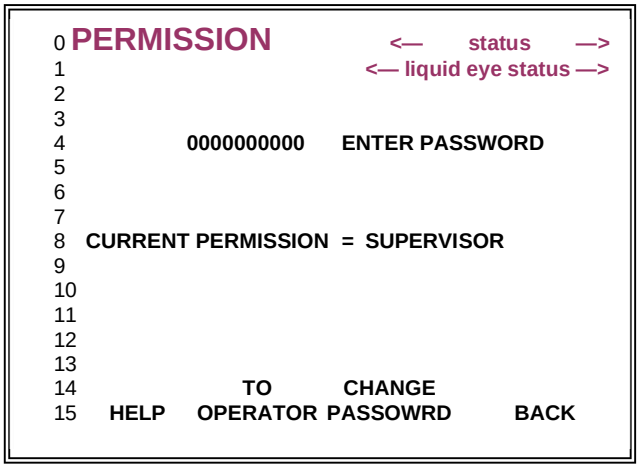
STATISTICS 5 – USB or RS232



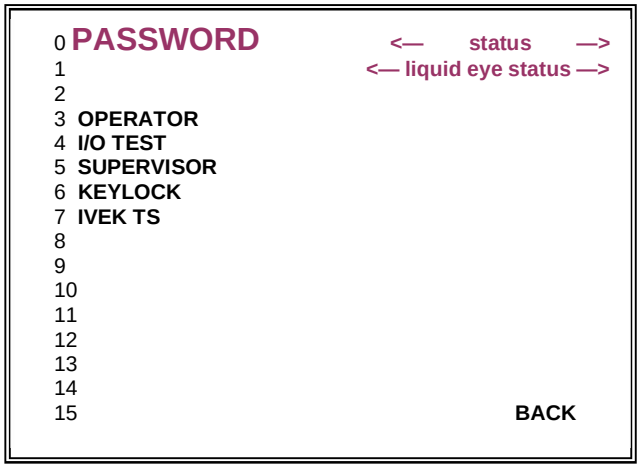
FAULT LOG



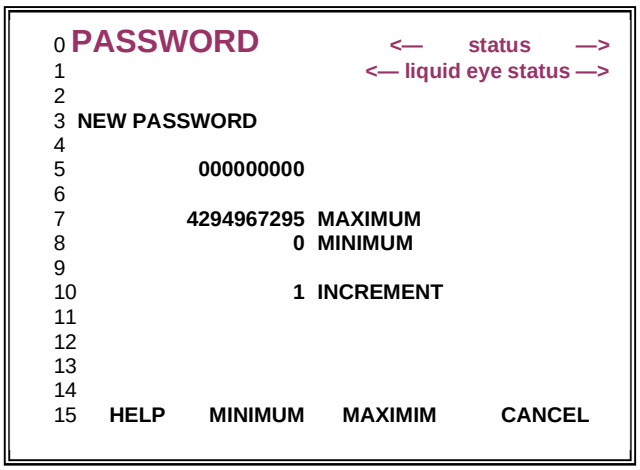
RESET LOG



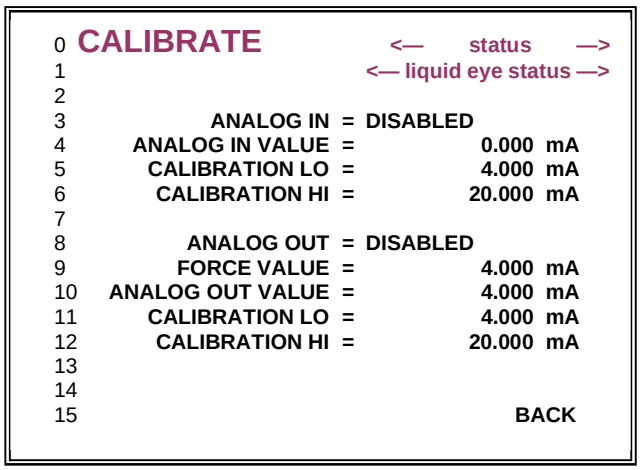
PERMISSION



CHANGE PASSWORD



NEW PASSWORD



CALIBRATE

3.3 PARAMETERS

Parameters provide configuration, command and status of the Controller and are grouped into seven categories: Pump, Production, Fluidic, System, Statistics, Information, and Operate. Some of the parameters are universal to all operations (e.g., Torque). Other parameters are specific to a single operation (e.g., Drawback only applies to Production operations). There are a few parameters that are shared across a few operations (e.g., Load Mode applies to both Production and Fluidic operations). System Parameters influence the various interfaces (e.g., front panel) and do not typically influence operations. Statistic Parameters are read-only Parameters that indicate various status or state conditions of the Controller. Information parameters are read-only Parameters that indicate the manufacturing information about the Controller. Operate Parameters control the pumping operations and indicate their status.

All Parameters, their type, and their ranges are listed in Appendix A. Each Parameter has an ID number, noted in this manual by "[P###]" with the "###" replaced with the specific Parameter ID. The following subsections provide information for the use of Parameter values and how changing them impacts operation.

Most Parameters are stored in non-volatile memory so they will retain their values through a power cycle. The exception to this is that some Statistic and Operate Parameters are volatile since they are updated continuously by either the Controller or PLC.

3.3.1 Pump Parameters

Pump Parameters configure the attached pump and should be the first Parameters to be configured before configuring other Parameters. Most rate or volume parameters in the Controller have units, ranges, and resolutions that depend on the pump motor pump type, pump volume, and pump units. Therefore, it is important to configure the Pump Parameters first.

3.3.2 Production Parameters

Production Parameters configure the pumping profiles of Production operations and Load operations.

3.3.3 Fluidic Parameters

The Fluidic Parameters provide Fluidic operations with independent settings from the Production operations. For example, it is typical to Prime the fluidic path at different rates than those used during Dispense operations.

3.3.4 System Parameters

The System parameters influence the overall Controller Module and do not typically influence pumping profiles. The System parameters include setting such as Permission Level.

3.3.5 Statistics Parameters

Statistic Parameters indicate different statistics of the system. Some of the parameters update periodically based on measurements. Other parameters update based on events or during operations.

3.3.6 Information Parameters

The Information Parameters indicate the version information for the specific Controller Module. Some of these values are fixed across the Controller Module product line whereas others are unique per Controller Module. Some of these parameters are useful for configuration management.

3.3.7 Operate Parameters

The Operate parameters are used to initiate operations and monitor status of the operations. Most of these are available via cyclic data exchange on the fieldbus network, Logic I/O, the Front Panel, and the HTTP interface (when the Fieldbus option contains Ethernet).

Due to the timing requirements typically associated with these parameters, it is recommended that they are modified using the cyclic data exchange feature of the fieldbus, rather than using direct parameter modification. The intention of including these values on the HTTP interface is to aid commissioning and troubleshooting.

3.3.8 Parameter Descriptions

The parameters described in this section are listed by name ordered by the ID number.

3.3.8.1 Product ID [P001]

The Product ID parameter should be used with the ADI Map Major Version and the ADI Map Minor Version for configuration management.

The Product ID indicates a unique ID for each IVEK Controller type. This parameter may be queried to make sure the expected Controller type is being communicated with.

The Product ID of this Controller Module is “1”.

3.3.8.2 ADI Map Major Version [P002]

The ADI Map Major version indicates the major version identification of the Parameters. Any change to the Major Version indicates that there are changes to the mapping of Parameters that would be expected to impact the communication with the PLC (e.g., changing the Parameter ID of a parameter).

The ADI Map Major Version as described by the parameter in this manual is “2”. The ADI Map is similar to, but not identical to the previous version, “1”.

3.3.8.3 ADI Map Minor Version [P003]

The ADI Map Minor version indicates the minor version identification of the Parameters. Any change to the Minor Version indicates that there are changes to the mapping of Parameters that would not be expected to impact the communication with the PLC (e.g., adding a new parameter to the map).

3.3.8.4 Primary Firmware Version [P004]

The Primary Firmware Version parameter indicates the IVEK part number and version of the Primary board firmware.

3.3.8.5 Primary Firmware CRC [P005]

The Primary Firmware CRC parameter indicates the CRC of the Primary board firmware.

3.3.8.6 Part Number [P006]

The Part Number parameter indicates the specific part number of the Controller and should match the part number label on the unit.

3.3.8.7 Serial Number [P007]

The Serial Number parameter indicates the specific serial number of the Controller and should match the serial number on the part number label of the unit.

3.3.8.8 Bootloader Version [P008]

The Bootloader Version parameter indicates the part number and version of the Primary board bootloader firmware.

3.3.8.9 Enter Bootloader [P009]

The Enter Bootloader parameter provides a way to force the controller into the Bootloader in order to upgrade the Firmware Version to a new version.

3.3.8.10 Commands [P010]

The Commands parameter hold different bits that may be used to control the Controller module and initiate operations. Each bit position(s) represents a different command. Some commands are edge triggered and others are level triggered.

Bit	Name	Value
0	Enable Motion	0 = Motion (operation) inhibited. Any operation in progress will stop, requiring a reference after re-enablement. 1 = Motion (operation) allowed.
1	Stop Operation	A rising edge will stop any operation in progress. Note: operations continue to their stopping point after receiving the Stop command, if applicable.
2	Start Production Operation	A rising edge will start a production operation if possible (indicated by Ready, Production status bit equal to 1).
3	Start Fluidic Operation	A rising edge will start a fluidic operation if possible (indicated by Ready, Fluidic status bit equal to 1).
4	Start Reference Operation	A rising edge will start a reference operation if possible (indicated by Ready, Idle status bit equal to 1).
5	Clear Fault	A rising edge will clear the present Fault (indicated by Faulted status bit equal to 1 and a Fault Code not equal to 0).
6	Clear Alert	A rising edge will clear the present Alert (indicated by Alerted status bit equal to 1 and an Alert Code not equal to 0).
7	Start Load Operation	A rising edge will start a load operation if possible (indicated by Ready, Load status bit equal to 1).
8	Crossover Synchronous	Used only with Linear pump types when the Chamber Mode is configured for Synchronous Mode. Connect this bit to the upstream unit's Crossover Synchronous status bit.
9	Start Park Port Operation	A rising edge will start a Park Port operation if possible (indicated by Ready, Park status bit equal to 1).
10	Start Unpark Port Operation	A rising edge will start an Unpark Port operation if possible (indicated by Ready, Unpark status bit equal to 1).
11	Start Piston Unstick Operation	A rising edge will start a Piston Unstick operation if possible (indicated by Ready, Idle status bit equal to 1).
12	Start Torque Test Operation	Reserved for IVEK manufacturing use.
13	Start Required	A rising edge will start any presently required operation (e.g., Load Required, Reference Required, Clear Fault).
14	Gate Production Operation	Controls the duration of Meter, Feeder, and Maintainer operations (active high).
15	Gate Fluidic Operation	Controls the duration of Prime and Agitate operations (active high).
16..31	Reserved	Reserved for future commands. Set these bits to 0.

3.3.8.11 Commands Extended [P011]

The Commands Extended parameters hold different bits that may be used to control the Controller module and initiate operations. Each bit position(s) represents a different command. Some commands are edge triggered and others are level triggered.

Bit	Name	Value
0..31	Reserved	Reserved for future commands. Set these bits to 0.

3.3.8.12 Status Flags [P012]

The Status Flags parameters hold different bit flags that indicate the status of the Controller module and operations. Each bit position(s) represents a different status as follows:

Bit	Name	Value
0	Initialized	0 = Digispense® 4000 is still initializing from power-up or reset 1 = Digispense® 4000 is initialized
1	Configured	0 = Pump Motor is not configured 1 = Pump Motor is configured
2	Faulted	0 = No fault 1 = Faulted

Bit	Name	Value
3	Alerted	0 = No alert 1 = Alerted
4	Motion Disabled	0 = Motion is enabled 1 = Motion is disabled
5	Reference Required	0 = No reference is required 1 = A reference is required before any other operation can be initiated
6	Load Required	0 = No load required 1 = A load is required before a production operation can be initiated
7	Porting Required	0 = No porting required 1 = A port change is required before a production operation can be initiated
8	Ready, Idle	0 = The unit is not ready to receive a start signal 1 = The unit is ready to receive a start signal
9	Ready, Production	0 = The unit is not ready to receive a production start signal 1 = The unit is ready to receive a production start signal
10	Ready, Fluidic	0 = The unit is not ready to receive a fluidic start signal 1 = The unit is ready to receive a fluidic start signal
11	Ready, Reference	0 = The unit is not ready to receive a reference start signal 1 = The unit is ready to receive a reference start signal
12	Ready, Load	0 = The unit is not ready to receive a load start signal 1 = The unit is ready to receive a load start signal
13	Ready, Park	0 = The unit is not ready to receive a park start signal 1 = The unit is ready to receive a park start signal
14	Ready, Unpark	0 = The unit is not ready to receive an unpark start signal 1 = The unit is ready to receive an unpark start signal
15	Busy Required	0 = The unit does not have any required operations blocking a production operation. 1 = The unit has a required operation blocking a production operation (e.g., Load Required, Reference Required, Faulted)
16	Busy, any operation active	0 = No operations are active 1 = Any operation is active (e.g., production, fluidic, reference, load, porting, etc.)
17	Busy, production	0 = No production operation is active 1 = Production operation (e.g., dispense) is active
18	Busy, fluidic	0 = No fluidic operation is active 1 = Fluidic operation (e.g., prime) is active
19	Busy, reference	0 = No reference operation is active 1 = Reference operation is active
20	Busy, load	0 = No load operation is active 1 = Load operation is active
21	Busy, port	0 = No porting operation is active 1 = Porting operation is active
22	Busy, park	0 = No port parking operation is active 1 = Port parking operation is active
23	Busy, autotrigger	0 = Autotrigger is not active 1 = Autotrigger is active
24	Parked	0 = Port is not parked 1 = Port is parked
25	Chamber Full	0 = Piston is not at the full chamber position 1 = Piston is at the full chamber position
26	Success Pulse	1 = Pulse indicating last dispense was successfully completed (i.e., no faults). Pulse length determined by Post-op dwell setting.
27	Success Last	0 = Last dispense was not successfully completed (ie a fault occurred or the dispense was stopped short, or no dispenses have occurred since power-up) 1 = Last dispense was successfully completed (i.e., no faults)
28..31	Reserved	

3.3.8.13 Status Flags Extended [P013]

The Status Flags Extended parameters hold different bit flags that indicate the status of the Controller module and operations. Each bit position(s) represents a different status as follows:

Bit	Name	Value
0	Dwelling Active	0 = Dwell is not active 1 = Any pump type, a dwell is active
1	Discharge Active	0 = Discharge portion of operation is not active 1 = Linear pump type, the discharge portion of the present operation is active (includes discharge portion only) Rotary pump type, the pump is pumping (includes both discharge and recharge portions of the cycle)
2	Intake Active	0 = Intake portion of operation is not active 1 = Linear pump type, the intake portion of the present operation is active Rotary pump type – not applicable
3	Piston Moving During Intake	0 = Piston is not moving during the intake portion of the present operation 1 = Linear pump type, piston is moving during the intake portion of the present operation Rotary pump type – not applicable
4	Valve Moving During Intake	0 = Valve is not moving during the intake portion of the present operation 1 = Linear pump type, valve is moving during the intake portion of the present operation Rotary pump type – not applicable
5	Drawback Dwell Active	0 = Drawback dwell portion of operation is not active 1 = Drawback dwell portion of operation is active
6	Drawback Active	0 = Drawback portion of operation is not active 1 = Drawback portion of operation is active
7	Reserved	
8	AP Prime Active	0 = AP Prime portion of Prime operation not active 1 = Rotary pump type, a Prime operation is active and at least 1 pumping cycle has completed Linear pump type – not applicable
9-11	Reserved	(future)
12	Crossover Synchronous	0 = Controller has not reached the Crossover point 1 = Controller has reached the Crossover point and is signaling the next controller to start pumping
13	Crossover Waiting	0 = Controller is not waiting of the Crossover signal 1 = Controller is waiting for the Crossover signal
14..31	Reserved	(future)

3.3.8.14 Status State [P014]

The Status State parameter indicates the present operation state. Some operations only have 1 state (e.g., Priming). However, some operations have multiple states (e.g., Dispense operations may include: Pre-op Dwell, Dispensing, Drawback Dwell, Drawback, Post-op Dwell).

Num	State	Description
0	Idle	No operations active.
1	Priming	Prime operation is active.
2	Dispensing	Dispense operation is active, discharge portion.
3	Metering	Meter operation is active, discharge portion.
4	Drawback Dwell	Dispense/meter/feeder operation is active, drawback dwell portion.
5	Drawback	Dispense/meter/feeder operation is active, drawback portion.
6	Faulted	A fault condition exists, must clear fault before operation possible.
7	Referencing	A reference operation is active.
8	Initializing	Unit is initializing.
9	Pre-op Dwell	Dispense/meter/feeder operation is active, pre-op dwell portion.
10	Post-op Dwell	Dispense/meter/feeder operation is active, post-op dwell portion.

Num	State	Description
11	Autotrigger Idle	Autotrigger is dwelling between operation triggers.
12	Isolating	Agitate operation is active, isolation volume portion.
13	Agitating	Agitate operation is active, active forward/reverse portion.
14	Returning	Agitate operation is active, returning back to starting point.
15	Bubble Clear	Bubble clear operation is active.
16	Loading	Load operation is active.
17	Changing Port	Port change operation is active.
18	Agitate Dwell	Agitate operation is active, dwelling between forward/reverse portions.
19	Parking Port	Parking operation is active.
20	Port Parked	Port is parked.
21	Port Unparking	Unparking operation is active.
22	Motion Locked	Motion is locked, no operations possible until unlocked.
23	Not Configured	A Pump Motor is not selected.
24	Feeding	Feeding operation is active, this pump is presently dispensing.
25	Crossover Waiting	Synchronous operation is active, this pump is waiting for the Crossover Synchronous signal to activate.
26	Clearing Fault	A fault is being cleared.
27	Intaking	Dispense/meter/feeder operation is active that requires more than a single chamber volume, intake (reload) portion active.
28	Maintaining	Maintaining operation is active.
29	Bubble Clear Dwell	The dwelling portion of the Bubble Clear operation is active.

3.3.8.15 Fault Code [P015]

The Fault Code parameter indicates the present fault code. If there is no fault, the fault code indicates zero (0). When a fault is present, all operations are inhibited. All faults must be cleared before operations are possible.

Fault Code	Name	Description
0	No Faults	There are no faults.
999	Internal	An unexpected internal software path was taken.
1000	Internal	Internal operation fault.
1001	Piston Stall	The encoder indicated a stall of the linear pump motor during piston movement.
1002	Port Stall	The encoder indicated a stall of the linear pump motor during port movement.
1003	Piston Home	The piston home sensor indicated an incorrect piston position.
1004	Port home	The port home sensor indicated an incorrect port position during valving.
1005	Rotary Home, Retry	The rotary pump motor stalled as indicated by the home sensor. The configured retry attempts were then made without success.
1006	Rotary Home	The rotary pump motor stalled as indicated by the home sensor.
1007	Rotary Stall	The rotary pump motor stalled as indicated by the encoder.
1100	Motor hardware	The motor hardware has an unexpected condition.
1101	DC Bus overvoltage	The motor dc bus voltage was detected to be over the high voltage limit.
1102	DC Bus undervoltage	The motor dc bus voltage was detected to be under the low voltage limit.
1103	Solenoid bus overvoltage	The solenoid (clutch/brake) dc bus voltage was detected to be over the high voltage limit.
1104	Solenoid bus undervoltage	The solenoid (clutch/brake) dc bus voltage was detected to be under the low voltage limit.
1105	Motor drive overcurrent	The motor drive current was detected to be over the high limit.
1106	Motor driver overtemperature	The motor driver temperature was detected to be over the high limit.
1107	Heatsink overtemperature	The heatsink temperature was detected to be over the high limit.
1108	Ambient overtemperature	The ambient PCB temperature was detected to be over the high limit.
1109	Unknown driver	An unknown fault occurred in the motor driver module.
1110	Power Failure	A power failure was detected.

1999	Internal Operation	A fault internal to the operation module was detected.
2000	External Operation	A fault external to the operation module was detected.
Fault Code	**Name**	**Description**
2011	Analog in above high limit	The analog in value was equal to or above the high limit.
2012	Analog in below low limit	The analog in value was equal to or below the low limit.
2020	Liquid Eye, No Sensor	Liquid eye detector is not connected or the sensor window is fully blocked.
2021	Liquid Eye, Air detected	The liquid eye detected air in the fluid line.

3.3.8.16 Alert Code [P016]

The Alert Code parameter indicates the present alert code. If there is no alert, the alert code indicates zero (0). Most alerts indicate an issue with a parameter(s). Alerts should be cleared and addressed before staring additional operations. However, it is possible to initiate operations while alerts are present.

Any change of the Pump Motor parameter generates an Alert. This is to provide a reminder to verify that the Pump Motor selection matches the motor/base or actuator that is physically attached to the Controller.

Alert Code	Name	Description
0	No alerts	There are no alerts.
999	Internal alert	An unexpected internal software path was taken.
2000	Nonvolatile hardware	A problem exists with the nonvolatile memory hardware.
2101	Recipe read backup	Unable to read the backup recipe record.
2102	Recipe read	Unable to read the primary recipe record.
2103	Recipe read limit	At least one of the values in the recipe record is out of limits.
2104	Recipe version	The version of the recipe record is incorrect.
2105	Recipe save backup	Unable to save the backup recipe record.
2106	Recipe save	Unable to save the primary recipe record.
2107	Erase recipe not all	Unable to erase all of the primary recipe records.
2108	Recipe erase backup	Unable to erase all of the backup recipe records.
2109	Erase recipe none	Unable to erase any recipe.
2110	Memory read	Unable to read nonvolatile memory.
2201	Parameter read backup	Unable to read the backup parameter record.
2202	Parameter read	Unable to read the primary parameter record.
2203	Parameter limit	At least one of the values in the parameter record is out of limits.
2204	Parameter version	The version of the parameter record is incorrect.
2205	Parameter blank	The parameter record is blank.
2206	Parameter save backup	Unable to save the backup parameter record.
2207	Parameter save primary	Unable to save the primary parameter record.
2301	Configuration read backup	Unable to read the backup configuration record.
2302	Configuration read	Unable to read the primary configuration record.
2303	Configuration read limit	At least one of the values in the configuration record is out of limits.
2304	Configuration version	The version of the configuration is incorrect.
2305	Configuration read blank	The configuration record is blank.
2306	Configuration save backup	Unable to save the backup configuration record.
2307	Configuration save	Unable to save the primary configuration record.
2401	Manufacturing save backup	Unable to save the backup manufacturing record.
2402	Manufacturing save	Unable to save the primary manufacturing record.
2403	Manufacturing limit	At lease on of the values in the manufacturing record is out of limits.
2501	Fault log read backup	Unable to save the backup fault log.
2502	Fault log read	Unable to save the primary fault log.
2504	Fault log version	Incorrect fault log version.
2505	Fault log read blank	The fault log is blank.
2506	Fault log save backup	Unable to save the backup fault log record.

2507	Fault log save	Unable to save the primary fault log record.
2999	Internal Nonvolatile fault	Internal fault in the nonvolatile software path.
Alert Code	**Name**	**Description**
3010	Pump motor change	The pump motor has been changed, verify that the attached motor matches the configured value.
3110	Multiple volumes and rates limited	A change in a pump or motor or pump chamber volume caused other volumes and rates to be limited.
3120	Multiple volumes limited	A change in a pump or motor or pump volume caused other volumes to be limited.
3121	Pump volume limited	The requested change to the pump chamber volume was limited
3122	Production volume limited	The requested change to the production dispense volume was limited.
3123	Fluidic volume limited	The requested change to the fluidic discharge volume was limited.
3124	Isolation volume limited	The requested change to the fluidic isolation volume was limited.
3125	Load volume limited	The requested change to the load volume was limited.
3126	Crossover volume limited	The requested change to the crossover volume was limited.
3127	Drawback volume limited	The requested change to the drawback volume was limited.
3128	Totalizer volume limited	The requested change to the totalizer(s) volume(s) were limited.
3140	Multiple rates limited	The change of pump, pump motor, or pump chamber volume resulted in multiple rates being limited.
3141	Production discharge rate limited	The requested change to the production discharge rate was limited.
3142	Production intake rate limited	The requested change to the production intake rate was limited.
3143	Fluidic discharge rate limited	The requested change to the fluidic discharge rate was limited.
3144	Fluidic intake rate limited	The requested change to the fluidic intake rate was limited.
3145	Drawback rate limited	The requested change to the drawback rate was limited.
4001	Interface Communications Lost	The communication link between the Primary board and Interface board has become disconnected.
4011	Analog in too high	Analog in value greater than or equal to alarm high limit.
4012	Analog in too low	Analog in value less than or equal to alarm low limit.
4020	Liquid Eye, No Sensor	Liquid eye detector is not connected, or the sensor window is fully blocked.
4021	Liquid Eye, Air detected	The liquid eye detected air in the fluid line.

