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3. DIGISPENSE® 4000PM W/BOOTLOADER CONTROLLER MODULE

3.1 DESCRIPTION

The Digispense® 4000PM W/Bootloader 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 Ethernet connections are located on the top panel and the Power, Sensors and Motor connectors are located on the bottom panel. The Controller Module measures 175mm (6.9”) tall, 76.2mm (3.0”) wide and 143.4mm (5.6”) deep and weighs approximately 1.23kg (2.7lbs).

3.1.1 Front Panel (Figure 3.1)

The front panel of the Controller Module contains three indicators: POWER, STATUS and NETWORK. These indicators illuminate based on specific criteria as described in the following three sections.

Figure 3.1 – Digispense 4000PM Controller Module Front Panel

3.1.1.1 POWER Indicator (Figure 3.1 Item 1)

The Power indicator provides a visual reference for the status of the input power. The indicator is off when no power is applied to the Controller Module, green when 24 to 48 VDC power is applied and red when power is applied, but above or below the 24 to 48 VDC range.

Color	Description
Off	No Power
Red	Power applied < 24 VDC or > 48 VDC
Green	Power applied between 24-48 VDC

3.1.1.2 STATUS Indicator (Figure 3.1 Item 2)

The Status Indicator provides a visual reference for the operational state of the Controller Module. The indicator will be off when no power is applied to the Controller Module, green when the pump is ready idle, blinking green when there is an alert, orange when the pump is busy and blinking red when there is a fault or in bootloader mode (parameters are not available when in bootloader mode).

Color	Description
Off	No power
Red, blinking	Faulted or in Bootloader Mode
Orange	Pump Busy
Green	Pump Idle
Green, blinking	Alert

3.1.1.3 NETWORK Indicator (Figure 3.1 Item 3)

The Network Indicator displays the status of the network connection. The indicator will be off when no power is applied to the Controller Module, green when connected with another bus device, red when there is a problem with the network module and orange at all other times.

NOTE

The indicator color is not impacted by either http or ftp connections. In other words, the Network Indicator will not turn green when connected with only a web browser or ftp server. When the Indicator is green, either the EtherNet/IP scanner is connected, or the PROFINET Controller is connected,or the EtherCAT device is in OP mode, and will continually overwrite the parameters that are contained in the Cyclical I/O (implicit data) assembly which may make it impossible to change those value via the web pages. However, non-cyclical I/O (explicit data) parameters may still be modified.

Color	Description
Off	No power
Red	Not active, Module problem or upgrading EtherNet/IP or PROFINET or EtherCAT module firmware.
Orange	Module active, EtherNet/IP scanner is not connected or PROFINET I/O Controller is not connected, or EtherCAT device is not in OP mode
Green	Module active, EtherNet/IP scanner is connected or PROFINET I/O Controller is connected, or EtherCAT device is in OP mode

3.1.2 Bottom Panel Connectors (Figure 3.2)

The Bottom Panel Connectors contain the connection to the power and motor/base or actuator.

Figure 3.2 – Digispense 4000PM Controller Module Bottom Panel

3.1.2.1 MOTOR Connector (Figure 3.2 Item 1)

The Motor connector is used for making the electrical connections (using the cable supplied by IVEK) to the motor of the Actuator Module or Motor/Base Module. Depending on the Actuator or Motor/Base type, all signals may not be populated.

PIN	SIGNAL	WIRE COLOR
11	Overall Cable Shield (Functional Earth Ground)	Drain (11)
10	Motor Frame (Functional Earth Ground)	GRN/YEL
9	Motor Phase A+	WHT/RED
8	Motor Phase A-	WHT
7	Motor Phase B+	GRN/RED
6	Motor Phase B-	GRN
5	Motor Cable Shield (Power Common)	Drain (5)
4	Solenoid VDC	BLU/BRN
3	Solenoid 0 (Clutch)	BLU
2	Solenoid 1 (Brake)	BRN
1	Solenoid Cable Shield (Power Common)	Drain (1)

CAUTION

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

3.1.2.2 SENSORS Connector (Figure 3.2 Item 2)

The Sensors connector is used for making the electrical connections (using the cable supplied by IVEK) to the sensors of the Actuator Module or the Motor/Base Module. Depending on the Actuator or Motor/Base type, all signals may not be populated.