3.3.8.17 Recipe [P017]

The Recipe parameter shows the Recipe presently active in the Controller. A Recipe of zero (0) indicates there is no specific Recipe active in the system. The Controller is capable of storing up to 32 Recipes. If a Recipe is active, and any parameter is changed, the Recipe parameter returns to zero (0), indicating that a Recipe is no longer active.

3.3.8.18 Recipe Get [P018]

The Recipe Get parameter allows the request of a stored Recipe. If the requested Recipe record number contains a valid Recipe (i.e., not blank), the parameters in the Controller are changed to the stored values. If the requested Recipe is blank, an alert is generated, indicating that the Recipe is blank.

NOTE

This value should be set to "0" when not in use, and changed back to "0" after the recipe is loaded or saved.

3.3.8.19 Recipe Save [P019]

The Recipe Save parameter allows the request to store a Recipe in a specific Recipe record (by number).

NOTE

This value should be set to "0" when not in use, and changed back to "0" after the recipe is loaded or saved.

3.3.8.20 Pump Motor [P020]

The Pump Motor parameter allows selection of the various motor/bases and actuators that may be used with the Controller Module. This determines internal system operating points and influences the acceptable ranges of other Parameters. Some of the internal system operating points influenced by the Pump Motor selection include: the amount of current supplied to the motor, which pumps may be attached to the motor/base or actuator, whether the pump operates with either linear or rotary sequence, and sensor polarity and offsets. Some of the other Parameters influenced by the Pump Motor selection include: various rates limited by maximum speed achievable, and initial rates and acceleration profiles are unique to each motor/base or actuator.

Each Pump Motor selection corresponds to a specific range of IVEK part numbers. The first six digits of the part number indicate the base model number of the motor/base or actuator. The remaining digits, after the "-" indicate the tabulation fields, which correspond to variants of the base model number. A "#" in the tabulation field indicates a field that does not need to match the attached motor/base or actuator in that tabulation field location. However, a number in the tabulation field indicates a field that MUST match the tabulation field of the attached motor/base in that location. In some cases, there are some motor/bases that have the same base part number as other Motor/Bases but contain a different motor type.

Examples: Actuator 032037-03121 or 032037-06121, must choose Pump 032037-##12#

Motor/Base 092128-21210, must choose Pump Motor 092128-##2##

Motor/Base 092128-21310, must choose Pump Motor 092128-##3##

CAUTION

It is necessary that the pump motor/base or actuator attached to the Controller Module matches the pump selected by the Pump Motor parameter. A mismatch of the Pump Motor parameter and the attached motor/base or actuator could result in both improper operation and overheating of the motor/base or actuator. The selected Pump Motor part number MUST match the attached motor part number in both the base model number portion and any non "#" tabulation fields.

3.3.8.21 Pump Size [P021]

The Pump Size parameter allows selection of the various pump sizes that may be used with the Controller Module. The Pump selection determines (linear pump type) or influences the range of (rotary pump type) the Pump Chamber Volume. Certain Pump Motor and Pump Size combinations are not allowed. When an invalid Pump Size is chosen for a specific Pump Motor, the Pump Size will be automatically set to "None".

The size of your Pump Module is identified in the Title Page section of your manual in the Pump section.

3.3.8.22 Pump Units [P022]

The Pump Units parameter determines the units of other volume and fluidic rate parameters. The Pump Units may be: revolutions per second (REV, REV/s), nanoliters per second (nL, nL/s), microliters per second (uL, uL/s), milliliters per second (mL, mL/s) or revolutions per minute (Rev, RPM). Selection of the Pump Units should be considered carefully as some unit selections will not allow full resolution of every pump size.

Decimal Points

Some Parameters contain decimal points. The number of decimal points depends on the specific parameter and the Pump Units setting. Parameter values displayed on the Front Panel show the actual number of decimal points and the actual units. However, Parameter values communicated over the Communication Interface do not contain decimal points. Rather, the number of decimal points is implied.

The following table indicates the number of implied decimal points for the different Parameter types. The table shows two examples for each parameter type depending on units. For example, when the Pump Units is "Rev", there are 3 implied decimal points for linear pump type volumes. This means to communicate a volume of "0.001 Rev" a "1" should be exchanged; to communicate a volume of "1.000 Rev", a "1000" should be exchanged.

Parameter Type	Implied Decimal Places	Value of 1 represents	Value of 1000 represents	Units
Volumes, Units = Rev, Linear pump types	3	0.001	1.000	Rev
Volumes, Units = Rev, Rotary pump types	0	1	1000	Rev
Volumes, Units = nL	0	1	1000	nL
Volumes, Units = uL	1	0.1	100.0	uL
Volumes, Units = mL	2	0.01	10.00	mL
Rates, Units = Rev	3	0.001	1.000	Rev/s
Rates, Units = nL	0	1	1000	nL/s
Rates, Units = uL	1	0.1	100.0	uL/s
Rates, Units = mL	2	0.01	10.00	mL/s
Parameter Type	**Implied Decimal Places**	**Value of 1 represents**	**Value of 1000 represents**	**Units**
Rates, Units = RPM	0	1	1000	RPM
Drawback Volume, Units = Rev, Rotary pump types	3	0.001	1.000	Rev
Drawback Volume, Units = nL, Rotary pump types	3	0.001	1.000	nL
Drawback Volume, Units = uL, Rotary pump types	4	0.0001	0.1000	uL
Drawback Volume, Units = mL, Rotary pump types	5	0.00001	0.01000	mL
Dwells	2	0.01	10.00	s
Voltages	1	0.1	100.0	V
Temperatures	1	0.1	100.0	°C

3.3.8.23 Pump Type [P023]

The Pump Type parameter is read-only and indicates the pump type based on the Pump Motor selection. The Pump Type determines the pumping sequence during different operations. The Controller Module supports two pump types: Linear and Rotary.

3.3.8.24 Pump Chamber Volume [P024]

The Pump Chamber Volume parameter indicates how much fluid a full pump chamber contains.

With a linear pump type, the Pump Chamber Volume is fixed and is determined by the Pump Size. Linear Production and Fluidic operations allow both partial-chamber and multi-chambers worth of fluid to be moved.

With a rotary pump type, the Pump Chamber Volume may be modified and should be configured to correspond to the calibrated volume of the attached pump (or pumps with a dual-end motor/base). Rotary Production and Fluidic operations allow only 1 or more multiples of the Pump Chamber Volume to be moved (an exception to this is Drawback which allows partial Pump Chamber Volume of fluid to be moved).

3.3.8.25 Pump Volume Resolution [P025]

The Pump Volume Resolution parameter is a read-only parameter that indicates the ideal volume resolution of the attached motor/base or actuator and pump combination. All entered volume parameters in the Controller must be a multiple of this resolution. Entering a volume that is not a multiple of the Pump Volume Resolution generates an Alert condition and the volume parameter is limited to the closest volume that is a multiple of the Pump Volume Resolution.

This parameter is useful to set the increment value for volume parameters in an external HMI.

3.3.8.26 Pump Rate Resolution [P026]

The Pump Rate Resolution parameter is a read-only parameter that indicates the ideal rate resolution of the attached motor/base or actuator and pump combination. All entered rate parameters in the Controller must be a multiple of this resolution. Entering a rate that is not a multiple of the Pump Rate Resolution generates an Alert condition and the rate parameter is limited to the closest rate that is a multiple of the Pump Rate Resolution.

This parameter is useful to set the increment value for rate parameters in an external HMI.

3.3.8.27 Invert Pump Ports [P027]

The Invert Pump Ports parameter allows inversion of the factory designated inlet/outlet (intake port, discharge port). This is useful in certain applications where the mounting of the pump would benefit from inversed port locations. The following table indicates how to set this parameter for a specific port offset relative to the physical factory setting (this applies to actuators 032037-#####, 032038-#####, 032241-######, 032254-##### and 032255-#####) for linear actuators.

Factory Discharge Port Setting (indicated by first 2 tabulation fields)	Factory Port Setting Description	Desired Discharge Port Position	Invert Pump Ports Setting
-03###	3 O'clock	3 O'clock	Disabled
		9 O'clock	Enabled
-06###	6 O'clock	6 O'clock	Disabled
		12 O'clock	Enabled
-09###	9 O'clock	9 O'clock	Disabled
		3 O'clock	Enabled
-12###	12 O'clock	12 O'clock	Disabled
		6 O'clock	Enabled

For rotary Motor/Bases, inverting the pump ports swaps the designated inlet and outlet ports. In order to achieve this, the motor runs in the opposite direction. Also, the default stop position of the motor is changed from 90 degrees to 270 degrees. This causes the piston to stop in the middle of the intake portion of the pump stroke.

NOTE

When inverting the pump ports on a rotary Motor/Base (Invert Pump Ports = Enabled), make sure the Stop Position is at the recommended location of 270 degrees. It is permissible to adjust this value to stop the stroke elsewhere in the cycle, but 270 degrees is the middle of the intake stroke when the pump ports are inverted. When the pump ports are not inverted, 90 degrees is the middle of the intake stroke.

3.3.8.28 Piston Backlash (Linear only) [P028]

When set greater than 0 the Piston Backlash parameter causes a backlash compensation move to be performed after the pump is loaded to the load position. Adding backlash compensation removes backlash from the system and may improve accuracy and/or repeatability. However, IVEK linear actuators have very little backlash so this parameter often has no noticeable effect.

NOTE

IVEK recommends keeping this value at 0. This value is hidden on the Front Panel to discourage modification of this value.

3.3.8.29 Encoder [P029]

Deprecated. The encoder parameter is now part of the pump motor selection.

3.3.8.30 Encoder Lines [P030]

Deprecated. The encoder lines parameter is now part of the pump motor selection.

3.3.8.31 Running Torque [P031]

The Running Torque parameter determines what percentage of maximum specified current is delivered to the motor while the motor is moving. This percentage is relative to the specified current of the Pump Motor rather than relative to the overall capability of the drive (i.e., 80% may mean 2A to one motor/base but 4A to another).

Increasing the Running Torque decreases the probability of a motor stall with higher viscosity fluids, but also increases the heat dissipated in the motor. Decreasing the Running Torque decreases the heat dissipated in the motor but increases the probability of a motor stall.

The Running Torque has limited influence of the capability of the motor drive at higher speeds. As the rotational speed of the motor increases, back-EMF of the motor also increases and limits the motor drive's ability to deliver the full current to the motor. The only way to increase torque at higher speeds is to increase the DC voltage to the Controller. This also implies that some higher viscosity fluids may need to be moved at slower rates so that the motor has enough torque to pump the fluid.

3.3.8.32 Holding Torque [P032]

The Holding Torque parameter determines what percentage of maximum specified current is delivered to the motor while the motor is not moving (holding still). This percentage is relative to the specified current of the Pump Motor rather than to the overall capability of the driver (i.e., 20% may mean 1A to one motor/base but 2A to another).

Increasing the Holding Torque increases the ability of the motor to hold its place when not moving, but increases the heat dissipated in the motor.

3.3.8.33 Holding Torque Delay [P033]

The Holding Torque Delay is the length of time between the motor changing from the Running Torque to the Holding Torque. This delay starts as soon as the motor stops moving. Adjusting this delay to be longer than short dwells (e.g., drawback dwell or idle time between Production operations) may reduce the probability of a stall.

NOTE

IVEK recommends keeping this value at the default value. This value is hidden on the Front Panel to discourage modification of this value.

3.3.8.34 Acceleration [P034]

The Acceleration setting determines how quickly the motor reaches the rate from a stopped position. It is also used to determine deceleration; how quickly the motor slows down when heading towards stop. Increasing the acceleration may reduce the cycle time and may help increase the shearing of certain fluids from the tip improving repeatability. However, with higher accelerations, fluid may cavitate, or high viscosity fluids may be more susceptible to causing the motor to stall.

3.3.8.35 Deceleration 2X [P035]

Enabling the Deceleration 2X parameter causes the motor to decelerate at twice the acceleration rate. This helps increase shearing of certain fluids from the tip, improving repeatability.

During Synchronous operations with two linear pumps, disabling this may help maintain linear fluid flow during the crossover point.

3.3.8.36 Initial Rate [P036]

The initial rate determines the motor speed at which acceleration starts. Increasing the initial rate may decrease the overall dispense cycle time and may increase shear at the tip. Decreasing the initial rate may help overcome stalling with larger motors.

NOTE

IVEK recommends keeping this value at the default value. This value is hidden on the Front Panel to discourage modification of this value.

3.3.8.37 Stop Position (Rotary pump types only) [P037]

The Stop Position determines the starting and stopping position of the pump. This is typically at the middle of the intake stroke. See the Invert Pump Ports parameter ([P027]) for more information about this parameter.

NOTE

If the Stop Position is configured such that it falls within the sensor flag window, this results in an effective stop position of 0.

The Stop Position is limited to less than the full 360 degrees of the motor rotation due to the need for maintaining a window for the rotary home sensor detection algorithm.

3.3.8.38 Valving Max Speed (Linear pump types only) [P038]

The Valving Max Speed parameter determines the speed of the motor during valving portions of operations. The valving speed may need to be reduced to avoid stalling of the motor when pumping higher viscosity fluids.

3.3.8.39 Valving Start Speed (Linear pump types only) [P039]

The Valving Start Speed parameter determines the motor speed at which acceleration starts, during valving portions of operations.

NOTE

IVEK recommends keeping this value at the default value. This value is hidden on the Front Panel to discourage modification of this value.

3.3.8.40 Stall Retries (Rotary pump types only) [P040]

The Stall Retries parameter determines how many times a motor will retry upon a stall before a fault condition is generated. This allows for retries to automatically occur during Production and Fluidic operations.

Setting the Stall Retries to something other than zero is only recommended when performing long metering operations (e.g., Maintainer or Feeder operations) where a transient (due to a stall or retry) in the fluid flow can be tolerated. For normal dispense operations where precise cycle time is critical, keep the Stall Retries at zero. A stalled pump is typically an indication of the need to either perform fluidic maintenance (e.g., clean the pump) or to adjust parameters (e.g., reduce the discharge rate).

3.3.8.41 Reserved [P041]

Reserved.

3.3.8.42 Reserved [P042]

Reserved.

3.3.8.43 Reserved [P043]

Reserved.

3.3.8.44 Reserved [P044]

Reserved.

3.3.8.45 Reserved [P045]

Reserved.

3.3.8.46 Reserved [P046]

Reserved.

3.3.8.47 Reserved [P047]

Reserved.

3.3.8.48 Reserved [P048]

Reserved.

3.3.8.49 Reserved [P049]

Reserved.

3.3.8.50 Production Mode [P050]

The Production Mode parameter determines which Production operation sequence will be performed when a Production operation is initiated: Dispense, Meter, Feeder or Maintainer. These operating modes are described above in the Operation section. Setting the Production Mode to Disabled inhibits Production operation of the pump when a Production Start command is received.

3.3.8.51 Direction (Production) [P051]

Deprecated. The direction is no longer a modifiable parameter. The direction is determined by the operating mode and the Invert Pump Ports parameter. Reverse production modes are no longer supported.

3.3.8.52 Dispense Volume [P052]

The Dispense Volume parameter determines how much fluid is discharged during Dispense operations. The Dispense Volume parameter must be a multiple of the Pump Volume resolution. The Dispense Volume has no effect in Meter, Feeder and Maintainer modes.

The maximum possible Dispense Volume is limited by the Chamber Mode parameter. In Single Chamber Mode, the maximum Dispense Volume possible is equal to the chamber volume of the attached pump. In MCV Chamber Mode, the maximum Dispense Volume possible is equal to the MCV Volume. In multiple Chamber Modes (Multiple, Synchronous), the maximum Dispense Volume possible is 100 times the attached pump chamber volume.

3.3.8.53 Dispense Rate [P053]

The Dispense Rate parameter determines the rate at which the fluid moves out of the Discharge Port.

For rotary pump types, this is an average rate over a full stroke as half of the stroke is an intake cycle and the other half is a discharge cycle.

For linear pump types, this is the rate during the discharge portion of the operation.

3.3.8.54 Load Rate (Production - Linear pump types only) [P054]

The Load Rate parameter determines the rate at which the fluid moves into the Intake Port. This rate applies to the intake portion of multi-chamber Production operations as well as to Load operations.

3.3.8.55 Drawback Volume [P055]

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. Drawback allows fluid to move in the opposite direction at the end of a Production operation 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.

3.3.8.56 Drawback Rate [P056]

The Drawback Rate parameter determines the rate of fluid movement during the drawback portion of a Production operation if P055 is greater than zero (0).

3.3.8.57 Drawback Dwell [P057]

The Drawback Dwell parameter determines the amount of time the fluid movement pauses between the end of the discharge portion of the operation and the beginning of the drawback portion of the operation if P055 is greater than zero (0).

Depending on the inertia of the pump and fluid, small dwell times may not give the pump enough time to settle between direction changes, resulting in a stall.

NOTE

A Drawback Dwell of less than 0.05 seconds is not recommended.

3.3.8.58 Load Mode (Linear pump types only) [P058]

The Load Mode parameter determines which Load mode is configured for the present Production operation as well as influences the decision as to when a Load is required (see description of Load Modes above). When a Load is required, a Production operation will be inhibited from starting.

The Load Mode does not impact the intake portion of multi-chamber operations. For example, in Multiple Chamber Mode, if a Dispense Volume is greater than the Pump Chamber Volume, intake cycles will automatically occur during the operation so that the desired volume will be dispensed. Automatic intake cycles will occur during Meter, Feeder and Maintainer modes also if necessary.

3.3.8.59 Load Threshold (Linear pump types only) [P059]

The Load Threshold parameter determines the piston position at which a Load is required. Changing this value adjusts the point in the pump chamber at which the pump is considered empty (requiring a reload). By default, the Load Threshold is equivalent to the pump chamber volume, which correlates to the piston location being at the empty chamber position. In other words, the Load Threshold determines the reload point based on how much fluid has been dispensed from the chamber. This is often used in conjunction with Load Empty mode to cause an automatic Load operation after a desired number of Dispense operations.

This parameter is ignored when the Chamber Mode is either MCV or Synchronous.

3.3.8.60 Stop Mode (Rotary pump types only, Meter, Feeder and Maintainer modes only) [P060]

The Stop Mode parameter determines whether a pump stops immediately or at the stop position of the pump after stopping of either a Meter, Feeder or Maintainer operation. Single-ended pumping, or simultaneous dual-ended pumping will typically use the Stop Position setting. Alternating dual-ended pumping will typically use the Immediate setting.

NOTE

If the present discharge rate of the pump is zero and a stop signal is received, the pump will be unable to move to the stop position. In Feeding and Maintaining operations that allow zero speed, it is recommended to use an alternating dual end rotary Motor/Base and a stop mode of Stop Immediate.

3.3.8.61 Chamber Mode (Linear pump types only) [P061]

The Chamber Mode modifies Production operations and includes Single; MCV, Push Inlet; MCV, Push Outlet; Multiple; Synchronous; Synchronous, Primary. See Chamber Mode in section 3.2.3.5.

3.3.8.62 MCV Volume (Linear pump types only) [P062]

The MCV Volume parameter determines how much fluid is loaded into the pump chamber when Chamber Mode is configured for one of the MCV modes. The MCV Volume may be as large as the specified pump chamber volume but is typically set to much less than the full chamber volume. See section 3.2.3.5 for further description of the MCV Chamber Mode.

3.3.8.63 Primary Feeder [P063]

Deprecated. Selection of the Primary Feeder is now part of Chamber Mode.

3.3.8.64 Crossover Volume (Linear pump type only) [P064]

When Synchronous Chamber Mode is enabled, the Crossover Volume parameter determines the point at which the pumping Controller Module signals the waiting Controller Module to start discharging. This point is typically set to be a very small volume. The controller calculates the Crossover point by subtracting the Crossover Volume from the end of the discharge stroke. In the case of Meter, Feeder, and Maintainer operations, the end of the discharge stroke is the empty chamber position. Therefore, in this scenario, the Crossover Volume is equivalent to saying that the active pump will signal the waiting pump when there is a volume remaining in the active pump equal to the Crossover Volume.

The Crossover Volume will require experimental adjustment to determine the setting that gives the most linear fluidic profile as one Control Module takes over for the other. Other parameters that may influence the linearity of the fluidic profile include dispense rates, acceleration, and deceleration 2X.

When the Chamber Mode is something other than Synchronous Mode, the Crossover Volume is ignored.

3.3.8.65 Pre-Op Dwell [P065]

The Pre-Op Dwell parameter allows the configuration of a dwell time before the Production operation, after a Start Command is received. This dwell time may be used in conjunction with certain status signals to perform other operations during the dwell time.

An example of this is to energize a valve with enough time for it to fully open before pumping fluid.

3.3.8.66 Post-Op Dwell [P066]

The Post-Op Dwell parameter allows the configuration of a dwell time after the Production operation. This dwell time may be used in conjunction with certain status signals to perform other operations during the dwell time.

An example of this is to delay the de-energization of a valve with enough time for pumping fluid to stop moving before the valve starts to close.

3.3.8.67 Autotrigger Mode (Dispense Mode only) [P067]

The Autotrigger Mode parameter allows multiple Dispense operations to be initiated by a single Start Production command. Autotrigger Count Mode causes the configured number of Dispense (see Dispense Count parameter) operations to be initiated by a single Start Production command. Autotrigger Infinite Mode causes multiple Dispense operations to continue until stopped by the Stop command.

Autotrigger Disabled Mode disables the Autotrigger feature.

3.3.8.68 Autotrigger Dwell (Dispense Mode only, Autotrigger Count or Autotrigger Infinite Modes only) [P068]

The Autotrigger Dwell parameter determines the time to wait before initiating the next Dispense operation after the previous Dispense operation completes.

3.3.8.69 Autotrigger Count (Dispense Mode only, Autotrigger Count Mode only) [P069]

The Autotrigger Count parameter determines the number of total dispense operations to perform when initiated by the Start Production command.

Load operations will be automatically initiated if the Load Mode is set to either Empty or Every. A setting of Load Manual causes the Autotrigger Mode to terminate if a Load Required condition occurs, even if less than the requested number of Dispense Count dispenses have occurred.

Changing Parameters during the Autotrigger operation will cause the Autotrigger operation to cease at the end of the present Dispense operation.

3.3.8.70 Setpoint Min [P070]

The Setpoint Min parameter is used in Maintainer Mode and is part of an equation that determines the flow rate. When the measured setpoint (i.e., Maintainer Setpoint [P072]) is equal to this parameter, the flow rate will be minimum (as determined by Min Discharge Rate [P077]).

3.3.8.71 Setpoint Max [P071]

The Setpoint Max parameter is used in Maintainer Mode and is part of an equation that determines the flow rate. When the measured setpoint (i.e., Maintainer Setpoint [P072]) is equal to this parameter, the flow rate will be maximum (as determined by Max Discharge Rate [P078]).

3.3.8.72 Maintainer Setpoint [P072]

The Maintainer Setpoint is used in Maintainer mode and is part of an equation that determines the flow rate. The flow rate in Maintainer mode is determined by the following equation:

Maintainer Discharge Rate = (((Max Discharge Rate – Min Discharge Rate) * (ABS(Maintainer Setpoint – Setpoint Min))/ABS(Setpoint Max – Setpoint Min)) + Min Discharge Rate.

The Maintainer Setpoint can be changed during Maintainer operation by any of its sources (Front Panel HMI, web page, Ethernet register (both implicit and explicit), 4-20mA Analog Input), and the flow rate will change per the equation.

NOTES

When either the 4-20mA Analog Input or Ethernet implicit data source are used, changes made by other sources will be ignored.

Changing the Maintainer Setpoint does not reset the Recipe to 0 like other parameter changes do.

3.3.8.73 Feeder Setpoint [P073]

The Feeder Setpoint parameter displays the value generated by the Analog In when configured to control the Feeder Setpoint in Feeder Mode. The flow rate in Feeder mode is determined by the following equation when controlled by the setpoint:

Actual Discharge Rate = (Max Discharge Rate – Min Discharge Rate) * (Feeder Setpoint).

The Feeder Setpoint can be changed during Feeder operation only by the 4-20mA Analog Input, and the flow rate will change per the equation.

NOTES

When the 4-20mA Analog Input is used, changes made by other sources will be ignored.

Changing the Feeder Setpoint does not reset the Recipe to 0 like other parameter changes do.

3.3.8.74 Feeder Rate [P074]

The Feeder Rate is used in Feeder mode and determines the flow rate. This value may be changed during Feeder operation. During operation, any change to this value immediately changes the flow rate of the pump. The actual discharge rate is also bounded by the Min Discharge Rate and Max Discharge Rate parameters.

The Feeder Rate can be changed during Feeder operation by any of its sources (Front Panel HMI, web page, fieldbus register (both implicit and explicit)).

NOTES

When the 4-20mA Analog Input is used to control the Feeder Setpoint, or the fieldbus implicit data source is used to control the Feeder Rate, changes made by other sources will be ignored.

Changing the Feeder Rate does not reset the Recipe to 0 like other parameter changes do.

3.3.8.75 Actual Rate [P075]

The Actual Rate displays the actual rate of the pump.

For linear pump types, this indicates the rate of the pump when it is moving fluid out of the Discharge Port. When the pump is either intaking/reloading, or idle, the rate will indicate zero.

For rotary pump types, the rate indicates the rate of the pump. When idle, the rate will indicate zero.

3.3.8.76 Rate or Setpoint [P076]

The Rate or Setpoint parameter is for use in Ethernet based fieldbus maps. This is an indirect access point to another parameter depending on which Production mode the Controller is configured for: Dispense mode and Meter mode - accesses Dispense Rate, Feeder Mode- accesses Feeder Rate, Maintainer Mode – access Maintainer Setpoint.

3.3.8.77 Minimum Discharge Rate [P077]

The Minimum Discharge Rate parameter determines the lower boundary of the discharge rate during Feeder and Maintainer modes. This is especially useful when using the 4-20mA input signal for setpoint-based control.

3.3.8.78 Maximum Discharge Rate [P078]

The Maximum Discharge Rate parameter determines the upper boundary of the discharge rate during Feeder and Maintainer modes. This is especially useful when using the 4-20mA input signal for setpoint-based control.

3.3.8.79 Reserved [P079]

Reserved.

3.3.8.80 Fluidic Mode [P080]

The Fluidic Mode parameter determines which Fluidic operation sequence will be performed when a Fluidic operation is initiated: Prime, Prime Timed, Prime Reverse, Prime Reverse Timed, Agitate, or Bubble Clear. These operating modes are described above in the Operation section. Setting the Fluidic Mode to Disabled inhibits Fluidic operation of the pump when a Fluidic Start command is received.

3.3.8.81 Direction (Fluidic operations) [P081]

Deprecated. This parameter was most commonly used to initiate a reverse prime to empty the fluidic system of fluid. This has been replaced by a distinct Fluid Mode: Prime Reverse.

3.3.8.82 Discharge Volume (Fluidic operations) [P082]

The Discharge Volume parameter determines how much fluid is discharged during Prime or Prime Reverse operations or how much fluid is agitated during Agitate operations. The Discharge Volume is ignored during Bubble Clear operations. The Discharge Volume parameter must be a multiple of the Pump Volume Resolution.

3.3.8.83 Discharge Rate (Fluidic Operations) [P083]

The Discharge Rate parameter determines the rate at which the fluid moves out of the Discharge Port during a Fluidic operation.

For rotary pump types, this is an average rate over a full stroke as half of the stroke is an intake cycle and the other half is a discharge cycle.

For linear pump types, this is the rate during the discharge portion of the operation.

3.3.8.84 Intake Rate (Fluidic Operations, Linear pump types only) [P084]

The Intake Rate parameter determines the rate at which the fluid moves into the Intake Port during Fluidic operations.

3.3.8.85 Fluidic Dwell [P085]

The Fluidic Dwell parameter determines the dwell time during Fluidic operations. During Prime operations, the dwell time is ignored. During Agitate operations, the dwell time is the time between changing directions in the agitate cycle. During Bubble Clear operations, the dwell time is the time the pump dwells in the discharge port position before pushing the fluid out of the pump chamber.

3.3.8.86 Isolation Volume [P086]

The Isolation Volume parameter determines the amount of fluid to move back into Discharge Port before starting the Agitate back and forth sequences. This provides an air barrier between the end of the fluid in the tubing and the tip.

3.3.8.87 Prime Time [P087]

The Prime Time parameter is the length of time that the Prime Timed, and Primed Timed Reverse, operations will take to complete.

3.3.8.88 Reserved [P088]

Reserved.

3.3.8.89 Reserved [P089]

Reserved.

3.3.8.90 Total Production Volume [P090]

The Total Production Volume is a totalizer which indicates the amount of fluid dispensed during Production operations (does not include fluid moved during other operations). The volume indicated by this totalizer uses the same units as other volumes as determined by the Pump Units parameter.

The Total Production Volume may be changed or cleared to zero. A typical use case for this is to clear the Total Production Volume at the beginning of a production shift so that the total fluid dispensed during the shift may be recorded.

3.3.8.91 Last Production Volume [P091]

The Last Production Volume is a totalizer that clears at the beginning of each Production operation. During and after a Production operation the totalizer indicates the amount of fluid dispensed.

3.3.8.92 Position [P092]

The Position indicates the present position of the pump.

For linear pump types, the Position indicates the position of the piston relative to the linear home position (0). The maximum linear position is 10.000 REV (except for A20 which is 5.000 REV).

For rotary pump types, the Position indicates the position of the piston relative to the rotary home position (0). The maximum rotary position is 1.000 REV.

This Position is always in REV units regardless of the Pump Units selection.

3.3.8.93 Chamber Volume Remaining (Linear pump types only) [P093]

The Chamber Volume Remaining parameter indicates how much piston distance is remaining in the pump chamber before reaching a fully empty position. The maximum Chamber Volume is 10.000 REV (except for A20 which is 5.000 REV). The Chamber Volume Remaining is always in REV units regardless of the Pump Units selection.

3.3.8.94 Last Fluidic Volume [P094]

The Last Fluidic Volume is a totalizer that clears at the beginning of each Fluidic operation. During and after a Fluidic operation the totalizer indicates the amount of fluid dispensed.

3.3.8.95 Production Cycles [P095]

The Production Cycles indicates the number of production operations that have occurred. The totalizer increments every time a Production operation is started.

The Production Cycles may be changed or cleared to zero. A typical use case for this is to clear the Production Cycles at the beginning of a production shift so that the total number of Production operations during the shift may be recorded.

3.3.8.96 Fluidic Cycles [P096]

The Fluidic Cycles indicates the number of fluidic operations that have occurred. The totalizer increments every time a Fluidic operation is started.

The Fluidic Cycles may be changed or cleared to zero. A typical use case for this is to clear the Fluidic Cycles at the beginning of a production shift so that the total number of Fluidic operations during the shift may be recorded.

3.3.8.97 Reference Cycles [P097]

The Reference Cycles indicates the number of reference operations that have occurred during the lifetime of the product. The totalizer increments every time a Reference operation is started.

3.3.8.98 Load Cycles (Linear pump types only) [P098]

The Load Cycles indicates the number of load operations that have occurred during the lifetime of the product. The totalizer increments every time a Load operation is started.

3.3.8.99 Clutch Cycles (Linear pump types only) [P099]

The Clutch Cycles indicates the number of clutch actuations that have occurred during the lifetime of the product. The totalizer increments every time the clutch is actuated.

3.3.8.100 Brake Cycles (Linear pump types only) [P100]

The Brake Cycles indicates the number of clutch actuations that have occurred during the lifetime of the product. The totalizer increments every time the brake is actuated.

3.3.8.101 Piston Sensor Hysteresis (Linear pump types only) [P101]

The Piston Sensor Hysteresis indicates the length of hysteresis of the linear sensor. Linear actuators with magnetic linear sensors often demonstrate a larger hysteresis than linear actuators with optical magnetic sensors.

This parameter can help troubleshoot whether the sensor hysteresis is adding an unexpected delay to the Production operation time.

3.3.8.102 Last Stall Count (Rotary pump types only) [P102]

The Last Stall Count parameter indicates whether the rotary pump indicated any stalls during the last or present Production operation.

3.3.8.103 DC Bus [P103]

The DC Bus parameter indicates the presently measured voltage of the DC Bus. The DC Bus provides the voltage to the internal controls and motor driver. The measured value should correspond to the voltage of the DC power supply connected to the Controller Module. For Benchtop units the DC Bus is an internally generated voltage and should be within 10% of 48V.

3.3.8.104 Solenoid Bus [P104]

The Solenoid Bus parameter indicates the presently measured voltage of the Solenoid bus. The Solenoid Bus is an internally generated voltage that supplies power to the clutch and brake of linear actuators. This voltage should be within 10% of 90V.

3.3.8.105 Heatsink [P105]

The Heatsink parameter indicates the present temperature of the motor driver PCB near the motor driver heatsink.

3.3.8.106 Ambient [P106]

The Ambient parameter indicates the present temperature of the motor driver PCB away from the motor driver heatsink.

3.3.8.107 Processor [P107]

The Processor parameter indicates the present temperature of the CPU.

3.3.8.108 Fault Count [P108]

The Fault Count parameter indicates the total number of Fault conditions that have occurred during the lifetime of the product.

3.3.8.109 Alert Count [P109]

The Alert Count parameter indicates the total number of Alert conditions that have occurred during the lifetime of the product.

3.3.8.110 Asserts SW [P110]

The Asserts SW parameter indicates the total number of software assert conditions that have occurred during the lifetime of the product.

3.3.8.111 Asserts SW Code [P111]

The Asserts SW Code parameter indicates the code of the last software assert condition.

3.3.8.112 Asserts HW [P112]

The Asserts HW parameter indicates the total number of hardware assert conditions that have occurred during the lifetime of the product.

3.3.8.113 Asserts HW Code [P113]

The Asserts HW Code parameter indicates the code of the last software assert condition.

3.3.8.114 Current Permission [P114]

The Current Permission parameter indicates what permission level is presently active in the Controller Module. The permission level is used typically to inhibit Front Panel HMI access to certain parameter modifications and commands. The majority of parameters are modifiable via the webpage and fieldbus registers no matter which permission level is active. There are a few parameters that are only modifiable with a Current Permission level of IVEK Technical Service.

The Current Permission parameter may not be directly modified. It is only modifiable by entering a proper password into the Change Permission parameter.

For security purposes, the passwords for the Controller Module are provided in a separate Tech Bulletin. Passwords for some permission levels are changeable.

3.3.8.115 Power-up Permission [P115]

The Power-up Permission parameter changes which permission level is entered upon power-up.

Operator - upon the next power-up, the Current Permission will be Operator, no matter which level it is presently.

Last At Power Off - upon the next power-up, the Current Permission will be the same as the level it is presently.

3.3.8.116 Permission [P116]

The Permission parameter allows entry of a password to change the Current Permission level. Each available permission level has its own unique password.

3.3.8.117 Operator Password [P117]

The Operator Password parameter contains the password for changing the Current Permission level to the Operator permission level.

3.3.8.118 IO Test Password [P118]

The IO Test Password parameter contains the password for changing the Current Permission level to the IO Test permission level.

3.3.8.119 Supervisor Password [P119]

The Supervisor Password parameter contains the password for changing the Current Permission level to the Supervisor permission level.

3.3.8.120 Keylock Password [P120]

The Keylock Password parameter contains the password for changing the Current Permission level to the Keylock permission level.

3.3.8.121 Reserved [P121]

Reserved.

3.3.8.122 Reserved [P122]

Reserved.

3.3.8.123 Contrast [P123]

The Contrast parameter is used to change the contrast on the screen. Changing the contrast may be required to compensate for changes in light levels within the room and changes in the display due to temperature.

3.3.8.124 Backlight Mode [P124]

The Backlight Mode Password is used to turn the backlight on or off or set a timer so the backlight will stay on for a preset amount of time.

3.3.8.125 Backlight Intensity [P125]

The Backlight Intensity sets the brightness of the backlight. Changing the intensity may be required to compensate for changes in light levels within the room and changes in the display due to temperature.

3.3.8.126 Backlight Timer [P126]

The Backlight Timer parameter determines the amount of time the backlight will be on after any button press.

The Backlight Timer is only effective if Backlight Mode is set to “On, Timer”.

3.3.8.127 Front Panel Lock Config [P127]

The Front Panel Lock Config parameter determines which parameters will be locked and unlocked.

3.3.8.128 Front Panel Lock Status [P128]

The Front Panel Lock Status parameter indicates the present Lock status based on the Front Panel Lock Config [P127].

3.3.8.129 Driver OTW [P129]

The Driver OTW parameter indicates whether an overtemperature warning has been indicated by the motor driver IC since last power-up.

3.3.8.130 Reserved [P130]

Reserved.

3.3.8.131 Reserved [P131]

Reserved.

3.3.8.132 Reserved [P132]

Reserved.

3.3.8.133 Reserved [P133]

Reserved.

3.3.8.134 Reserved [P134]

Reserved.

3.3.8.135 Reserved [P135]

Reserved.

3.3.8.136 Reserved [P136]

Reserved.

3.3.8.137 Reserved [P137]

Reserved.

3.3.8.138 Erase Params [P138]

The Erase Params parameter provides a way for all Parameters to be reset to their Factory Default values. The permission level must be set to the Keylock permission level in order to successfully execute this command.

3.3.8.139 Reserved [P139]

Reserved.

3.3.8.140 Reserved [P140]

Reserved.

3.3.8.141 Reserved [P141]

Reserved.

3.3.8.142 Reserved [P142]

Reserved.

3.3.8.143 Reserved [P143]

Reserved.

3.3.8.144 Reserved [P144]

Reserved.

3.3.8.145 Reserved [P145]

Reserved.

3.3.8.146 Reserved [P146]

Reserved.

3.3.8.147 Reserved [P147]

Reserved.

3.3.8.148 Reserved [P148]

Reserved.

3.3.8.149 Reserved [P149]

Reserved.

3.3.8.150 Interface Firmware Version [P150]

The Interface Firmware Version parameter indicates the specific version of the interface board firmware.

3.3.8.151 Interface Bootloader Version [P151]

The Interface Bootloader Version parameter indicates the specific version of the interface board bootloader.

3.3.8.152 Interface Firmware CRC [P152]

The Interface Firmware CRC parameter indicates the CRC of the Interface board firmware.

3.3.8.153 Interface Communication Baud Rate [P153]

The Interface Communication Baud Rate parameter determines the baud rate of the communication link between the Primary board and Interface board. Do not change this value or communication between the boards will be lost.

3.3.8.154 Interface Communication Errors [P154]

The Interface Communication Errors parameter indicates the number of communication errors detected between the Primary board and the Interface board.

3.3.8.155 Interface Communication Status [P155]

The Interface Communication Status parameter indicates the status of the communication link between the Primary board and the Interface board.

3.3.8.156 Reserved [P156]

Reserved.

3.3.8.157 Reserved [P157]

Reserved.

3.3.8.158 Reserved [P145]

Reserved.

3.3.8.159 Reserved [P159]

Reserved.

3.3.8.160 Logic In 1 Configuration [P160]

3.3.8.161 Logic In 2 Configuration [P161]

3.3.8.162 Logic In 3 Configuration [P162]

3.3.8.163 Logic In 4 Configuration [P163]

3.3.8.164 Logic In Reserved Configuration [P164]

3.3.8.165 Logic In Reserved Configuration [P165]

3.3.8.166 Logic In Reserved Configuration [P166]

3.3.8.167 Logic In Reserved Configuration [P167]

3.3.8.168 CC In 1 Configuration [P168]

3.3.8.169 CC In 2 Configuration [P169]

3.3.8.170 Logic In Reserved Configuration [P170]

3.3.8.171 Logic In Reserved Configuration [P171]

The Logic In 1 – Logic In 4, CC In 1 and CC In 2 Configuration parameters provide a programmable input allowing for configuration of each input to provide different functions.

Logic In Configuration	Function
<DISABLED>	Changes on the input signal are ignored.
<ENABLE> Motion	Same as Commands [P010] bit 0.
<TRIGGER> Stop Operation	Same as Commands [P010] bit 1.
<TRIGGER> Production Operations	Same as Commands [P010] bit 2.
<TRIGGER> Fluidic Operations	Same as Commands [P010] bit 3.
<TRIGGER> Reference	Same as Commands [P010] bit 4.
<TRIGGER> Clear Fault	Same as Commands [P010] bit 5.
<TRIGGER> Clear Alert	Same as Commands [P010] bit 6.
<TRIGGER> Load	Same as Commands [P010] bit 7.
<CROSSOVER> Synchronous	Same as Commands [P010] bit 8.
<TRIGGER> Park Port	Same as Commands [P010] bit 9.
<TRIGGER> Unpark Port	Same as Commands [P010] bit 10.
<TRIGGER> Piston Unstick	Same as Commands [P010] bit 11.
<TRIGGER> Torque Test	Same as Commands [P010] bit 12.
<TRIGGER> Clear Required	Same as Commands [P010] bit 13.
<GATE> Production Operations	Same as Commands [P010] bit 14.
<GATE Fluidic Operations	Same as Commands [P010] bit 15.
<LOCK> Front Panel	An inactive signal on the input locks the front panel based on the Front Panel Lock configuration.

3.3.8.172 Logic In 1 Invert [P172]

3.3.8.173 Logic In 2 Invert [P173]

3.3.8.174 Logic In 3 Invert [P174]

3.3.8.175 Logic In 4 Invert [P175]

3.3.8.176 Logic In Reserved Invert [P176]

3.3.8.177 Logic In Reserved Invert [P177]

3.3.8.178 Logic In Reserved Invert [P178]

3.3.8.179 Logic In Reserved Invert [P179]

3.3.8.180 CC In 1 Invert [P180]

3.3.8.181 CC In 2 Invert [P181]

3.3.8.182 Logic In Reserved Invert [P182]

3.3.8.183 Logic In Reserved Invert [P183]

Logic In 1 – Logic In 4, CC In 1 and CC In 2 Invert parameters, when enabled, inverts the In input from active when voltage applied to active when voltage is not applied.

3.3.8.184 Logic In 1 Value [P184]

3.3.8.185 Logic In 2 Value [P185]

3.3.8.186 Logic In 3 Value [P186]

3.3.8.187 Logic In 4 Value [P187]

3.3.8.188 Logic In Reserved Value [P188]

3.3.8.189 Logic In Reserved Value [P189]

3.3.8.190 Logic In Reserved Value [P190]

3.3.8.191 Logic In Reserved Value [P191]

3.3.8.192 CC In 1 Value [P192]

3.3.8.193 CC In 2 Value [P193]

3.3.8.194 Logic In Reserved Value [P194]

3.3.8.195 Logic In Reserved Value [P195]

The Logic In 1 – Logic In 4, CC In 1 and CC In 2 value parameter indicates the present state of the corresponding input. This is useful for troubleshooting purposes.

3.3.8.196 Input Debounce [P196]

The Input Debounce parameter changes the amount of time an input signal needs to be active before being accepted. Longer debounce times filter out small signals but increase the response time to trigger commands.

3.3.8.197 I/O Test [P197]

The I/O Test parameter, when enabled, allows the Logic and Auxiliary outputs to be forced to specific values. This is useful for troubleshooting purposes.

NOTE

It is not recommended to enable I/O test mode when an operation is active as it will override the outputs.

3.3.8.198 Reserved [P198]

Reserved.

3.3.8.199 Reserved [P199]

Reserved.

3.3.8.200 Logic Out 1 Configuration [P200]

3.3.8.201 Logic Out 2 Configuration [P201]

3.3.8.202 Logic Out 3 Configuration [P202]

3.3.8.203 Logic Out 4 Configuration [P203]

3.3.8.204 Logic Out Reserved Configuration [P204]

3.3.8.205 Logic Out Reserved Configuration [P205]

3.3.8.206 Logic Out Reserved Configuration [P206]

3.3.8.207 Logic Out Reserved Configuration [P207]

3.3.8.208 Aux Out 1 Configuration [P208]

3.3.8.209 Aux Out 2 Configuration [P209]

3.3.8.210 Logic Out Reserved Configuration [P210]

3.3.8.211 Logic Out Reserved Configuration [P211]

The Logic Out 1 – Logic Out 4, Aux Out 1 and Aux Out 2 Configuration parameters provide a programmable output allowing for configuration of each output to provide a different function. The outputs conduct when active (i.e., true) and do not conduct when inactive (i.e., false).

Logic Out Configuration	Function
<DISABLED>	Output does not change state during operations.
<READY> Initialized	Same as Status Flag [P012] bit 0.
<READY> Configured	Same as Status Flag [P012] bit 1.
<STATUS> Fault	Same as Status Flag [P012] bit 2.
<STATUS> Alert	Same as Status Flag [P012] bit 3.
<STATUS> Motion Disabled	Same as Status Flag [P012] bit 4.
<STATUS> Reference Required	Same as Status Flag [P012] bit 5
<STATUS> Load Required	Same as Status Flag [P012] bit 6.
<STATUS> Port Required	Same as Status Flag [P012] bit 7.
<READY> Idle	Same as Status Flag [P012] bit 8.
<READY> Production	Same as Status Flag [P012] bit 9.
<READY> Fluidic Setup	Same as Status Flag [P012] bit 10.
<READY> Reference	Same as Status Flag [P012] bit 11.
<READY> Load	Same as Status Flag [P012] bit 12.
<READY> Park	Same as Status Flag [P012] bit 13.
<READY> Unpark	Same as Status Flag [P012] bit 14.
<STATUS> Operation Required	Same as Status Flag [P012] bit 15.
<BUSY> Any Operation	Same as Status Flag [P012] bit 16.
<BUSY> Production Operation	Same as Status Flag [P012] bit 17.
<BUSY> Fluidic Setup Operation	Same as Status Flag [P012] bit 18.
<BUSY> Reference Operation	Same as Status Flag [P012] bit 19.
<BUSY> Load Operation	Same as Status Flag [P012] bit 20.
<BUSY> Porting Operation	Same as Status Flag [P012] bit 21.
<BUSY> Park Operation	Same as Status Flag [P012] bit 22.

<BUSY> Autotrigger Active	Same as Status Flag [P012] bit 23.
<STATUS> Parked	Same as Status Flag [P012] bit 24.
<STATUS> Chamber Full	Same as Status Flag [P012] bit 25.
<SUCCESS> Pulse	Same as Status Flag [P012] bit 26.
<SUCCESS> Last	Same as Status Flag [P012] bit 27.
<BUSY> Dwell	Same as Status Flag Extended [P013] bit 0.
<BUSY> Discharge	Same as Status Flag Extended [P013] bit 1.
<BUSY> Intake	Same as Status Flag Extended [P013] bit 2.
<BUSY> Intake Piston	Same as Status Flag Extended [P013] bit 3.
<BUSY> Valve	Same as Status Flag Extended [P013] bit 4.
<BUSY> Drawback Dwell	Same as Status Flag Extended [P013] bit 5.
<BUSY> Drawback	Same as Status Flag Extended [P013] bit 6.
<BUSY> AP Prime	Same as Status Flag Extended [P013] bit 8.
<CROSSOVER> Synchronous	Same as Status Flag Extended [P013] bit 16.
<CROSSOVER> Waiting	Same as Status Flag Extended [P013] bit 17.

3.3.8.212 Logic Out 1 Invert [P212]

3.3.8.213 Logic Out 2 Invert [P213]

3.3.8.214 Logic Out 3 Invert [P214]

3.3.8.215 Logic Out 4 Invert [P215]

3.3.8.216 Logic Out Reserved Invert [P216]

3.3.8.217 Logic Out Reserved Invert [P217]

3.3.8.218 Logic Out Reserved Invert [P218]

3.3.8.219 Logic Out Reserved Invert [P219]

3.3.8.220 Aux Out 1 Invert [P220]

3.3.8.221 Aux Out 2 Invert [P221]

3.3.8.222 Logic Out Reserved Invert [P222]

3.3.8.223 Logic Out Reserved Invert [P223]

Logic Out 1 – Logic Out 4, Aux Out 1 and Aux Out 2 Invert parameters, when enabled, inverts the Output from conducting when active to not conducting when active.

3.3.8.224 Logic Out 1 Value [P224]

3.3.8.225 Logic Out 2 Value [P225]

3.3.8.226 Logic Out 3 Value [P226]

3.3.8.227 Logic Out 4 Value [P227]

3.3.8.228 Logic Out Reserved Value [P228]

3.3.8.229 Logic Out Reserved Value [P229]

3.3.8.230 Logic Out Reserved Value [P230]

3.3.8.231 Logic Out Reserved Value [P231]

3.3.8.232 Aux Out 1 Value [P232]

3.3.8.233 Aux Out 2 Value [P233]

3.3.8.234 Logic Out Reserved Value [P234]

3.3.8.235 Logic Out Reserved Value [P235]

When the I/O Test parameter is enabled, these parameters can be used to force the outputs to desired values.

3.3.8.236 Reserved [P236]

Reserved.

3.3.8.237 Reserved [P237]

Reserved.

3.3.8.238 Reserved [P238]

Reserved.

3.3.8.239 Reserved [P239]

Reserved.

3.3.8.240 Analog In Value [P240]

The Analog In Value parameter indicates the present measured value of the 4-20mA input.

3.3.8.241 Analog In Configuration [P241]

The Analog In Configuration parameter allows the 4-20mA Analog Input to be configured for different functions.

Analog In Configuration	Function
Disabled	The analog input is ignored.
Monitor	The analog input value is compared against the alarms if they are enabled.
Feeder Setpoint	The analog input value is used to control the Feeder Setpoint parameter when operating in Feeder mode. This in conjunction with the Min Discharge Rate and Max Discharge Rate determines the Feeder Discharge Rate.
Maintainer Setpoint	The analog input value is used to control the Maintainer Setpoint parameter when operating in Maintainer mode. This in conjunction with the Setpoint Min, Setpoint Max, Min Discharge Rate, and Max Discharge Rate determines the Maintainer Discharge Rate.
Calibrate Lo	The analog input value is used to determine the Calibration Lo parameter.
Calibrate Hi	The analog input value is used to determine the Calibration Hi parameter.

3.3.8.242 Alarm Low Configuration [P242]

The Alarm Low Config parameter provides an alarm function when the Analog In Value is less than or equal to the Alarm Low Limit.

Alarm Low Configuration	Function
Disabled	The alarm does not generate either a fault or alert.
Alert	An alert is generated if the Analog In Value is less than or equal to the Alarm Low Limit.
Fault	A fault is generated if the Analog In Value is less than or equal to the Alarm Low Limit.

3.3.8.243 Alarm Low Limit [P243]

The Alarm Low Limit parameter determines the point at which an Analog In Value causes the alarm to generate either an alert or fault.

3.3.8.244 Alarm High Configuration [P244]

The Alarm High Config parameter provides an alarm function when the Analog In Value is greater than or equal to the Alarm High Limit.

Alarm Low Configuration	Function
Disabled	The alarm does not generate either a fault or alert.
Alert	An alert is generated if the Analog In Value is greater than or equal to the Alarm Low Limit.
Fault	A fault is generated if the Analog In Value is greater than or equal to the Alarm Low Limit.

3.3.8.245 Alarm High Limit [P245]

The Alarm High Limit parameter determines the point at which an Analog In Value causes the alarm to generate either an alert or fault.

3.3.8.246 Alarm Delay [P246]

The Alarm Delay parameter determines how long the Analog In Value must exceed either limit before an alert or fault is generated.

3.3.8.247 Analog In Calibration Lo [P247]

The Analog In Calibration Lo parameter, along with the Analog In Calibration Hi parameter, is used to calibrate the Analog In Value using a two point slope and offset type of calibration.

3.3.8.248 Analog In Calibration Hi [P248]

The Analog In Calibration Hi parameter, along with the Analog In Calibration Lo parameter, is used to calibrate the Analog In Value using a two point slope and offset type of calibration.

3.3.8.249 Reserved [P249]

Reserved.

3.3.8.250 Analog Out Value [P250]

The Analog Out Value parameter indicates the present value of the 4-20mA Analog Output.

3.3.8.251 Analog Out Configuration [P251]

The Analog Out Configuration parameter allows the 4-20mA Analog Output to be configured for different functions.

Analog Out Configuration	Function
Disabled	The analog output is disabled.
Actual Rate	The analog output is proportional to the actual discharge rate of the pump.
Dispense Rate	The analog output is proportional to the configured Dispense Rate.
Feeder Rate	The analog output is proportional to the Feeder Rate parameter. This may be used to communicate the Feeder Rate from one Controller to another during Synchronous Feeder operations.
Maintain Setpoint	The analog output is proportional to the Maintainer Setpoint. This may be used to communicate the Maintainer Setpoint from one Controller to another during Synchronous Maintainer operations.
Dispense Volume	The analog output is proportional to the amount of fluid moved during Dispense operations.

Pump Location	The analog output is proportional to the location of the piston in the pump chamber.
Repeat Analog In	The analog output is equivalent to the value on the analog input.
Forced Value	The analog output is determined by the value in the Force Value parameter.
Calibrate Lo	The analog output is forced to 4.000mA for calibration measurements.
Calibrate Hi	The analog output is forced to 20.000mA for calibration measurements.

3.3.8.252 Force Value [P252]

The Force Value parameter provides the value for the analog output when configured to be a Forced Value.

3.3.8.253 Analog Out Calibration Lo [P253]

The Analog Out Calibration Lo parameter, along with the Analog Out Calibration Hi parameter, is used to calibrate the Analog Out Value using a two-point slope and offset type of calibration.

3.3.8.254 Analog Out Calibration Hi [P254]

The Analog Out Calibration Hi parameter, along with the Analog Out Calibration Lo parameter, is used to calibrate the Analog Out Value using a two-point slope and offset type of calibration.

3.3.8.255 Reserved [P255]

Reserved.

3.3.8.256 Liquid Eye Value [P256]

The Liquid Eye Value parameter indicates the present value measured on the liquid eye detector.

3.3.8.257 Liquid Eye Status [P257]

The Liquid Eye Status parameter indicates the present state of the Liquid Eye.

Liquid Eye Status	Description
Blank	Liquid Eye is disabled.
Air Detected	The Liquid Eye Value is below the Air Threshold.
Liquid Detected	The Liquid Eye Value is above the Liquid Threshold.
No Sensor	The Liquid Eye circuit detects a missing sensor.
Tuning Air	The Liquid Eye is configured to tune air.
Tuning Liquid	The Liquid Eye is configured to tune liquid.

3.3.8.258 Liquid Eye Configuration [P258]

The Liquid Eye Configuration parameter determines the present operating mode of the Liquid Eye detector.

Liquid Eye Configuration	Description
Disabled	Liquid Eye is disabled.
Tune Air	Allow the Controller to determine the air threshold. Place a tube with air in the detector to measure the Air Threshold.
Tune Liquid	Allow the Controller to determine the liquid threshold. Place a tube with liquid in the detector to measure the Liquid Threshold.
Status Liquid/Air	The Controller indicates whether the detector is detecting air or liquid but does not generate either an alert or fault.
Alert Air	Generate an alert when air is detected.
Fault Air	Generate a fault when air is detected.

3.3.8.259 Detection [P259]

The Detection parameter determines the length of time the Liquid Eye Value needs to exceed a Threshold to change state.

3.3.8.260 Liquid Threshold [P260]

The Liquid Threshold parameter determines the point at which the detection algorithm considers liquid in the tubing. This threshold is typically automatically tuned by placing the tubing with liquid in the detector and configuring the Liquid Eye for Tune liquid. This value may be manually modified to account for process variations.

3.3.8.261 Air Threshold [P261]

The Air Threshold parameter determines the point at which the detection algorithm considers air in the tubing. This threshold is typically automatically tuned by placing the tubing with air in the detector and configuring the Liquid Eye for Tune air. This value may be manually modified to account for process variations.

3.3.8.262 Source Intensity [P262]

The Source Intensity parameter determines the intensity of the source in the detector. The intensity may need to be increased for larger tubing and decreased for smaller tubing.

3.3.8.263 Source Offset [P263]

The Source Offset parameter determines the DC offset of the source in the detector. This is typically left at the default value.

3.4 INSTALLATION

General operating practices provide the best guidelines for locating the components of the system. The Controller Module should be located for ease of use during all phases of operation and maintenance.

3.5 OPTIONS

IVEK Corporation offers a variety of options to best meet the customers' needs. Following is a list and description of available options for the Controller Module. Refer to the Title Section of this manual for the list of options provided with this system.

3.5.1 EtherNet/IP Communication Module

The EtherNet/IP Communication Module provides both explicit and implicit communication of parameters between the Controller Module and an external device (typically a PLC). Appendix A contains additional information. Also, IVEK's Application Note AN-101 describes how to setup the Controller Module for use with a typical Rockwell PLC and software.

The Communication Module contains an HTTP server to deliver web pages to a web browser for accessing the parameters. The web pages may be accessed using most modern web browsers. The home page may be accessed by typing in the IP address of the Controller Module. The Communication Module also contains an FTP server that is used to upgrade the firmware of the Controller Module.

3.5.2 PROFINET Communication Module

The PROFINET communication interface provides both cyclic and acyclic communication of parameters between the Controller Module and an external device (typically a PLC). Appendix A contains additional information. Also, IVEK's Application Note AN-101 describes how to setup the Controller Module for use with a typical Siemens PLC and software.

The Communication Module contains an HTTP server to deliver web pages to a web browser for accessing the parameters. The web pages may be accessed using most modern web browsers. The home page may be accessed by typing in the IP address of the Controller Module. The Communication Module also contains an FTP server that is used to upgrade the firmware of the Controller Module.

The Communication Module provides the following PROFINET features: 100Mbps full duplex with auto negotiation, Diagnostic support, Conformance Class B (RT & SNMP), 250us cycle time, Media Redundancy Protocol (MRP) Identification & Maintenance (I&M) including I&M5, Address Conflict Detection (ACD).

3.5.3 EtherCAT Communication Module

The EtherCAT communication interface provides both explicit and implicit communication of parameters between the Controller Module and an external device (typically a PLC). Appendix A contains additional information. Also, IVEK's Application Note AN-101 describes how to setup the Controller Module for use with a typical Beckhoff PLC and software.

The Communication Module contains an HTTP server to deliver web pages to a web browser for accessing the parameters. The web pages may be accessed using most modern web browsers. The home page may be accessed by typing in the IP address of the Controller Module. The Communication Module also contains an FTP server that is used to upgrade the firmware of the Controller Module. In order to access the HTTP server and FTP server, the Ethernet over EtherCAT (EoE) needs to be enabled and the device needs to be placed into either the Pre-Op, Safe-Op, or Op state.

3.5.4 Web Pages (for Controller Modules containing EtherNet/IP or EtherCAT)

By default, DHCP is enabled in the Controller Module. DHCP may be disabled, and a static IP address may be assigned using an IP Configuration tool that is compliant with the HICP protocol (IP Config tool is available on IVEK's website www.ivek.com). Alternatively, the DHCP setting and IP address may be changed using the Network Configuration page. There are six menu headers on the home page for selecting each of the thirteen pages. Clicking on the menu header will go directly to the page if there is only one option or will show a drop-down list if there is more than one option for that header. Click on the appropriate header then the drop-down item, if required, to load the desired page. The six headers (ALL CAPS) and thirteen pages (Initial Caps) are as follows:

INFORMATION	**SETUP**	**OPERATE**	**STATISTICS**	**NETWORK**	**HELP**
Information	Production	Operate	Statistics	Status	Manual
	Fluidic			Configuration	Units & Decimal Points
	Pump			CPU	Contact us
	System				

Parameters that may be changed have a "Set" button in the table – only one Parameter may be changed at a time. A Refresh button in the table header allows the Parameter values to be updated from the Controller Module (Parameter values are a snapshot of values taken when the page loads or the refresh button is activated).

There are different types of data entry fields for the Parameter values based on the Parameter type. The possible data entry field types include: Decimal, Hexadecimal, Enumeration (drop-down list), Binary (check box), and Text. Be careful to observe the data type format when entering in new Parameter values. Also, when entering new Parameter values, ensure that the new value is within the range of the Parameter.

The following pages simply show Parameters that are categorized together: Information, Production, Fluidic, Pump, System, Operate, Statistics. Each of these pages contains a table with the ID (#), Name, and Value of each Parameter contained within the group.

3.5.4.1 Information Page (Figure 3.11)

The Information Page contains the Information Parameters. See Appendix A for additional information.

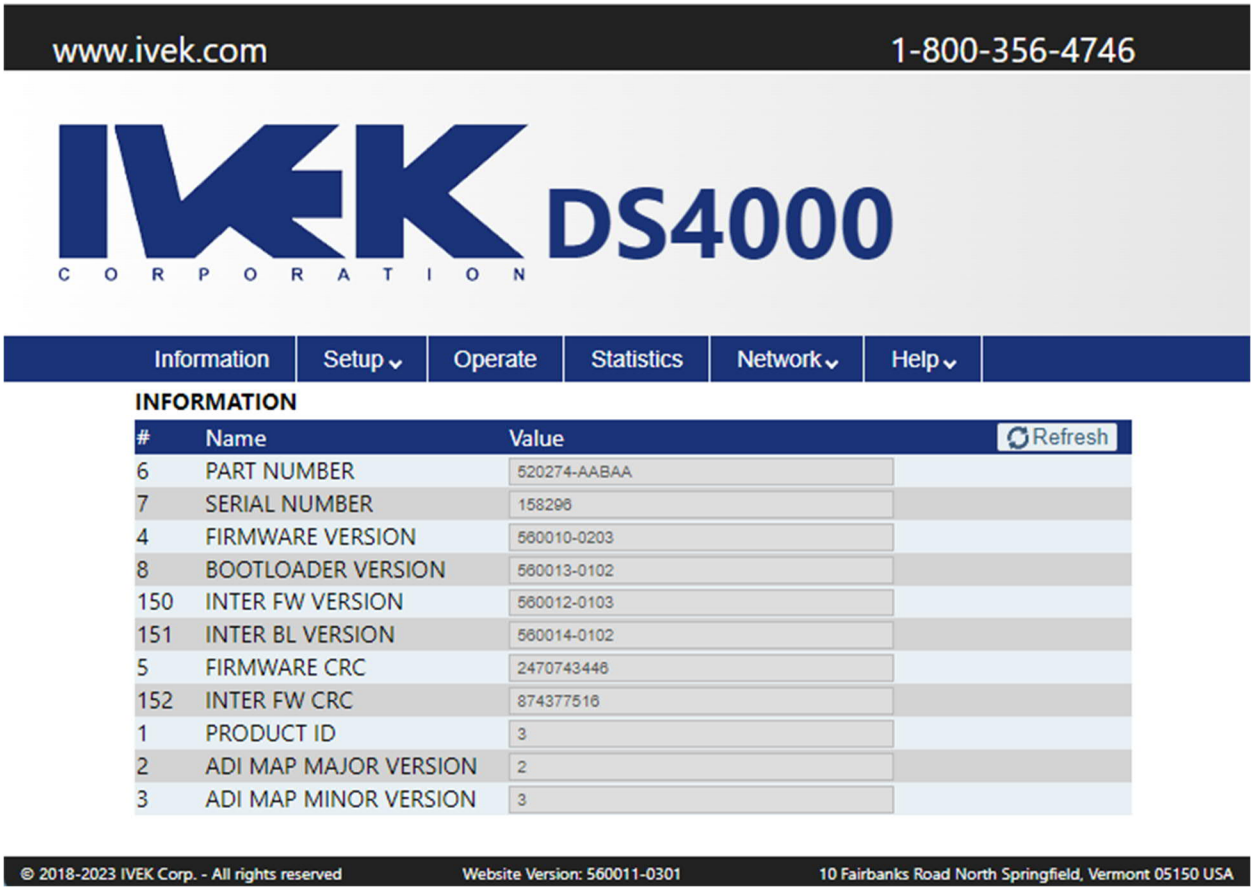


Figure 3.11 – Information Page

3.5.4.2 Setup->Production Page (Figure 3.12)

The Production page contains the production parameters. See Appendix A for additional information.

Figure 3.12 – Production Page

3.5.4.3 Setup-> Fluidic Page (Figure 3.13)

The Fluidic page contains the Fluidic parameters in preparation for Fluidic operations. See Appendix A for additional information.

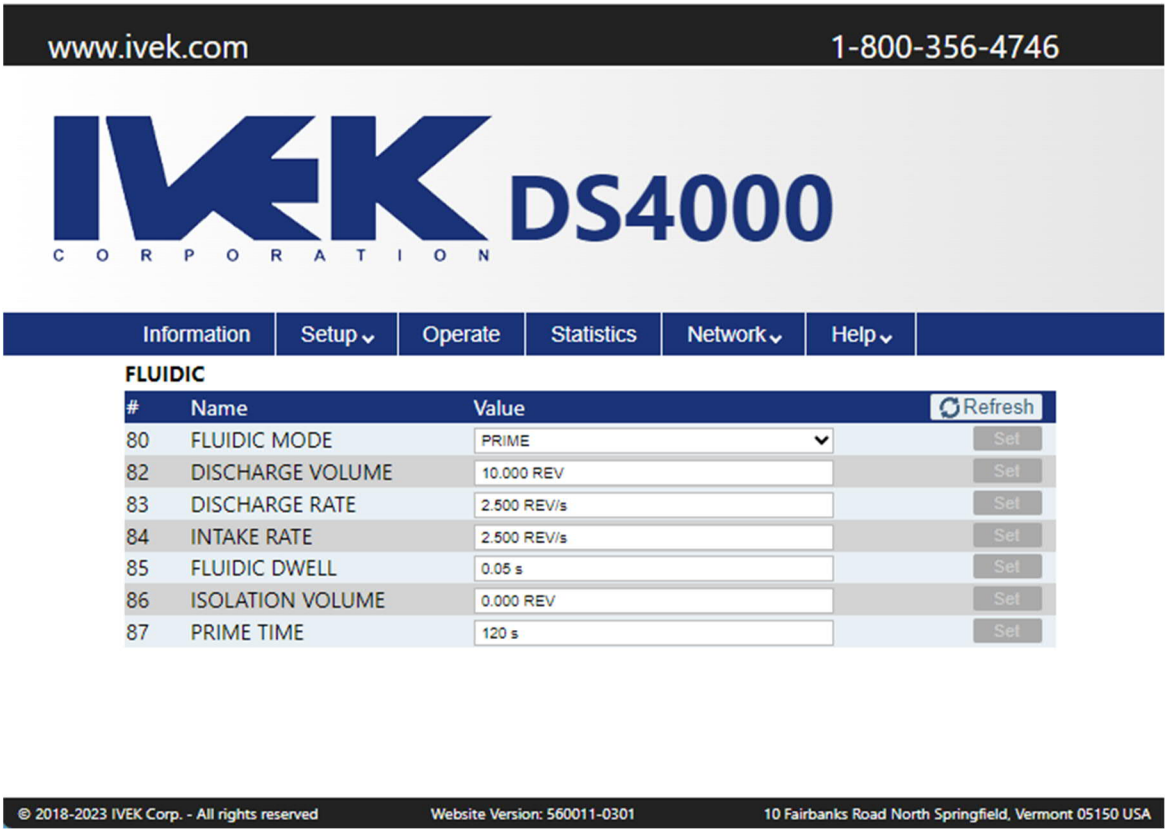


Figure 3.13 – Fluidic Page

3.5.4.4 Setup->Pump Page (Figure 3.14)

The Pump Page contains the Pump parameters. See Appendix A for additional information.

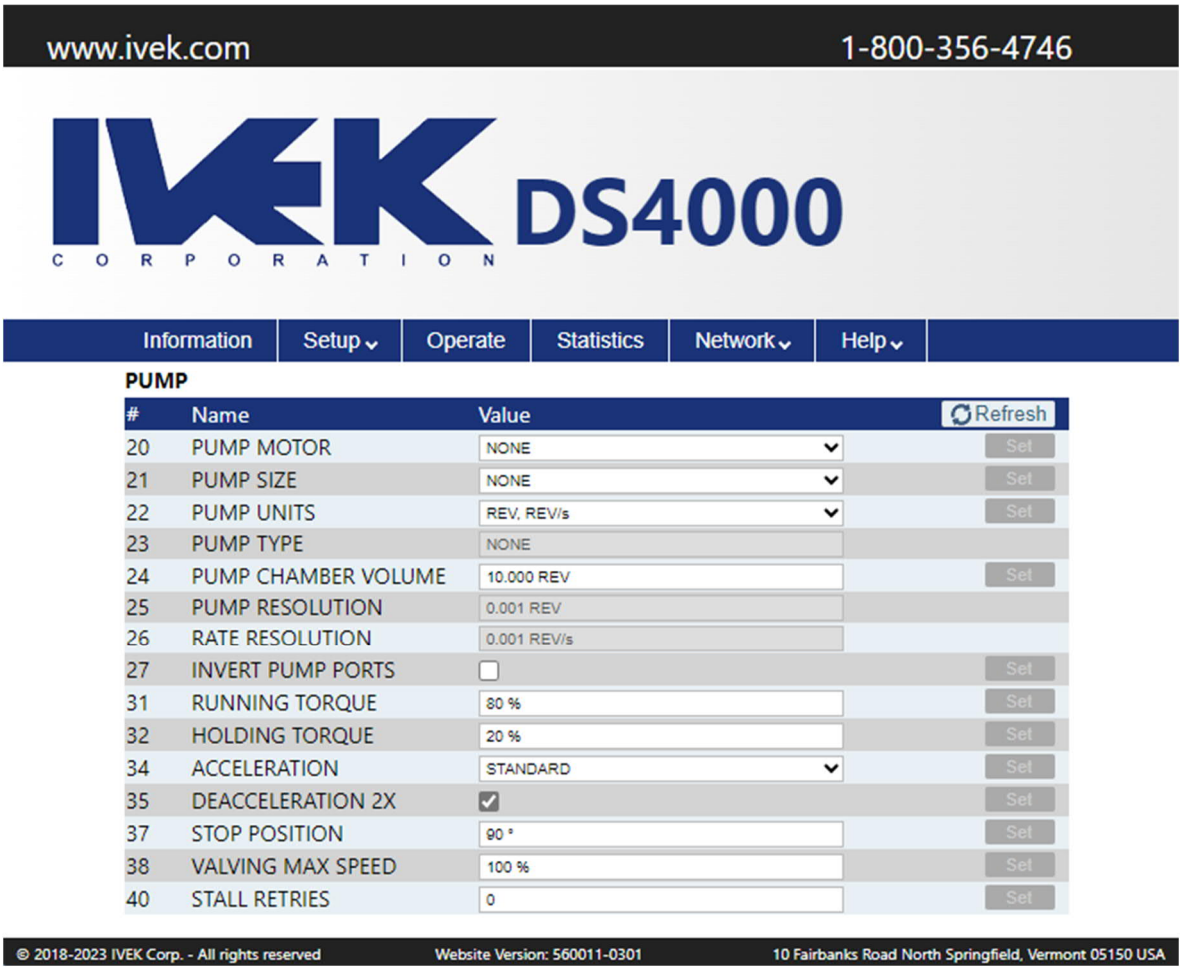
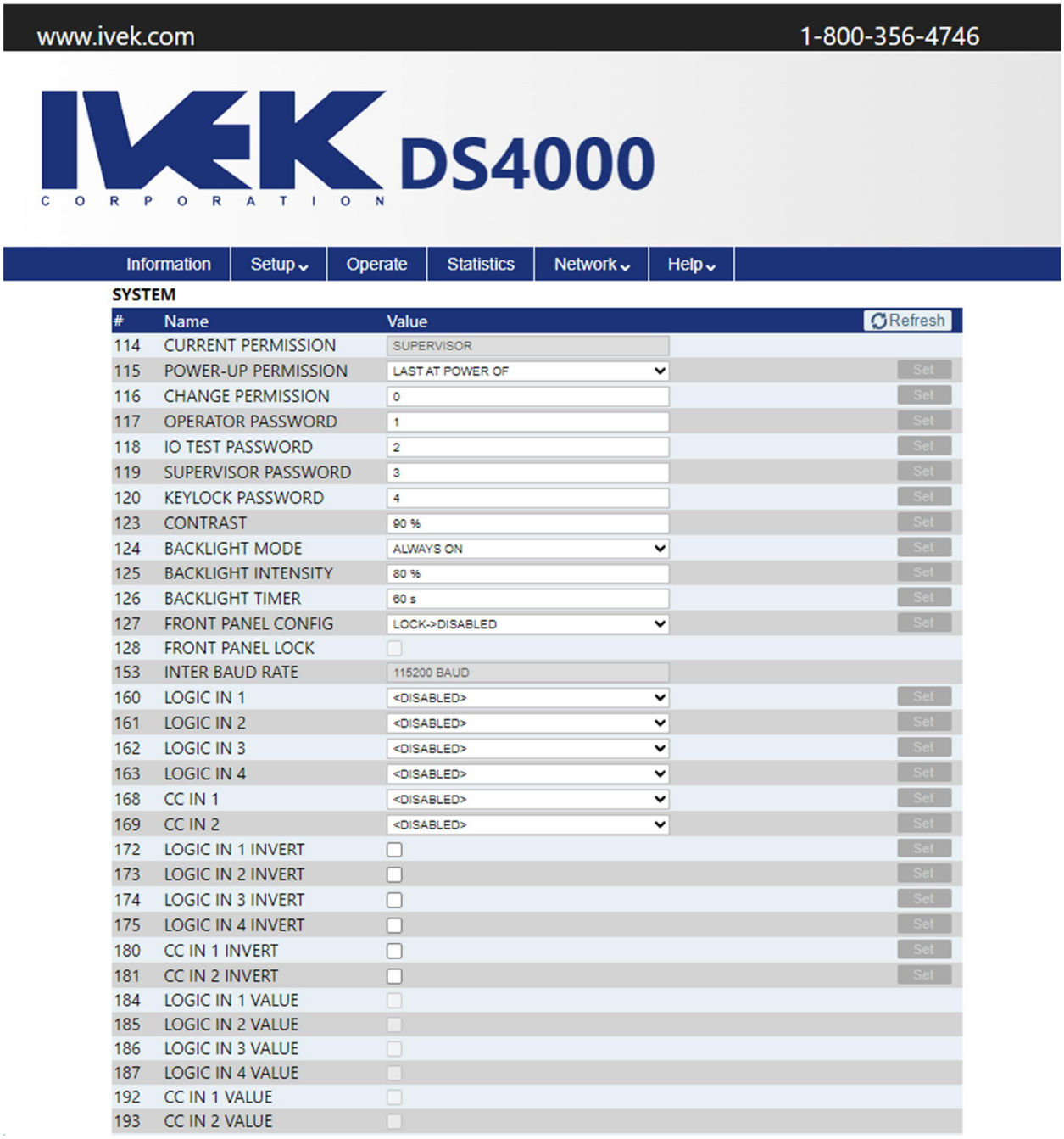


Figure 3.14 Pump Page

3.5.4.5 Setup->System Page (Figure 3.15)

The System Page contains the System parameters. See Appendix A for additional information.



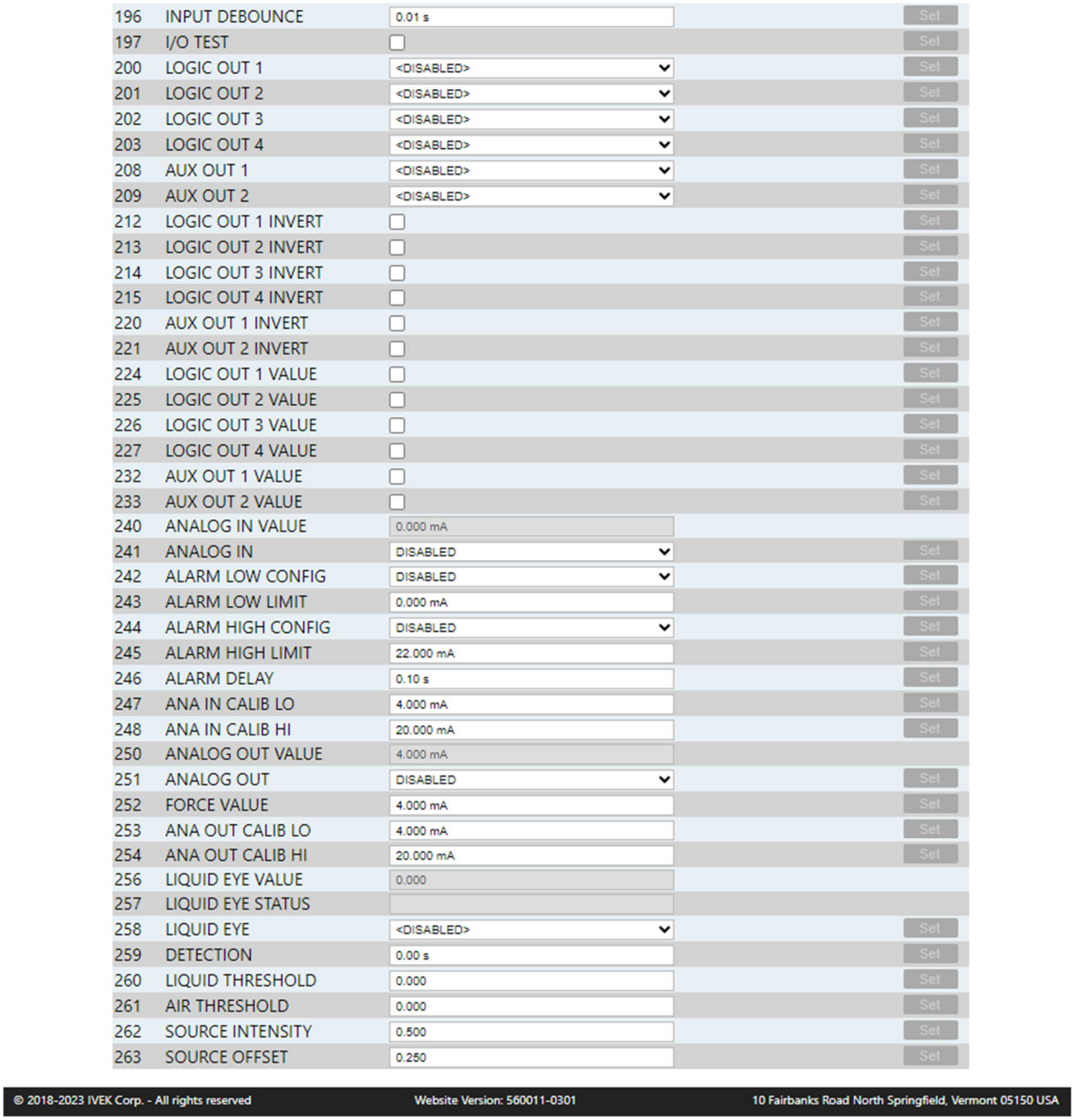


Figure 3.15 System Page

3.5.4.6 Operate Page (Figure 3.16)

The Operate Page contains the Operate parameters. See Appendix A for additional information.

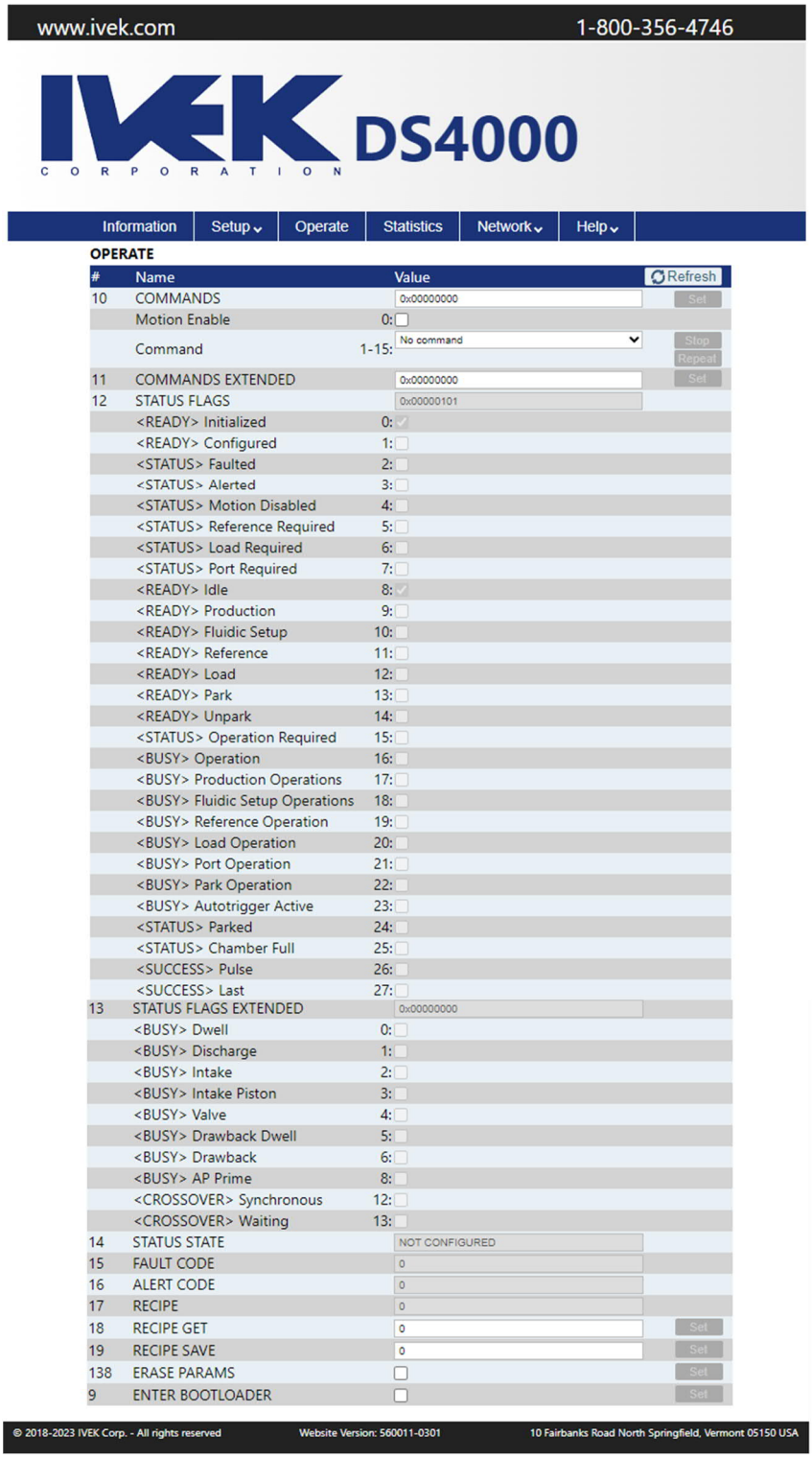


Figure 3.16 Operate Page

3.5.4.7 Statistics Page (Figure 3.17)

The Statistics Screen displays a variety of useful information pertaining to the operation of the system.

Figure 3.17 Statistics Page

3.5.4.8 Network->Status Page (Figure 3.18)

The Network Status Screen displays the Current IP Settings, Current Ethernet Status, Interface Counters, Media Counters and Ethernet IP statistics.

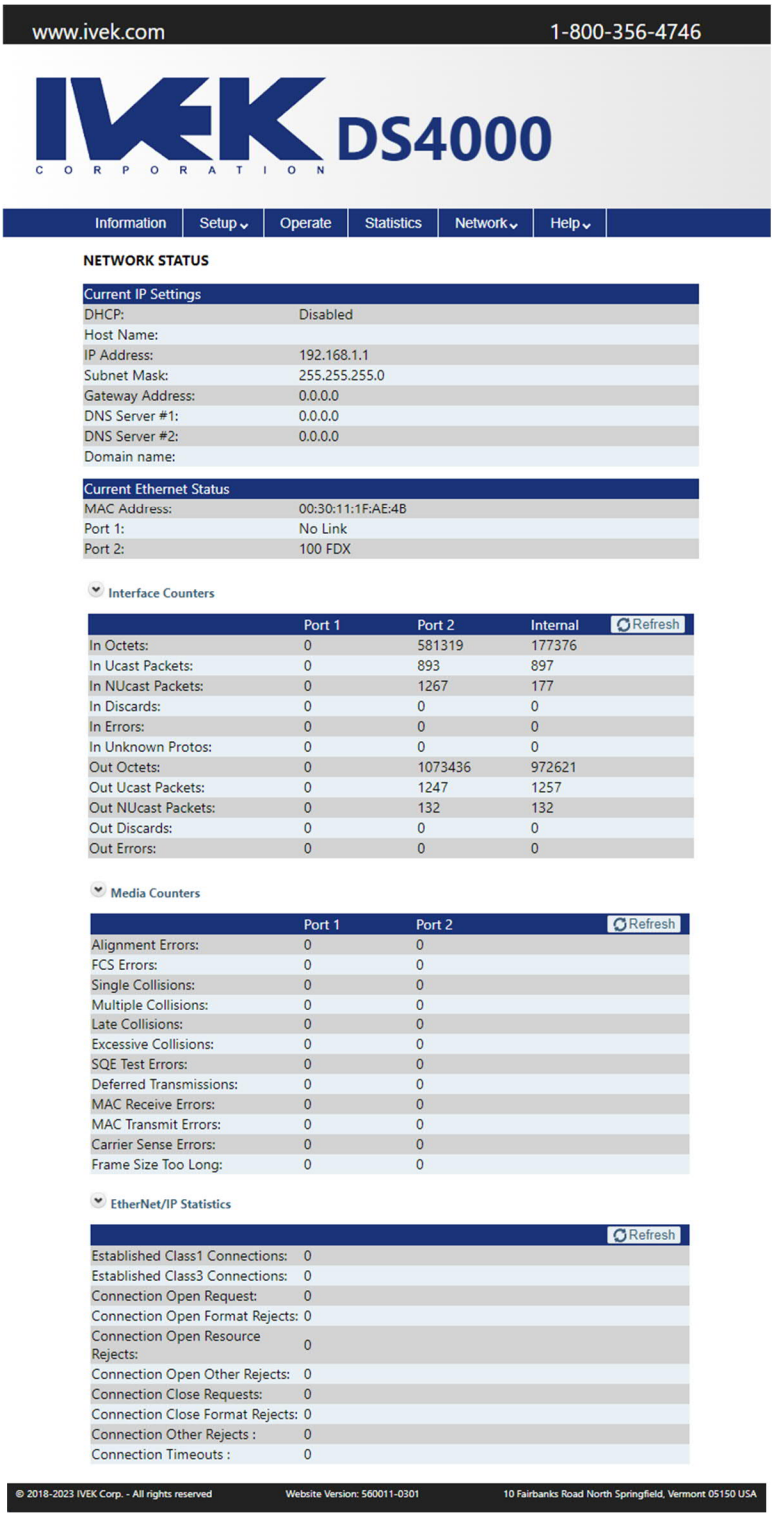


Figure 3.18 Network Status

3.5.4.9 Network->Configuration Page (Figure 3.19)

The Network Configuration Screen contains the network settings including the IP Configuration and Ethernet Configuration.

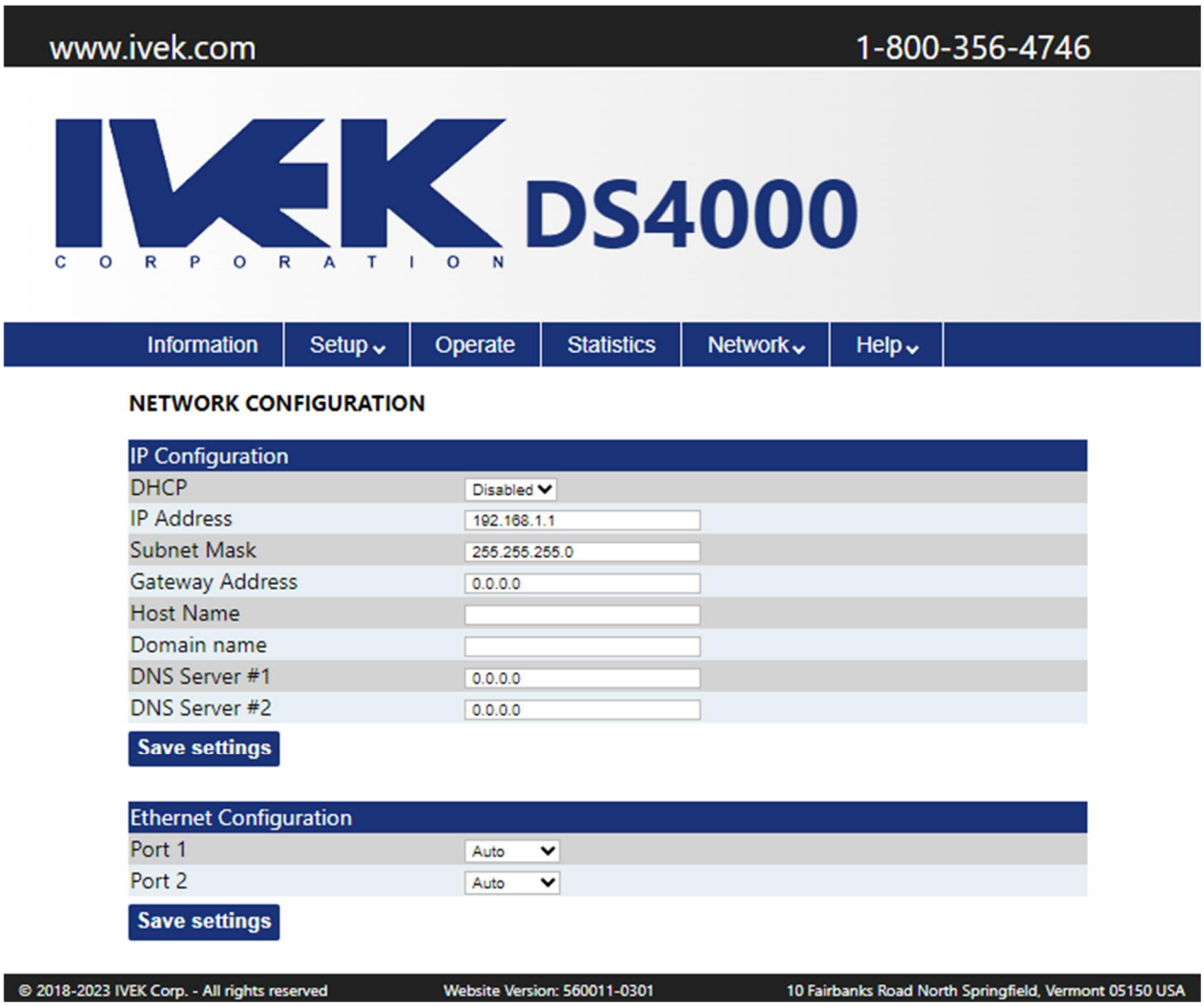


Figure 3.19 Configuration Page

3.5.4.10 Network->CPU Page (Figure 3.20)

The Network CPU page contains information about the fieldbus module CPU.

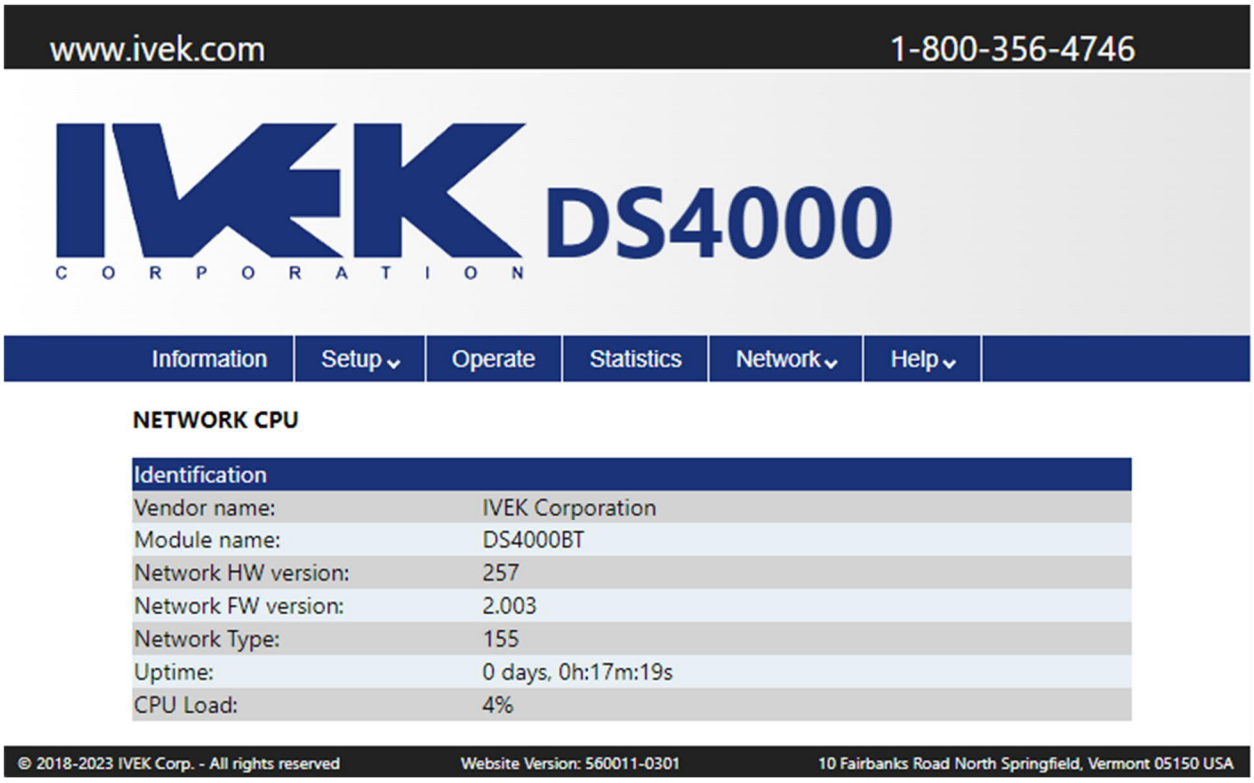


Figure 3.20 Network CPU Page

3.5.4.11 Help->Manual Page (Figure 3.21)

The Manual page provides information on how to access the User Manual and the Electronic Data Sheet (EDS) for the EtherNet/IP module and the EtherCAT Slave Information (ESI) for the EtherCAT module.

Figure 3.21 Manual Page

3.5.4.12 Help->Units & Decimal Points Page (Figure 3.22)

The Units & Decimal Points page contains information about the units and decimal points, especially for volume and fluidic rate parameters.

Figure 3.22 Units & Decimal Points Page

3.5.4.13 Help->Backup/Restore DS4000 Page (Figure 3.23)

The Backup/Restore DS4000 page contains a way to backup and restore parameters. It is possible to copy parameters and recipes from one DS4000 to another. Please see AN-109.

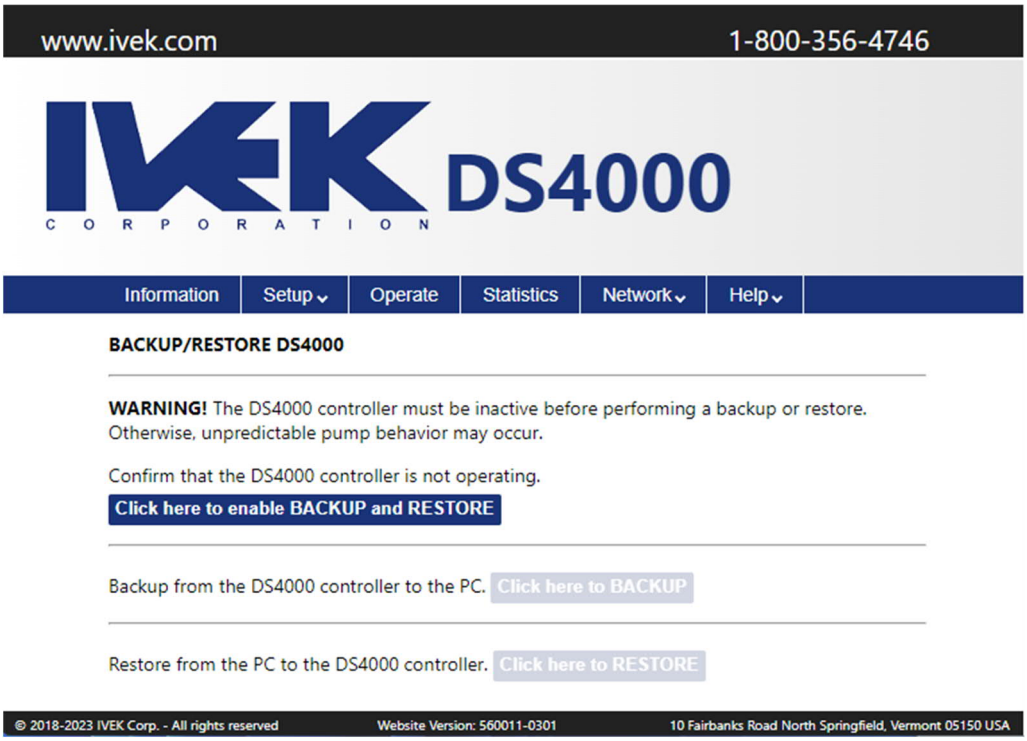


Figure 3.23 – Help->Backup/Restore DS4000 Page

3.5.4.14 Contact Us

The Contact Us page contains IVEK's address, phone numbers and e-mail address.

Figure 3.24 Contact Us Page

3.5.5 RS-232 and USB Interfaces

The RS-232 serial interface provides control of all functions available, with electrical isolation between the RS-232 input signals and the Logic I/O signals (not isolated from internal electronics). The hardware is configured as RS-232 Data Terminal Equipment (DTE) standard, using a 9-pin DSUB male connector with the pin configuration shown in Table 3.2. Connecting to other DTE equipment, such as a computer, requires a crossover (null modem) cable. No hardware signals are currently used for handshaking.

Pin	Signal	Direction
1	NC	Not connected
2	RD	To Controller Module
3	TD	From Controller Module
4	NC	Not connected
5	COM	Common
6	NC	Not connected
7	RTS	From controller module
8	NC	Not connected
9	NC	Not connected

Table 3.2 - RS-232 Connections

The USB is an alternate for the RS-232 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 parameters of the communications interface are as follows:

- 9600, 19200, 57600, 115200, 230400 BAUD (Configurable using the System 1 screen)
- 8 BIT
- NO PARITY
- ONE STOP BIT
- After 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.

3.5.5.1 Command Structure

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

Commands are not directly echoed as they are received. The terminal being utilized to send commands should be setup for local echo of sent characters.

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

The complete command form is:

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

<cmd> Command

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.

Example:

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.

3.5.5.2 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 response form is:

<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.

Example:

p1,100,0<CR> Command p1 (valving speed) has a setting of 100% and no faults or warnings.

3.5.5.3 Command Set

The command set controls the overall settings of the system. Most commands allow reading/writing of parameters. Parameters that may be modified via RS232 are listed in Appendix A along with their corresponding commands. Table 3.3 list the commands.

NOTE

Refer to previous description for complete command syntax (“COMMAND STRUCTURE”).
<value3> has been omitted from the response in this table but will either be a 0 if no faults or warnings exist or will provide the fault or warning number.

Command	Response	Description
a => Autoload		
a0[,<value2>]	a0,<value2>	Read/write the Load Mode parameter [P058].
a1[,<value2>]	a1,<value2>	Read/write the Chamber Mode parameter [P061].
a2[,<value2>]	a2,<value2>	Read/write the Autotrigger Mode parameter [P067].
a3[,<value2>]	a3,<value2>	Read/write the Autotrigger Count parameter [P069].
b => BEGIN		
b or b0	b0,<value2>	Start a Production Mode operation [P010, bit 2].
b1	b1,<value2>	Start a Fluidic Setup Mode operation [P010, bit 3].
c => CLEAR FAULT		
c or c0	c0,<value2>	Clear the present Fault [P010, bit 5].
c1	c1,<value2>	Clear the present Alert [P010, bit 6].
c2	c2,<value2>	Start the next required operation (clear fault, reference, load) [P010, bit 13].
e => END		
e or e0	e0,<value2>	Stop the current pumping operation [P010, bit 1]. In Prime mode, will continue until piston has reached the stop position. In Agitate mode, will continue until fluid is back at starting position.
f => REFERENCE		
f or f0	f0,<value2>	Start a Reference operation [P010, bit 4].
f1	f1,<value2>	Start a Reference operation, piston unstick [P010, bit 11].
f2	f2,<value2>	Start a Reference operation, torque test [P010, bit 12].
g => TOTALIZER		
g0	g0,<value2>	Reads the Total Production Volume [P090].
g0,0	g0,0	Clears the Total Production Volume to 0.
g1	g1,<value2>	Reads the Total Production Cycles [P095].
g1,0	g1,0	Clears the Total Production Cycles to 0.
g2	g2,<value2>	Reads the Last Fluidic Volume [P094].
g2,0	g2,0	Clears the Last Fluidic Volume to 0.
g3	g3,<value2>	Reads the Last Production Volume [P091].
g3,0	g3,0	Clears the Last Production Volume to 0.
g4	g4,<value2>	Reads the Total Fluidic Cycles [P096].
g4,0	g4,0	Clears the Total Fluidic Cycles to 0.
g5	g5,<value2>	Reads the Total Reference Cycles [P097].
g6	g6,<value2>	Reads the Total Load Cycles [P098].
g6,0	g6,0	Clears the Total Load Cycles to 0.
g7	g7,<value2>	Reads the Total Clutch Cycles [P099].
g8	g8,<value2>	Reads the Total Brake Cycles [P100].
g9	g9,<value2>	Reads the Fault Count [P108].
g10	g10,<value2>	Reads the Alert Count [P109].
h => HARDWIRED READY SIGNAL OPERATION		
h2,<value2>	h2,<value2>	Read/write the Front Panel HMI Contrast parameter [P123].
h6,<value2>	h6,<value2>	Read/write the Front Panel HMI Backlight Mode parameter [P124].
h7,<value2>	h7,<value2>	Read/write the Front Panel HMI Backlight Intensity parameter [P125].
h8,<value2>	h8,<value2>	Read/write the Front Panel HMI Backlight Timer parameter [P126].
h9,<value2>	h9,<value2>	Read/write the CC/Logic Input Debounce parameter [P96].
h10,<value2>	h10,<value2>	Read/write the CC In 1 Configuration parameter [P168].
h11,<value2>	h11,<value2>	Read/write the Logic In 1 Configuration parameter [P160].
h12,<value2>	h12,<value2>	Read/write the Logic In 2 Configuration parameter [P161].
h13,<value2>	h13,<value2>	Read/write the Logic In 3 Configuration parameter [P162].
h14,<value2>	h14,<value2>	Read/write the Logic In 4 Configuration parameter [P163].
h19,<value2>	h19,<value2>	Read/write the CC In 2 Configuration parameter [P169].

h20,<value2>	h20,<value2>	Read/write the Aux Out 1 Configuration parameter [P208].
h21,<value2>	h21,<value2>	Read/write the Logic Out 1 Configuration parameter [P200].
h22,<value2>	h22,<value2>	Read/write the Logic Out 2 Configuration parameter [P201].
h23,<value2>	h23,<value2>	Read/write the Logic Out 3 Configuration parameter [P202].
h24,<value2>	h24,<value2>	Read/write the Logic Out 4 Configuration parameter [P203].
h29,<value2>	h29,<value2>	Read/write the Aux Out 2 Configuration parameter [P209].
h30,<value2>	h30,<value2>	Read/write the CC In 1 Invert parameter [P180].
h31,<value2>	h31,<value2>	Read/write the Logic In 1 Invert parameter [P172].
h32,<value2>	h32,<value2>	Read/write the Logic In 2 Invert parameter [P173].
h33,<value2>	h33,<value2>	Read/write the Logic In 3 Invert parameter [P174].
h34,<value2>	h34,<value2>	Read/write the Logic In 4 Invert parameter [P175].
h39,<value2>	h39,<value2>	Read/write the CC In 2 Invert parameter [P181].
h40,<value2>	h40,<value2>	Read/write the Aux Out 1 Invert parameter [P220].
h41,<value2>	h41,<value2>	Read/write the Logic Out 1 Invert parameter [P212].
h42,<value2>	h42,<value2>	Read/write the Logic Out 2 Invert parameter [P213].
h43,<value2>	h43,<value2>	Read/write the Logic Out 3 Invert parameter [P214].
h44,<value2>	h44,<value2>	Read/write the Logic Out 4 Invert parameter [P215].
h49,<value2>	h49,<value2>	Read/write the Aux Out 2 Invert parameter [P221].
h50	h50,<value2>	Read the present CC In 1 value [P192].
h51	h51,<value2>	Read the present Logic In 1 value [P184].
h52	h52,<value2>	Read the present Logic In 2 value [P185.
h53	h53,<value2>	Read the present Logic In 3 value [P186].
h54	h54,<value2>	Read the present Logic In 4 value [P187].
h59	h59,<value2>	Read the present CC In 2 value [P193].
h60,<value2>	h60,<value2>	Read/write the Aux Out 1 Value parameter [P232].
h61,<value2>	h61,<value2>	Read/write the Logic Out 1 Value parameter [P224].
h62,<value2>	h62,<value2>	Read/write the Logic Out 2 parameter [P225].
h63,<value2>	h63,<value2>	Read/write the Logic Out 3 parameter [P226].
h64,<value2>	h64,<value2>	Read/write the Logic Out 4 parameter [P227].
h69,<value2>	h69,<value2>	Read/write the Aux Out 2 Value parameter [P233].
h70	h70,<value2>	Read the present Analog In 1 value [P240].
h71,<value2>	h71,<value2>	Read/write the Analog In Configuration parameter [P241].
h72,<value2>	h72,<value2>	Read/write the Analog In Alarm Low Configuration parameter [P242].
h73,<value2>	h73,<value2>	Read/write the Analog In Alarm Low Limit parameter [P243].
h74,<value2>	h74,<value2>	Read/write the Analog In Alarm High Configuration parameter [P244].
h75,<value2>	h75,<value2>	Read/write the Analog In Alarm High Limit parameter [P245].
h76,<value2>	h76,<value2>	Read/write the Analog In Alarm Delay parameter [P246].
h77,<value2>	h77,<value2>	Read/write the Analog In Calibration Lo parameter [P247].
h78,<value2>	h78,<value2>	Read/write the Analog In Calibration Hi parameter [P248].
h80	h80,<value2>	Read the present Analog Out value [P250].
h81,<value2>	h81,<value2>	Read/write the Analog Out Configuration parameter [P251].
h82,<value2>	h82,<value2>	Read/write the Analog Out Force Value parameter [P252].
h83,<value2>	h83,<value2>	Read/write the Analog In Calibration Lo parameter [P253].
h84,<value2>	h84,<value2>	Read/write the Analog In Calibration Hi parameter [P254].
h90	h90,<value2>	Read the present Liquid Eye value [P256].
h91	h91,<value2>	Read the present Liquid Eye status [P257].
h92,<value2>	h92,<value2>	Read/write the Liquid Eye Configuration parameter [P258].
h93,<value2>	h93,<value2>	Read/write the Liquid Eye Detection parameter [P259].
h94,<value2>	h94,<value2>	Read/write the Liquid Eye Liquid Threshold parameter [P260].
h95,<value2>	h95,<value2>	Read/write the Liquid Eye Air Threshold parameter [P261].
h96,<value2>	h95,<value2>	Read/write the Liquid Eye Source Intensity parameter [P262].
h97,<value2>	h95,<value2>	Read/write the Liquid Eye Source Offset parameter [P263].
h101,<value2>	h101,<value2>	Read/write the I/O Test Enable parameter [P197].

k => KEYLOCK

k or k0	k0,<value2>	Read the current Enable Motion setting [P010, bit0].
k0,<value2>	k0,<value2>	Write the Enable Motion setting.
k1,<value2>	k1,<value2>	Read/write the Front Panel Lock Configuration parameter [P127].
k2,	k2,<value2>	Read the present Permission Level [P114].
K2,<value2>	k2,<value2>	Write the password of the desired permission level to change the permission [P116].
k3,<value2>	k3,<value2>	Read/write the Power-up Permission Level parameter [P115].
k4,	k4,<value2>	Read the present Front Panel Lock status [P128].
k5,<value2>	k5,<value2>	Read/write the Operator Password [P117].
k6,<value2>	k6,<value2>	Read/write the I/O Test Password [P118].
k7,<value2>	k7,<value2>	Read/write the Supervisor Password [P119].
k8,<value2>	k8,<value2>	Read/write the Keylock Password [P120].

l => LOAD

l or l0	l0,<value2>	Start a Load operation [P010, bit 7].
l1	l1,<value2>	Trigger the Crossover Synchronous signal [P010, bit 8].

m => MODE

m0[,<value2>]	m0,<value2>	Read/write the Production Mode parameter [P050].
m1[,<value2>]	m1,<value2>	Read/write the Fluidic Mode parameter [P080].

n => RECIPE

n or n0	n0,<value2>	Reads the present recipe number [P017].
n0,<value2>	n0,<value2>	Load the parameters from the recipe stored in non-volatile memory [P018].
n98,<value2>	n98,<value2>	Saves the present parameter values to the recipe in non-volatile memory, but only if the location does not already contain a valid recipe [P019].
n99,<value2>	n99,<value2>	Saves the present parameter values to the recipe in non-volatile memory regardless of whether the location already contains a valid recipe [P019].

p => PORT

p0[,<value2>]	p0,<value2>	Read/write the Invert Pump Ports [P027].
p1[,<value2>]	p1,<value2>	Read/write the Valving Max Speed parameter [P038].
p3[,<value2>]	p3,<value2>	Parks/unparks the Port. <value2>: 0 = unpark port [P010, bit 10] 1 = park port [P010, bit 9]
p4[,<value2>]	p4,<value2>	Read/write the Valving Start Speed parameter [P039].

q => READY/BUSY

q or q0	q0,<value2>	Read the present status state [P014].
q1	q1,<value2>	Read the present status flags [P012].
q2	q2,<value2>	Read the present extended status flags [P013].

r => RATES

r0[,<value2>]	r0,<value2>	Read/write the Production Mode Dispense Rate parameter [P053].
r1[,<value2>]	r1,<value2>	Read/write the Fluidic Mode Discharge Rate parameter [P083].
r2[,<value2>]	r2,<value2>	Read/write the Production Mode Load Rate parameter [P054].
r3[,<value2>]	r3,<value2>	Read/write the Fluidic Mode Intake Rate parameter [P084].
r4[,<value2>]	r4,<value2>	Read/write the Setpoint Min parameter [P070].
r5[,<value2>]	r5,<value2>	Read/write the Setpoint Max parameter [P071].
r6[,<value2>]	r6,<value2>	Read/write the Maintainer Setpoint parameter [P072].
r7	r7,<value2>	Read the Feeder Setpoint parameter [P073].
r8[,<value2>]	r8,<value2>	Read/write the Feeder Rate parameter [P074].
r9	r9,<value2>	Read the present Actual Rate [P075].
r10[,<value2>]	r10,<value2>	Read/write the Feeder/Maintainer mode Min Discharge Rate parameter [P077].
r11[,<value2>]	r11,<value2>	Read/write the Feeder/Maintainer mode Max Discharge Rate parameter [P078].

s => STATUS

s0	s0,<value2>	Read the Volume Remaining in the pump chamber [P093].
s2	s2,<value2>	Read the Last Stall Count [P102].
s3	s3,<value2>	Dump parameters, multiple line response.
s4	s4,<value2>	Dump status, multiple line response.
s5	s5,<value2>	Read the present Pump Position [P092].
s6	s6,<value2>	Read the Pump Chamber Volume [P?].
s8	s8,<value2>	Read the present Fault Code [P015].
s9	s9,<value2>	Read the present Alert Code [P016].
s10	s10,<value2>	Read the present Assert SW Count [P110].
s11	s11,<value2>	Read the Assert SW Code [P111].
s12	s12,<value2>	Read the present Assert HW Count [P112].
s13	s13,<value2>	Read the Assert HW Code [P113].
s14	s14,<value2>	Read the Serial Number of the controller [P007].
s15	s15,<value2>	Dump the parameters that are part of recipes.
s16	s16,<value2>	Dump the parameters that are no part of recipes.
s17	s17,<value2>	Read the present Part Number as a number [P006]
s30	s30,<value2>	Read the present Driver Overtemperature Warning [P129].
s31	s31,<value2>	Read the present Heatsink Temperature measurement [P105].
s32	s32,<value2>	Read the present Ambient Temperature measurement [P106].
s33	s33,<value2>	Read the present Processor Temperature measurement [P107].
s40	s40,<value2>	Read the present DC Bus Voltage measurement [P103].
s41	s41,<value2>	Read the present Solenoid Bus Voltage measurement [P104].
s42	s42,<value2>	Read the present Interface Communication Errors [P154].
s43	s43,<value2>	Read the present Interface Communication Status [P155].
s101	s101,<value2>	Read the present Sensor Hysteresis measurement [P101].

t => DWELL

t0[,<value2>]	t0,<value2>	Read/write the Prime Time parameter [P087].
t2[,<value2>]	t2,<value2>	Read/write the Pre-op Dwell parameter [P065].
t3[,<value2>]	t3,<value2>	Read/write the Post-op Dwell parameter [P066].
t4[,<value2>]	t4,<value2>	Read/write the Autotrigger Dwell parameter [P068].
t5[,<value2>]	t5,<value2>	Read/write the Fluidic Dwell parameter [P085].

u => UNITS

u0[,<value2>]	u0,<value2>	Read/write the Pump Units parameter [P022].

v => VOLUMES

v0[,<value2>]	v0,<value2>	Read/write the Production Mode Dispense Volume parameter [P052].
v1[,<value2>]	v1,<value2>	Read/write the Fluidic Mode Discharge Volume parameter [P082].
v2[,<value2>]	v2,<value2>	Read/write the Load Threshold parameter [P059].
v3[,<value2>]	v3,<value2>	Read/write the Isolation Volume parameter [P086].
v4[,<value2>]	v4,<value2>	Read/write the Crossover Volume parameter [P064].
v5[,<value2>]	v5,<value2>	Read/write the MCV Volume parameter [P062].

w => DRAWBACK

w0[,<value2>]	w0,<value2>	Read/write the Drawback Volume parameter [P055].
w1[,<value2>]	w1,<value2>	Read/write the Drawback Rate parameter [P056].
w2[,<value2>]	w2,<value2>	Read/write the Drawback Dwell parameter [P057].

y => MOTOR/BASE

y0[,<value2>]	y0,<value2>	Read/write the Acceleration parameter [P031].
y1[,<value2>]	y1,<value2>	Read/write the Running Torque parameter [P034].
y2[,<value2>]	y2,<value2>	Read/write the Pump Motor parameter [P020].
y3[,<value2>]	y3,<value2>	Read/write the Rotary Stop Position parameter [P037].
y4[,<value2>]	y4,<value2>	Read/write the Rotary Meter Stop Mode parameter [P060].
y5[,<value2>]	y5,<value2>	Read/write the Stall Retires parameter [P040].
y6[,<value2>]	y6,<value2>	Read/write the Pump Size parameter [P021].
y11[,<value2>]	y11,<value2>	Read/write the Initial Rate parameter [P036].

y12[,<value2>]	y12,<value2>	Read/write the Holding Torque parameter [P032].
y13[,<value2>]	y13,<value2>	Read/write the Holding Delay parameter [P033].
y14	y14,<value2>	Read the Pump Type parameter [P023].
y15[,<value2>]	y15,<value2>	Read/write the Pump Chamber Volume parameter [P024].
y16	y16,<value2>	Read the Pump Volume Resolution parameter [P025].
y17	y17,<value2>	Read the Pump Rate Resolution parameter [P026].
y18	y18,<value2>	Read the Piston Backlash parameter [P028].
y19[,<value2>]	y19,<value2>	Read/write the Deacceleration 2X parameter [P035].

z => IDENTIFICATION

z or z0	z0,<value2>	Returns the software version as text [P004].
z1	z1,<value2>	Returns the Product Name as text (“DS4000”).
z2	z2,<value2>	Returns the Primary board firmware CRC as a number [P005].
z3	z3,<value2>	Returns the bootloader version as text [P008].
z4	z4,<value2>	Returns the interface board firmware version as text [P150].
z5	z5,<value2>	Returns the interface board bootloader version as text [P151].
z6	z6,<value2>	Returns a number indicating the Part Number [P006].
z7	z7,<value2>	Returns the Serial Number as a number [P007].
Z8	z8,<value2>	Returns the Interface board firmware CRC as a number [P152].

Table 3.3 - Serial Protocol Commands

3.5.5.4 Warnings

Warnings indicate problems in the command received, or a state of the Actuator or Motor/Base 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 delimiter.
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.

3.6 ALERTS

Alerts are a result of the system detecting an issue with a parameter. When an alert occurs, the screen will flash “ALERT SCREEN”. Pressing the push button below this message will take you to the Alert Screen where information pertaining to the alert will be displayed and the alert can be cleared. Alerts should be cleared and addressed before staring additional operations. However, it is possible to initiate operations while alerts are present.

The Alert Code parameter [P016] indicates the present alert code. If there is no alert, the alert code indicates zero.

Any change of the Pump Motor parameter generates an Alert. This is to provide a reminder to verify that the Pump Motor selection matches the Motor/base or actuator that is physically attached to the Controller.

3.7 FAULTS

Faults are a result of the system detecting improper operation of the Actuator Module. When a fault occurs, the screen will flash “FAULT SCREEN”. Pressing the push button below this message will take you to the Fault Screen where information pertaining to the fault will be displayed and the fault can be cleared. Faults must be cleared and addressed before staring additional operations.

The ‘clear faults’ command must be used before any subsequent operation of the affected channel is performed.

If a fault occurs, the type of fault will be displayed on the screen. Once the problem is corrected the pump must be referenced.

After a fault, the normal action is to "CLEAR FAULT”. If repeated "CLEAR FAULTS" all result in faults, contact IVEK Technical Service for assistance.

The Fault Code parameter [P015] indicates the present fault code. If there is no fault, the fault code indicates zero.

3.8 LIQUID EYE SYSTEMS

The Liquid Eye System optically senses air and liquids in a translucent fluid line. Typical applications include detecting air bubbles or absence of liquid in a fluid line. The System generates a single fault for a single fluid line.

Some of the System features are:

- Liquid eye detector is non-intrusive to fluid line.
- Adjustment for a variety of fluids and line sizes.

The System is made up of two main components; a detector (purchased separately) and this Controller Module. The detector contains a source and sensor that enclose the fluid line and the Controller Module contains the electronics and algorithm to make the air vs. liquid determination.

3.8.1 Liquid Eye Configuration – Go To System Screen

The Liquid Eye configuration [P258] may be configured for one of five different values: Disabled, Tune Air, Tune Liquid, Status Liquid/Air, Alert Air, and Fault Air. When enabled, the Liquid Eye measures a transmission factor across the tubing (called the Liquid Eye Value [P256]). The Air Threshold [P261] and Liquid Threshold [P262] are used by the algorithm to determine the Liquid Eye Status [P257] of either Liquid or Air.

The Disabled configuration places the detector in an inactive state. Use this configuration when either no detector is attached, or during the tuning procedure.

The Tune Air configuration automatically adjusts the Air Threshold parameter. Use this configuration during the tuning procedure.

The Tune Liquid configuration automatically adjusts the Liquid Threshold parameter. Use this configuration during the tuning procedure.

The Status Liquid/Air mode updates the Liquid Eye Status, indicating either Air or Liquid is present in the detector. The Detection time is ignored in this mode.

The Alert Air configuration updates the Liquid Eye Status, indicating either Air or Liquid is present in the detector. After Air is detected for longer than the Detection time, an Alert is generated (Alerts do not stop pumping operations).

The Alert Fault configuration updates the Liquid Eye Status, indicating either Air or Liquid is present in the detector. After Air is detected for longer than the Detection time, a Fault is generated (Faults stop pumping operations).

3.8.2 Liquid Eye Tuning Procedure

Tuning should be performed each time the detector, tubing type, or liquid type is changed. The tuning procedure requires both a piece of tubing and some liquid that are representative of the application (water often is an acceptable substitute for other liquids during tuning). Often a fluid loop is used, half full of liquid and half full of air, to allow easy movement of liquid and air in and out of the sensor using gravity. The procedure is as follows:

1. Place the tubing into the detector, making sure that air is in the section of tubing that is in the detector. Verify that there are not any drops inside the tubing section that is in the detector.
2. Change the Liquid Eye configuration to Tune Air.
3. Adjust the Source Intensity so that the measured Liquid Eye value is just above or at 0.300.
4. Change the Liquid Eye configuration to Tune Liquid.
5. Fill the tubing section in the detector with the liquid. Verify there are not any air bubbles inside the tubing section that is in the detector.
6. Change the Liquid Eye configuration to Disabled.
7. Verify that the Liquid Threshold is greater than the Air Threshold.

3.8.3 Liquid Eye Hints and Troubleshooting

When tuning, it is common for air bubbles and drops to interfere with the measurement. Often a simple tap on the tubing will dislodge the bubble or drop from the tubing in the detector.

It is possible that placing the tubing into the detector will cause a scratch in the tubing surface. It is also possible that the material that is scratched off will fill the small detector sensor window. Either a filled window or an irregular tubing surface will impact the accuracy of the Liquid Eye detector. It is also important that the detector opening matches the outer diameter of the tubing.

It is permissible to modify the values determined by the tuning algorithm. The only requirement is that the Liquid Threshold is greater than the Air Threshold. The difference between these values provides some hysteresis to the algorithm.

It is important to keep the detector in a stationary position once the installation procedure has been performed. Motion may cause erroneous fault indications.

It is possible that certain external light sources could interfere with the detection algorithm.

3.9 ANALOG IN/OUT (4-20MA)

The 4-20mA Analog In/Out feature provides measurement and control of various transducers and actuators. A typical application for this is to measure the output of a pH sensor and adjust the pumping rate in order to maintain a certain pH level.

3.9.1 Analog In/Out Configurations

The Analog In and Analog Out are independent of each other and are each configurable.

3.9.2 Analog In/Out Tuning Procedure

In order to achieve the highest possible accuracy, it is necessary to tune the 4-20mA Analog In/Out according to the following procedure:

1. Change the Analog In configuration to Disabled.
2. Create a current loop between the Analog In, Analog Out, the 24V Power Supply, and a precision current meter.
3. Change the Analog Out configuration to Calibrate Lo.
4. Change the Analog Out Calibration Lo parameter to the value displayed on the current meter (expected to be near 4.000mA).
5. Change the Analog Out configuration to Calibrate Hi.

6. Change the Analog Out Calibration Hi parameter to the value displayed on the current meter (expected to be near 20.000mA).
7. Change the Analog Out configuration to Disabled.
8. Change the Analog In configuration to Calibrate Lo.
9. Change the Analog Out configuration to Calibrate Lo.
10. Wait a moment to allow the Controller to measure the Calibrate Lo parameter.
11. Change the Analog In configuration to Calibrate Hi.
12. Change the Analog Out configuration to Calibrate Hi.
13. Wait a moment to allow the Controller to measure the Calibrate Hi parameter.
14. Change the Analog In configuration to Disabled.
15. Change the Analog Out configuration to Disabled.

3.9.3 Analog In/Out Hints and Troubleshooting

The 4-20mA output is typically accurate enough for many applications. Therefore, if a precision current meter is not readily available, skip steps 3-7 of the tuning procedure.

Neither Analog In nor Analog Out have polarity. This reduces the probability of a miswire.

3.10 MAINTENANCE

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

3.10.1 Assembly/Disassembly Procedures

The Controller Module contains the following replaceable parts.

- Main Power Fuse

3.10.1.1 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.

3.11 PROBLEM GUIDE

Table 3.4 contains a list of possible problems, causes and solutions for the Controller Module.

WARNING

Hazardous voltages exist inside the Controller Module. Under no circumstances should the Controller Module be opened. There are no user serviceable parts inside the Controller Module. Any unauthorized access to the inside will void the warranty.

Table 3.4 - Common Operational Problems and Solutions

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
No power, nothing works.	AC power may be absent or inadequate. Unit not plugged in.	Ensure AC power cord is plugged into a properly grounded three-prong outlet capable of 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.	Motor Cable malfunction or not connected.	Check the cable connection between the Controller Module and Actuator or Motor/Base Module. Inspect and repair faulty cable.
	Motor malfunction.	Turn off controller power. Check to ensure Actuator or Motor/Base 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 system to IVEK Corporation for repair.
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
Power is on, display is blank, START indicator flashing.	The firmware is corrupted.	Program a new firmware image.
Power is on, display is blank, at least 1 indicator illuminated or flashing.	Contrast set too low.	Increase Contrast (P123). To get into the contrast screen after power-up press the FBP4 button twice. Then the up arrow will increase the contrast.
Power is on, display contains a dark rectangle, at least 1	Contrast set too high.	Decrease Contrast (P123). To get into the contrast screen after power-up press the FBP4

indicator illuminated or flashing.		button twice. Then the down arrow will decrease the contrast.
Certain parameters cannot be modified using the HMI.	Permission level too low.	Change permission to a higher level (P114).
	Inhibited by Front Panel Lock.	Change value of Front Panel Config (P127) to a less restrictive value. Need to be in Keylock permission level to change.
Cannot reach Dispense, Meter, Feeder or Maintainer screen.	Production mode is disabled.	Go to the Main Screen, change Production Mode (P050) to Dispense, Meter, Feeder or Maintainer.
The XXXX function button is not visible.	Permission level too low.	Change permission to a higher level (P114).
	Inhibited by Front Panel Lock.	Change value of Front Panel Config (P127) to a less restrictive value. Need to be in Keylock permission level to change.
Power is on, Controller Module accepts a trigger, arrow push button does not function.	Inhibited by Front Panel Lock.	Change value of Front Panel Config (P127) to a less restrictive value. Need to be in Keylock permission level to change.
Fluid moves backwards relative to expected.	Plumbing attached to pump is opposite of software configuration.	Make sure connection of tubing to inlet/outlet matches factory setting. If it is desired to connect the fluidic system to the opposite of the factory default ports, then enable the Invert Pump Ports parameter (P027).
Port Home Fault or Port Stall Fault	Fluid viscosity too high for valving speed causing a stall during valving	Reduce Valving Speed and/or increase Torque.
	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, Piston Stall Fault, or Motor Stall Fault	Fluid viscosity too high for rate of piston movement.	Decrease Acceleration, Dispense Rate, or Load Rate and/or increase Torque.
	Tubing too small for rate of fluid movement causing excessive back pressure.	Increase tubing diameter.
	Piston seized.	Refer to Chapter 7.

	Faulty cable connection.	Check the cable connection. Inspect and repair faulty cable.
	Incorrect Pump Motor or Pump Size selected.	Make sure the Pump Motor (P020) and Pump Size (P21) parameters match the pump motor and pump size presently attached to the Controller.
Motor Control Hardware Fault	Disconnected cable while powered.	Turn off power, reconnect cable, turn-on power.
	Shorted on motor cable.	Check the cable connection. Inspect and repair faulty cable.
	Component failure in controller.	Cycle power. If fault continues contact IVEK Technical support.
Motor Drive Current Over Limit	Short on motor cable.	Inspect cable for bent pins or shorted conditions.
	Short in motor or wrong motor attached.	Verify correct pump motor attached to the controller and that no shorted windings exist.
DC Bus Voltage Over/Under Limit	AC power brownout or transient.	Make sure AC power is available to the unit.
	Internal DC power supply problem.	Make sure DC Bus parameter (P103) is within 10% of 48V (available on Statistics 2 screen). If fault persists, contact IVEK Technical support.
Solenoid Bus Voltage Over/Under Limit	AC power brownout or transient.	Make sure AC power is available to the unit.
	Internal DC power supply problem.	Make sure Solenoid Bus parameter (P104) is within 10% of 90V (available on Statistics 2 screen). If fault persists, contact IVEK Technical support.
Motor Drive IC Temperature Over Limit, Motor Drive HTSNK Temperature Over Limit, Ambient Temperature Over Limit	Excessive ambient temperature.	Verify that the temperature around the controller is lower than 40 °C.
	Fan not working	Verify that the fan is moving and blowing air out of the enclosure.
Internal Operation Fault	Internal software error	Clear fault and cycle power.
Motion Disabled during Operation Fault	Motion Enable signal deactivated while pump was operating.	Enable the Motion Enable signal and clear the fault. Motion Enable signal available via Fieldbus, Logic I/O, or web pages depending on specific configuration of Controller.

Backup Parameter, Recipe, or Configuration Read Alert	The non-volatile backup copy is corrupted.	Clear alert. Check all parameter values. Cycle power. Check all parameter values.
Parameter, Recipe, or Configuration Value Out of Bounds Alert	A value in the saved parameters is out of bounds of the system.	Clear alert. Check all parameter values. Cycle power. Check all parameter values.
Parameter, Recipe, or Configuration Version Alert	The saved parameters contain an unexpected version number.	Most likely to occur after a firmware update. Some firmware updates may require resetting the non-volatile memory after updating. Otherwise, clear alert. Check all parameter values. Cycle power. Check all parameter values. (WARNING: will reset all parameters and recipes)
Parameters or Configuration Blank Alert	The stored parameters are corrupted.	Most likely to occur after a firmware update. Some firmware updates may require resetting the non-volatile memory after updating. Otherwise, clear alert. Check all parameter values. Cycle power. Check all parameter values. (WARNING: will reset all parameters and recipes)
If none of the above solves the problem, contact IVEK technical support for assistance.		

3.12 SPECIFICATIONS

3.12.1.1 INPUT POWER Requirements:

Voltage: +100 – +240 VAC, 50 or 60 Hz
Maximum current: 4A

3.12.1.2 CC TRIG Signal Requirements:

Accepts mechanical contact closure or solid state switch capable of +5 VDC @ 15mA (max). Power source in Digispense® 4000BT.

DO NOT APPLY VOLTAGE

3.12.1.3 LOGIC IN Signal Requirements:

Maximum external voltage: +48 VDC
High State Threshold: 11V
Low State Threshold: 5V
Maximum current: 3mA

3.12.1.4 LOGIC OUT Signal Requirements:

Maximum external voltage: +48 VDC
Maximum current: 120mA

3.12.1.5 AUX OUT Signal Requirements:

Maximum external voltage: 48 VDC
Maximum current: 2.5 A

3.13 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.

520274 # # # # #

Drive Interface
- **A** – 1500 RPM, 48 VDC, 5Arms Output

Logic I/O
- **A** – Contact Closure, Auxiliary Inputs/Outputs Analog Input/Output, Liquid Eye

Fieldbus Module
- **A** – No Fieldbus Module
- **B** – EtherNet/IP Fieldbus Module
- **C** – RS-232
- **D** – USB
- **E** – EtherCAT
- **F** – PROFINET

Front Panel
- **A** – Membrane Switch Panel, Monochrome LCD W/LED Backlight

Power Cord
- **A** – North American Line Cord
- **B** – International Line Cord

3.14 ILLUSTRATED PARTS BREAKDOWN

There are no replaceable parts on the Digispense® 4000BT Controller Module.

3.15 ACCESSORIES

The following accessories are available for your Controller Module.

Linear Actuator Cables

540241-###	Cable Assy, Linear, DS3020, Std, Sty B; ### = Length in decimeters (010 = 1 meter)
540238-###	Cable Assy, Linear, DS3020, Enc, Sty A; ### = Length in decimeters

Rotary Motor/Base Cables

540242-###	Cable Assy, Rotary Step, Mcrsp, Sty 2 To Ctrlr 3, Sty B; ### = Length in decimeters
540265-###	Cable Assy, Rotary Step, MB3 To Ctrlr 3, Sty B ### = Length in decimeters
540243-###	Cable Assy, Rotary Step, Std & HD, Sty2 To Ctrlr 3, Sty B; ### = Length in decimeters

Liquid Eye Detectors

152018-002	Optical Detector Fabrication, 1/4” O.D. Tubing
152018-003	Optical Detector Fabrication, 3/8" O.D. Tubing
152018-004	Optical Detector Fabrication, 7/16" & 11mm O.D. Tubing
152018-005	Optical Detector Fabrication, 1/2" & 13mm O.D. Tubing
152018-006	Optical Detector Fabrication, 9/16" & 14mm O.D. Tubing
152018-007	Optical Detector Fabrication, 3/16" O.D. Tubing
152018-008	Optical Detector Fabrication, 5/16" & 8mm O.D. Tubing
152018-009	Optical Detector Fabrication, 5/8” & 16mm O.D. Tubing
152018-010	Optical Detector Fabrication, 4mm O.D. Tubing
152018-011	Optical Detector Fabrication, 6mm O.D. Tubing
152018-012	Optical Detector Fabrication, l0mm O.D. Tubing
152018-013	Optical Detector Fabrication, 15mm O.D. Tubing
152019-001	Optical Detector Fabrication, 1/8" O.D. Tubing, 2M Cable
152019-002	Optical Detector Fabrication, 3MM O.D. Tubing, 2M Cable
152019-003	Optical Detector Fabrication, 1/8” O.D. Tubing, 6M Cable

3.16 APPENDIX A

The following Parameter table lists all the parameters associated with the Digispense® 4000 Controller Module. Please note that the data types are generally understood, though some PLCs do not support the given data types. In those cases, use the following mappings:

Data Type	Rockwell Type	Beckhoff	Siemens
UINT8	SINT	USINT	USINT
UINT16	INT	UINT	UINT
UINT32	DINT	UDINT	UDINT
BIT32	WORD	UDINT	UDINT
ENUM	SINT	INT	INT
BOOL	BOOL	BOOL	BOOL
VOL	DINT	DINT	DINT
RATE	DINT	DINT	DINT

The address of each parameter depends on the communication interface. The ID listed in the table is the relative offset of the parameter. When using EtherNet/IP, the ID is the Instance address that should be used. All parameters are contained in the CIP Parameter object (Object 15). Here are a couple of examples for EtherNet/IP:

Product ID (ID 1) Object 15, Instance 1
Pump Motor (ID 20) Object 15, Instance 20

When using EtherCAT, the parameters are located sequentially starting at address 8192 (0x2000hex). Therefore, the location of a parameter can be found by adding ID of the parameter to 8192. Here are a couple of examples for EtherCAT:

Product ID (ID1) 1 + 8192 = 8193 (0x2001hex)
Pump Motor (ID 20) 20 + 8192 = 8212 (0x2014hex)

For more information on interfacing PLCs and Gateways, see Application Note AN-101.

When using PROFINET, the parameters are all located at API 0, Slot 0, Subslot 1 and then offset by an Index equal to the Parameter ID of the parameter. Here are a couple of examples for PROFINET:

Product ID (ID1) API 0, Slot 0, Subslot 1, Index 1
Pump Motor (ID 20) API 0, Slot 0, Subslot 1, Index 20

Table 3.5 – Parameter Locations and Possible Values

ID	Descriptor	Data Type	Front Panel Screen	Web Page	Serial	R/W	Values/Limits
	ERASE FAULT LOG		Reset Log			N/A	Erases the fault log
N/A	FAULT LOG	Various	Statistics 5	N/A		R	The fault log contains information about conditions during the last 6 fault events (00-06). This information is intended to help IVEK Technical Service determine possible causes of the fault. Pres the up/down arrows to cycle through the Fault Log. Information includes: The Time/Date of the Fault The Fault Code Production Cycle on which the fault occurred Pump Motor Setting

							Running Torque Setting Holding Torque Setting Acceleration Setting Initial Rate Setting DC Bus Voltage Solenoid Bus Voltage Ambient Temperature Heatsink Temperature Processor Temperature
N/A	SERIAL BAUD RATE	ENUM	System 1	N/A		R/W	0 = 9600 Baud 1 = 19200 Baud 2 = 57600 Baud 3 = 115200 Baud (Default) 4 = 230400 Baud
1	PRODUCT ID	UINT32	N/A	Information		R	1
2	ADI MAP MAJOR VERISON	UINT16	N/A	Information		R	2
3	ADI MAP MINOR VERSION	UINT16	N/A	Information		R	3
4	PRIMARY FIRMWARE VERSION	BYTE[11]	Statistics 1	Information	z0	R	“560010-0203” (subject to change)
5	PRIMARY FIRMWARE CRC	UINT32	Statistics 1	Information	z3	R	“2069223996” (subject to change)
6	PART NUMBER	ENUM	Statistics 1	Information	z6	R	0 = Unconfigured 1 = 520269-AAAAA 2 = 520269-AABAA 3 = 520269-AACAA 4 = 520269-AADAA 5 = 520269-AAEAA 6 = 520269-AAFAA 7 = 520274-AAAAA 8 = 520274-AAAAB 9 = 520274-AABAA 10 = 520274-AABAB 11 = 520274-AACAA 12 = 520274-AACAB 13 = 520274-AADAA 14 = 520274-AADAB 15 = 520274-AAEAA 16 = 520274-AAEAB 17 = 520274-AAFAA 18 = 520274-AAFAB
7	SERIAL NUMBER	UINT32	Statistics 1	Information	s14, z7	R	Unique per controller
8	BOOTLOADER VERSION	BYTE[11]	Statistics 1	Information	z2	R	“560013-0102” (subject to change)
9	ENTER BOOTLOADER	BOOL	Reset Params (FK1)	Operate		W	0 = Disabled (Default) 1 = Enter Bootloader (Permission must be >= Keylock)
10	COMMANDS	UINT32	Various Buttons and FKs	Operate	b0, b1, c0, c1, c2, e0, f0,	W	Available in assembly instance 0x96 0x00000000 = Min (Default) 0xFFFFFFFF = Max

					f1, f2, k0, l0, l1, p3,		
11	COMMANDS EXT	UINT32	N/A	Operate		W	Available in assembly instance 0x96 0x00000000 = Min (Default) 0xFFFFFFFF = Max
12	STATUS FLAGS	UINT32	N/A	Operate	q1	R	Available in assembly instance 0x64 0x00000000 = Min (Default) 0xFFFFFFFF = Max
13	STATUS FLAGS EXT	UINT32	N/A	Operate	q2	R	Available in assembly instance 0x64 0x00000000 = Min (Default) 0xFFFFFFFF = Max
14	STATUS STATE	ENUM	ALL (upper right hand corner, no label)	Operate	q0	R	Available in assembly instance 0x64 0 = IDLE 1 = PRIMING 2 = DISPENSING 3 = METERING 4 = DRAWBACK DWELL 5 = DRAWBACK 6 = FAULTED 7 = REFERENCING 8 = INITIALIZING 9 = PRE-OP DWELL 10 = POST-OP DWELL 11 = AUTORIGER IDLE 12 = ISOLATING 13 = AGITATING 14 = RETURNING 15 = BUBBLE CLEAR 16 = LOADING 17 = CHANGING PORT 18 = AGITATE DWELL 19 = PARKNG PORT 20 = PORT PARKED 21 = UNPARKING PORT 22 = MOTION LOCKED 23 = NOT CONFIGURED 24 = FEEDING 25 = CROSSOVER WAITING 26 = CLEARING FAULT 27 = INTAKING 28 = MAINTAINING 29 = BUBBLE CLEAR DWELL
15	FAULT CODE	UINT32	Fault	Operate	s8	R	Available in assembly instance 0x64 See [P015] for a list and description of possible Fault codes.
16	ALERT CODE	UINT32	Alert	Operate	s9	R	Available in assembly instance 0x64 See [P016] for a list and description of possible Alert codes.

17	RECIPE (CURRENT)	UINT8	Main, Production 1 – 3, Fluidics 1, Pump 1 – 2	Operate	n0	R	Available in assembly instance 0x64 0 = No Recipe active 1-32 = Recipe active
18	RECIPE GET	UINT8	Recipe (FK2)	Operate	n0	W	Available in assembly instance 0x96 0 = No Recipe load request 1-32 = Load requested Recipe
19	RECIPE SAVE	UINT8	Recipe (FK3)	Operate	n98, n99	W	0 = No Recipe save request 1-32 =Save requested Recipe
20	PUMP MOTOR	ENUM	Pump 1	Pump	y2	R/W	0 = None (Default) 1 = 032037-##11# 2 = 032038-##11# 3 = 082114-##### 4 = 082216-##### 5 = 092117-##1# 6 = 092117-##2# 7 = 092117-##3# 8 = 092128-##1## 9 = 092128-##2## 10 = 092128-##3## 11 = 092117-##5# 12 = 092128-##5## 13 = 102006-2### 14 = 102009-2### 15 = 102118-2### 16 = 102144-2### 17 = 102150-2#### 18 = 102006-4### 19 = 102009-4### 20 = 102118-4### 21 = 102144-4### 22 = 102150-4#### 23 = 102006-5### 24 = 102009-5### 25 = 102118-5### 26 = 102144-5### 27 = 102150-5#### 28 = 032037-##12# 29 = 032255-##12# 30 = 032037-##21# 31 = 032037-##22# 32 = RESERVED 33 = 032038-##12# 34 = 032254-##12# 35 = 032038-##21# 36 = 032038-##22# 37 = RESERVED 38 = 032241-1##### 39 = 032241-2##### 40 = 032241-3##### 41 = 032241-4##### 42 = 032241-5##### 43 = 032241-6##### 44 = 032241-7##### 45 = 032214-8#####

21	PUMP SIZE	ENUM	Pump 1	Pump	y6	R/W	0 = None (Default) 1 = 4A 2 = 3A 3 = 2A 4 = A 5 = B 6 = C 7 = D 8 = 16mm 9 = E/HD+ 10 = F 11 = G
22	PUMP UNITS	ENUM	Pump 1	Pump	u0	R/W	0 = REV, REV/s (revolutions per second) (Default) 1 = nL, nL/s (nanoliters per second), 0 decimal places 2 = uL, uL/s (microliters per second), 1 decimal place 3 = ml, mL/s (milliliters per second), 2 decimal places 4 = REV, RPM (revolutions per minute)
23	PUMP TYPE	ENUM	Pump 1	Pump	y14	R	0 = None (Default) 1 = Rotary 2 = Linear
24	PUMP CHAMBER VOLUME	VOL	Pump 1	Pump	s6, y15	R/W (rotary) R (linear)	Varies based on Pump Motor, Pump Size, and Units
25	PUMP RESOLUTION	VOL	Pump 1	Pump	y16	R	Varies based on Pump Motor, Pump Size, and Units
26	RATE RESOLUTION	RATE	Pump 1	Pump	y17	R	Varies based on Pump Motor, Pump Size, and Units
27	INVERT PUMP PORTS	BOOL	Pump 2	Pump	p0	R/W	0 = Disabled(Default) 1 = Enabled
28	PISTON BACKLASH	UINT16	Hidden	Pump	y18	R/W	0 = Min (Default) (0.000 REV) 200 = Max (0.200 REV)
29	Deprecated						
30	Deprecated						
31	RUNNING TORQUE	UINT8	Pump 2	Pump	y1	R/W	1 = Min (1 %) 100 = Max (100 %) 80 = Default (80 %)
32	HOLDING TORQUE	UINT8	Pump 2	Pump	y12	R/W	0 = Min (0 %) 100 = Max (100 %) 20 = Default (20 %)
33	HOLDING DELAY	UINT16	Hidden	Pump	y13	R/W	0 = Min (0.00 Sec) 100 = Max (1.00 Sec) 50 = Default (0.50 Sec)

34	ACCELERATION	ENUM	Pump 2	Pump	y0	R/W	0 = Slow 1 = Medium 2 = Standard (Default) 3 = Fast
35	DEACCELERATION 2X	BOOL	Pump 2	Pump	y19	R/W	0 = Disabled 1 = Enabled (Default)
36	INITIAL RATE	ENUM	Hidden	Pump	y11	R/W	0 = Low 1 = Medium 2 = High (Default)
37	STOP POSITION	UINT16	Pump 2 (Rotary)	Pump	y3	R/W	0 = Min (0 DEG) 359 = Max (359 DEG) 90 = Default (90 DEG)
38	VALVING MAX SPEED	UINT8	Pump 2 (Linear)	Pump	p1	R/W	1 = Min (1 %) 100 = Max (Default) (100 %)
39	VALVING START SPEED	UINT8	Hidden	Pump	p4	R/W	1 = Min (1 %) 100 = Max (100 %) 50 = Default (50 %)
40	STALL RETRIES	UINT8	Pump 2 (Rotary)	Pump	y5	R/W	0 = Min (Default) 20 = Max
50	PRODUCTION MODE	ENUM	Main	Production	m0	R/W	0 = Disabled 1 = Dispense (Default) 2 = Meter 3 = Feeder 4 = Maintainer
51	Deprecated.						
52	DISPENSE VOLUME	VOL	Production 1 (Disabled, Dispense)	Production	v0	R/W	Varies based on Pump Motor, Pump Size, and Units
53	DISPENSE RATE	RATE	Production 1	Production	r0	R/W	Varies based on Pump Motor, Pump Size, and Units
54	LOAD RATE	RATE	Production 1 (Linear)	Production	r2	R/W	Varies based on Pump Motor, Pump Size, and Units
55	DRAWBACK VOLUME	VOL	Production 2	Production	w0	R/W	Varies based on Pump Motor, Pump Size, and Units
56	DRAWBACK RATE	RATE	Production 2	Production	w1	R/W	Varies based on Pump Motor, Pump Size, and Units
57	DRAWBACK DWELL	UINT16	Production 2	Production	w2	R/W	0 = Min (0.00 Sec) 6000 = Max (60.00 Sec) 5 = Default (0.05 Sec)
58	LOAD MODE	ENUM	Production 2 (Linear)	Production	a0	R/W	0 = Manual 1 = Empty (Default) 2 = Every
59	LOAD THRESHOLD	VOL	Production 2 (Linear, Single or Multiple Chamber Modes)	Production	v2	R/W	Varies based on Pump Motor, Pump Size, and Units
60	STOP MODE	ENUM	Production 2 (Rotary)	Production	y4	R/W	0 = Stop Position (Default) 1 = Immediate
61	CHAMBER MODE	ENUM	Production 2 (Linear)	Production	a1	R/W	0 = Single(Default) 1 = MCV, Push Inlet 2 = MCV, Push Outlet 3 = Multiple 4 = Synchronous

							5 = Synchronous, Primary
62	MCV VOLUME	VOL	Production 2 (Linear, MCV Chamber Modes)	Production	v5	R/W	Varies based on Pump Motor, Pump Size, and Units
63	Deprecated						
64	CROSSOVER VOLUME	VOL	Production 2 (Linear, Synchronous Chamber modes)	Production	v4	R/W	Varies based on Pump Motor, Pump Size, and Units
65	PRE-OP DWELL	UINT16	Production 3	Production	t2	R/W	0 = Min (Default) (0.00 Sec) 6000 = Max (60.00 Sec)
66	POST-OP DWELL	UINT16	Production 3	Production	t3	R/W	0 = Min (Default) (0.00 Sec) 6000 = Max (60.00 Sec)
67	AUTOTRIGGER MODE	ENUM	Production 3	Production	a2	R/W	0 = Disabled (Default) 1 = Count 2 = Infinite
68	AUTOTRIGGER DWELL	UINT16	Production 3	Production	t4	R/W	0 = Min (Default) (0.00 Sec) 300 = Max (300.00 Sec)
69	AUTOTRIGGER COUNT	UINT32	Production 3	Production	a3	R/W	2 = Min (Default) 10000000 = Max
70	SETPOINT MIN	UINT16	Production 1 (Maintainer)	Production	r4	R/W	0 = Min (0.000) 1000 = Max (Default) (1.000)
71	SETPOINT MAX	UINT16	Production 1 (Maintainer)	Production	r5	R/W	0 = Min (0.000) 1000 = Max (Default) (1.000)
72	MAINTAINER SETPOINT	UINT16	Production 1 (Maintainer)	Production	r6	R/W	0 = Min (0.000) 1000 = Max (Default) (1.000)
73	FEEDER SETPOINT	UINT16	N/A	Production	r7	R	0 = Min (0.000) 1000 = Max (Default) (1.000) This value is generated by the Analog In when configured to control the Feeder Setpoint in Feeder Mode. The value of this modifies the Feeder Setpoint which determines the Feeder Discharge Rate.
74	FEEDER RATE	RATE	Production 1 (Feeder)	Production	r8	R/W	Varies based on Pump Motor, Pump Size, and Units
75	ACTUAL RATE	RATE	Production 1-3 (no label)	Production	r9	R	Varies based on Pump Motor, Pump Size, and Units
76	RATE OR SETPOINT	UINT32	N/A	N/A		R/W	This gets mapped to other parameters based on the Production Mode. Dispense, Meter = Dispense Rate [53] Feeder = Feeder Rate [74] Maintainer = Maintainer Setpoint [72]
77	MIN DISCHARGE RATE	RATE	Production 1	Production	r10	R/W	Varies based on Pump Motor, Pump Size, and Units. Limits the Feeder Rate or Maintainer Rate.
78	MAX DISCHARGE RATE	RATE	Production 1	Production	r11	R/W	Varies based on Pump Motor, Pump Size, and Units. Limits the Feeder Rate or Maintainer Rate.

80	FLUIDIC MODE	ENUM	Main	Fluidic	m1	R/W	0 = Disabled 1 = Prime (Default) 2 = Agitate 3 = Bubble Clear 4 = Prime Reverse 5 = Prime Timed 6 = Prime Timed Reverse
81	Deprecated						
82	DISCHARGE VOLUME (FLUIDIC)	VOL	Fluidic 1	Fluidic	v1	R/W	Varies based on Pump Motor, Pump Size, and Units
83	DISCHARGE RATE (FLUDIC)	RATE	Fluidic 1	Fluidic	r1	R/W	Varies based on Pump Motor, Pump Size, and Units
84	INTAKE RATE (FLUIDIC)	RATE	Fluidic 1 (Linear)	Fluidic	r3	R/W	Varies based on Pump Motor, Pump Size, and Units
85	FLUIDIC DWELL	UINT16	Fluidic 1 (Disabled, Agitate, Bubble Clear)	Fluidic	t5	R/W	0 = Min (0.00 Sec) 30000 = Max (300.00 Sec) 5 Default (0.05 Sec)
86	ISOLATION VOLUME	VOL	Fluidic 1 (Agitate)	Fluidic	v3	R/W	Varies based on Pump Motor, Pump Size, and Units
87	PRIME TIME	UINT16	Fluidic 1 (Prime Timed, Prime Timed Reverse)	Fluidic	t0	R/W	1 = Min (1 Sec) 30,000 = Max (30,000 Sec) 120 = Default (120 Sec)
90	TOTAL PROD VOLUME	VOL	Production 1-3 (no label), Totalizers	Statistics	g0	R/W	0 = Min (Default) 1999999999 = Max (Rollover)
91	LAST PROD VOLUME	VOL	Production 1-3 (no label), Totalizers	Statistics	g3	R/W	0 = Min (Default) 1000000000 = Max
92	POSITION	UINT32	N/A	Statistics	s5	R	0 = Min (0.000 REV) 10000 = Max (10.000 REV)
93	VOLUME REMAINING	UINT32	N/A	Statistics	s0	R	0 = Min (0.000 REV) 10000 = Max (10.000 REV)
94	LAST FLUIDIC VOLUME	VOL	Fluidic 1-2 (no label), Totalizers	Statistics	g2	R/W	Varies based on Pump Motor, Pump Size, and Units
95	PRODUCTION CYCLES	UINT32	Totalizers	Statistics	g1	R	0 = Min (Default) 1999999999 = Max (Rollover)
96	FLUIDIC CYCLES	UINT32	Fluidic 1-2 (no label), Totalizers	Statistics	g4	R	0 = Min (Default) 1999999999 = Max
97	REFERENCE CYCLES	UINT32	Statistics 3	Statistics	g5	R	0 = Min (Default) 2000000000 = Max
98	LOAD CYCLES	UINT32	Totalizers	Statistics	g6	R	0 = Min (Default) 2000000000 = Max
99	CLUTCH CYCLES	UINT32	Statistics 3	Statistics	g7	R	0 = Min (Default) 2000000000 = Max
100	BRAKE CYCLES	UINT32	Statistics 3	Statistics	g8	R	0 = Min (Default) 2000000000 = Max
101	SENSOR MEASURE	UINT16	N/A	Statistics	s101	R	0 = Min (0.000 REV) 10000 = Max (10.000 REV)

102	LAST STALL COUNT	UINT8	Statistics 3	Statistics	s2	R	0 = Min (Default) 20 = Max
103	DC BUS	UINT16	Statistics 2	Statistics	s40	R	0 = Min (0.0 V) 30000 = Max (300.0V)
104	SOLENOID BUS	UINT16	Statistics 2	Statistics	s41	R	0 = Min (0.0 V) 30000 = Max (300.0V)
105	HEATSINK	UINT16	Statistics 2	Statistics	s31	R	0 = Min (0.0 °C) 30000 = Max (300.0°C)
106	AMBIENT	UINT16	Statistics 2	Statistics	s32	R	0 = Min (0.0 °C) 30000 = Max (300.0°C)
107	PROCESSOR	UINT16	Statistics 2	Statistics	s33	R	0 = Min (0.0 °C) 30000 = Max (300.0°C)
108	FAULT COUNT	UINT32	Statistics 3	Statistics	g9	R	0 = Min (Default) 2000000000 = Max
109	ALERT COUNT	UINT32	Statistics 3	Statistics	g10	R	0 = Min (Default) 2000000000 = Max
110	ASSERTS SW	UINT32	Statistics 4	Statistics	s10	R	0 = Min (Default) 2000000000 = Max
111	ASSERT SW CODE	UINT32	Statistics 4	Statistics	s11	R	0 = Min (Default) 4294967295 = Max
112	ASSERTS HW	UINT32	Statistics 4	Statistics	s12	R	0 = Min (Default) 2000000000 = Max
113	ASSERT HW CODE	UINT32	Statistics 4	Statistics	s13	R	0 = Min (Default) 4294967295 = Max
114	CURRENT PERMISSION	ENUM	Main, Production 1-3, Fluidic 1, Pump 1-2	System	k2	R	0 = Operator 1 = I/O Test 2 = Supervisor (Default) 3 = Keylock
115	POWER-UP PERMISSION	ENUM	System 1	System	k3	R/W	0 = Operator 1 = Last at Power Off (Default)
116	ENTER PASSWORD (CHANGE PERMISSION)	UINT32	Permission	System	k2	W	Changes to the permission level that matches the password entered. If an invalid password is entered, the permission is changed to Operator.
117 118 119 120	OPERATOR PASSWORD IO TEST PASSWORD SUPERVISOR PASSWORD KEYLOCK PASSWORD	UINT32	Password	System	k5 k6 k7 k8	R/W	0 = Min 4294967295 = Max All passwords must be unique. Default passwords provided in separate technical bulleting, TB-105.
123	CONTRAST	UINT8	Contrast (▲ higher or ▼ lower)	System	h2	R/W	50 = Min (50 %) 100 = Max (100 %) 90 = Default (90 %)
124	BACKLIGHT MODE	ENUM	Backlight	System	h6	R/W	0 = Always On (Default) 1 = Always Off 2 = On, Timer
125	BACKLIGHT INTENSITY	UINT8	Backlight	System	h7	R/W	1 = Min (1 %) 100 = Max (100 %) 80 = Default (80 %)

126	BACKLIGHT TIMER	UINT16	Backlight	System	h8	R/W	1 = Min (1 Sec) 10000 = Max (10,000 Sec) 60 – Default (60 Sec)
127	FRONT PANEL CONFIG	ENUM	System 1	System	k1	R/W	0 = Lock->Disabled (Default) 1 = Lock->Recipe Save 2 = Lock->Recipe Save, Value Change 3 = Lock ->Recipe Save, Value Change, Prime Direction 4 = Lock->Recipe Save & Get, Value Change 5 = Lock->Recipe Save & Get, Value Change, Prime Direction 6 = Lock->Recipe Save & Get, Value Change, Prime Direction, Start/Stop Buttons
128	FRONT PANEL LOCK	BOOL	System 1	System	k4	R	0 = Disabled (Default) 1 = Enabled
129	DRIVER OTW	BOOL	Statistics 2	Statistics	s30	R	0 = False 1 = True (Motor Driver Overtemperature Warning)
138	ERASE PARAMS	BOOL	Reset Parameters (FK2)	Operate		W	0 = Disabled 1 = Erase all parameters, recipes, system settings, and passwords
150	INTER FW VERSION	BYTE[11]	Statistics 1	Information	z4	R	“560012-0102” (subject to change)
151	INTER BL VERSION	BYTE[11]	Statistics 1	Information	z5	R	“560014-0101” (subject to change)
152	INTER FW CRC	UINT32	Statistics 1	Information	z8	R	“2082112158” (subject to change)
153	INTER COMM BAUD RATE	ENUM	Tech Service	Statistics	N/A	R	0 = 9600 BAUD 1 = 19200 BAUD 2 = 57600 BAUD 3 = 115200 BAUD (default) 4 = 230400 BAUD
154	INTER COMM ERRORS	UINT32	Statistics 4	Statistics	s42	R	0 = Min (Default) 2000000000 = Max
155	INTER COMM STATUS	ENUM	Statistics 4	Statistics	s43	R	0 = Disabled 1 = Connected 2 = Disconnected
160 161 162 163 168 169	LOGIC IN 1 (CONFIG) LOGIC IN 2 (CONFIG) LOGIC IN 3 (CONFIG) LOGIC IN 4 (CONFIG) CC IN 1 (CONFIG) CC IN 2 (CONFIG)	ENUM	System 4	System	h11 h12 h13 h14 h10 h19	R/W	0 = Disabled (Default) 1 = Enable – Motion 2 = Trigger – Stop Operations 3 = Trigger – Production Ops 4 = Trigger – Fluidic Ops 5 = Trigger – Reference 6 = Trigger – Clear Faults 7 = Trigger – Clear Alerts 8 = Trigger – Load 9 = Crossover – Synchronous 10 = Trigger – Park Port 11 = Trigger – Unpark Port 12 = Trigger – Piston Unstick 13 = Trigger – Torque Test 14 = Trigger – Clear Required 15 = Gate – Production Ops 16 = Gate – Fluidic Ops 17 = Lock – Front Panel

172	LOGIC IN 1 INVERT	BOOL	System 5	System	h31	R/W	0 = Disabled (Default) 1 = Enabled
173	LOGIC IN 2 INVERT				h32		
174	LOGIC IN 3 INVERT				h33		
175	LOGIC IN 4 INVERT				h34		
180	CC IN 1 INVERT				h30		
181	CC IN 2 INVERT				h39		
184	LOGIC IN 1 (VALUE)	BOOL	I/O Test	System	h51	R	0 = False (Default) 1 = True
185	LOGIC IN 2 (VALUE)				h52		
186	LOGIC IN 3 (VALUE)				h53		
187	LOGIC IN 4 (VALUE)				h54		
192	CC IN 1 (VALUE)				h50		
193	CC IN 2 (VALUE)				h59		
196	INPUT DEBOUNCE	UINT16	System 5	System	h9	R/W	0 = Min (0.00 Sec) 6000 = Max (60.00 Sec) 1 = Default (0.01 Sec)
197	I/O TEST	BOOL	I/O Test	System	h101	R/W	0 = Disabled (Default) 1 = Enabled
200	LOGIC OUT 1 (CONFIG)	ENUM	System 6	System	h21	R/W	0 = Disabled (Default) 1 = Ready – Initialized 2 = Ready – Configured 3 = Status – Fault 4 = Status – Alert 5 = Status – Motion Disabled 6 = Status – Ref Required 7 = Status – Load Required 8 = Status – Port Required 9 = Ready – Idle 10 = Ready – Production 11 = Ready – Fluidic Setup 12 = Ready – Reference 13 = Ready – Load 14 = Ready – Park 15 = Ready – Unpark 16 = Status – OP Required 17 = Busy – Operation 18 = Busy – Production Ops 19 = Busy – Fluidic Setup Ops 20 = Busy – Reference Op 21 = Busy – Load Operation 22 = Busy – Port Operation 23 = Busy – Park Operation 24 = Busy – Autotrigger Active 25 = Status – Parked 26 = Status – Chamber Full 27 = Success – Pulse
201	LOGIC OUT 2 (CONFIG)				h22		
202	LOGIC OUT 3 (CONFIG)				h23		
203	LOGIC OUT 4 (CONFIG)				h24		
208	AUX OUT 1 (CONFIG)				h20		
209	AUX OUT 2 (CONFIG)				h29		

							28 = Success – Last 29 = Busy – Dwell 30 = Busy – Discharge 31 = Busy – Intake 32 = Busy – Intake Piston 33 = Busy – Valve 34 = Busy – Drawback Dwell 35 = Busy -Drawback 36 = Busy -AP Prime 37 = Crossover – Synchronous 38 = Crossover – Waiting
212 213 214 215 220 221	LOGIC OUT 1 INVERT LOGIC OUT 2 INVERT LOGIC OUT 3 INVERT LOGIC OUT 4 INVERT AUX OUT 1 INVERT AUX OUT 2 INVERT	BOOL	System 7	System	h41 h42 h43 h44 h40 h49	R/W	0 = Disabled (Default) 1 = Enabled
224 225 226 227 232 233	LOGIC OUT 1 (VALUE) LOGIC OUT 2 (VALUE) LOGIC OUT 3 (VALUE) LOGIC OUT 4 (VALUE) AUX OUT 1 (VALUE) AUX OUT 2 (VALUE)	BOOL	I/O Test	System	h61 h62 h63 h64 h60 h69	R/W	0 = False (Default) 1 = True
240	ANALOG IN VALUE (no label on screen)	UINT16	System 2	System	h70	R	0 = Min (Default) (0.000mA) 22000 = Max (22.000mA)
241	ANALOG IN	ENUM	System 2	System	h71	R/W	0 = Disabled (Default) 1 = Monitor 2 = Feeder Setpoint 3 = Maintainer Setpoint 4 = Calibrate Lo 5 = Calibrate Hi
242	ALARM LOW CONFIG	ENUM	System 2	System	h72	R/W	0 = Disabled (Default) 1 = Alert 2 = Fault
243	ALARM LOW LIMIT	UINT16	System 2	System	h73	R/W	0 = Min (Default) (0.000mA) 22000 = Max (22.000mA)
244	ALARM HIGH CONFIG	ENUM	System 2	System	h74	R/W	0 = Disabled (Default) 1 = Alert 2 = Fault
245	ALARM HIGH LIMIT	UINT16	System 2	System	h75	R/W	0 = Min (Default) (0.000mA) 22000 = Max (22.000mA)
246	ALARM DELAY	UINT16	System 2	System	h76	R/W	0 = Min (0.00 Sec) 6000 = Max (60.00 Sec) 10 = Default (0.10 Sec)

247	ANALOG IN CALIBRATE LO	UINT16	Calibrate	System	h77	R/W	3000 = Min (3.000mA) 5000 = Max (5.000mA) 4000 = Default (4.000mA)
248	ANALOG IN CALIBRATE HI	UINT16	Calibrate	System	h78	R/W	19000 = Min (19.000mA) 21000 = Max (21.000mA) 20000 = Default (20.000mA)
250	ANALOG OUT VALUE (no label on screen)	UINT16	System 2	System	h80	R	4000 = Min (Default) (4.000mA) 22000 = Max (22.000mA)
251	ANALOG OUT	ENUM	System 2	System	h81	R/W	0 = Disabled (Default) 1 = Actual Discharge Rate 2 = Dispense Rate 3 = Feeder Rate 4 = Maintainer Setpoint 5 = Dispense Volume 6 = Pump Location 7 = Repeat Analog In 8 = Forced Value 9 = Calibrate Lo 10 = Calibrate Hi
252	FORCE VALUE	UINT16	System 2	System	h82	R/W	4000 = Min (Default) (4.000mA) 22000 = Max (22.000mA)
253	ANALOG IN CALIBRATE LO	UINT16	Calibrate	System	h83	R/W	3000 = Min (3.000mA) 5000 = Max (5.000mA) 4000 = Default (4.000mA)
254	ANALOG IN CALIBRATE HI	UINT16	Calibrate	System	h84	R/W	19000 = Min (19.000mA) 21000 = Max (21.000mA) 20000 = Default (20.000mA)
256	LIQUID EYE VALUE	UINT16	System 3	System	h90	R	0 = Min (Default) (0.000) 1000 = Max (1.000)
257	LIQUID EYE STATUS	ENUM	System 3	System	h91	R	0 = Disabled (Default) 1= Air Detected 2 = Liquid Detected 3 = Tuning Air 4 = Tuning Liquid 5 = no Sensor
258	LIQUD EYE (CONFIG)	ENUM	System 3	System	h92	R/W	0 = Disabled (Default) 1 = Tune – Air 2 = Tune – Liquid 3 = Status – Liquid/Air 4 = Alert – Air 5 = Fault – Air
259	DETECTION	UINT16	System 3	System	h93	R/W	0 = Min (Default) (0.00 Sec) 6000 = Max (60.00 Sec)
260	LIQUID THRESHOLD	UINT16	System 3	System	h94	R/W	0 = Min (Default) (0.000) 1000 = Max (1.000)
261	AIR THRESHOLD	UINT16	System 3	System	h95	R/W	0 = Min (Default) (0.000) 1000 = Max (1.000)
262	SOURCE INTENSITY	UINT16	System 3	System	h96	R/W	0 = Min (Default) (0.000) 1000 = Max (1.000)
263	SOURCE OFFSET	UINT16	System 3	System	h97	R/W	0 = Min (Default) (0.000) 1000 = Max (1.000)

Cyclic Data Exchange

EtherNet/IP Producing Data Bytes (Assembly 100) **EtherCAT Transmit PDO Mapping** **PROFINET Module Mapping (Rack 0)** **(32 bytes total)**	**Contents**	**EtherNet/IP Parameter Instance (Assembly 100)**	**EtherCAT Index**	**PROFINET Slot**
0-3	Status Flags	12	0x200C	8
4-7	Status Flags Extended	13	0x200D	9
8	Status State	14	0x200E	10
9	Reserved	N/A	N/A	11A
10-11	Reserved	N/A	N/A	12
12	Recipe Current	17	0x2011	13
13	Reserved	N/A	N/A	14
14-15	Reserved	N/A	N/A	15
16-19	Fault Code	15	0x200F	16
20-23	Alert Code	16	0x2010	17
24-27	Last Production Volume	91	0x205B	18
28-31	Actual Rate	75	0x204B	19
EtherNet/IP Consuming Data Bytes (Assembly 150) **EtheCAT Receive PDO Mapping** **PROFINET Module Mapping (Rack 0)** **(20 bytes total)**	**Contents**	**EtherNet/IP Parameter Instance (Assembly 150)**	**EtherCAT Index**	**PROFINET Slot**
0-3	Command	10	0x200A	1
4-7	Commands Extended	11	0x200B	2
8	Recipe Get	18	0x2012	3
9	Reserved	N/A	N/A	4
10-11	Reserved	N/A	N/A	5
12-15	Dispense Volume	52	0x2034	6
16-19	Rate or Setpoint	76	0x204C	7

CHAPTER REVISIONS

F 01/16/2025 Per DCR/N 22449 Updates to include MCV and PROFINET

E 08/13/2023 Per DCR/N 22073 Updates 3.13 for consistency

D 08/01/2023 Per DCR/N 21734 Added EtherCAT and other updates

C 3/15/2022 Per DCR/N 21066 Added Cyclic Data Exchange information

B 1/13/2022 Per DCR/N 20902 Photo showing updated rear labeling

A 9/29/2021 Per DCR/N 20821 Clarify instructions

- 6/16/2021 Initial release