PIN	SIGNAL	WIRE COLOR
1	Sensor Power (5V)	RED
2	Sensor Common	BLK
3	Sensor 0 (Rotary Home)	ORN/BRN
4	Sensor 1 (Linear Home)	ORN/GRN
5	Encoder A	YEL/BRN
6	Encoder B	YEL/VIO
7	Sensor 2 (future)	VIO/ORN
8	Sensor 3 (future)	VIO/GRN
9	Sensor Cable Shield (Sensor Common)	Drain (9)

3.1.2.3 POWER Connector (Figure 3.2 Item 3)

The Power connector provides a connection point for the customer supplied power supply. Functional Earth Ground (FGND) must be connected to either pin 2 of this connector or to the mounting stud located on the enclosure (item 4). The Power In provides reverse polarity protection and some power filtering.

PIN	SIGNAL	WIRE COLOR
1	Power In (24 to 48 VDC), 8 ADC Max	Customer supplied
2	Functional Earth Ground In	Customer supplied
3	Power In Common	Customer supplied

3.1.2.4 FGND Mount (Figure 3.2 Item 4)

The FGND Mount provides an additional mounting location for Functional Earth Ground (FGND). While the POWER connector has a location for FGND (pin 2), the FGND Mount provides an additional connection point in case a more secure or lower impedance mounting option is desired.

3.1.3 Top Panel Connectors

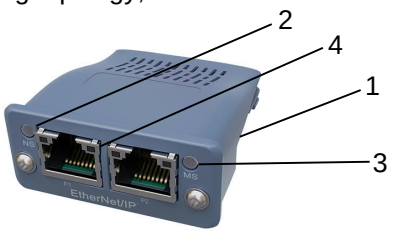
The top panel of the Controller Module contains the fieldbus module. The Ethernet module contains two RJ-45 10/100 Mbit/s connectors. Please follow the cabling recommendations for the specific fieldbus. ANSI/TIA/EIA-568-B.2, category 5e (CAT5e) is the minimum recommended cable performance rating for Ethernet.

3.1.3.1 FIELDBUS Module (Figure 3.2 Item 5)

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

3.1.3.1.1 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.

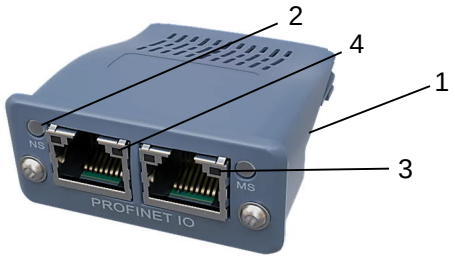
Color	Description
Off	No power
Red	Major fault
Red, Flashing	Recoverable fault
Green	Controlled by a Scanner, Run state
Green, Flashing	Not configured or Scanner, Idle state

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)

3.1.3.1.2 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

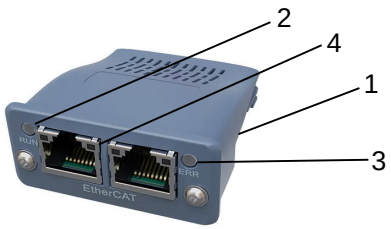
The Ethernet Data indicators (leds on item 4) indicate the status of data transmission and connectivity on the physical Ethernet link.

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

Green, flickering	Ethernet link established, communicating

3.1.3.1.3 **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

3.2 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. 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 3.3.8 and 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.

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 difference 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 difference 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 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 to properly setup the fluid path 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 to properly setup the fluid path 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 (DS4000BT only). 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 (DS4000BT only) 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.

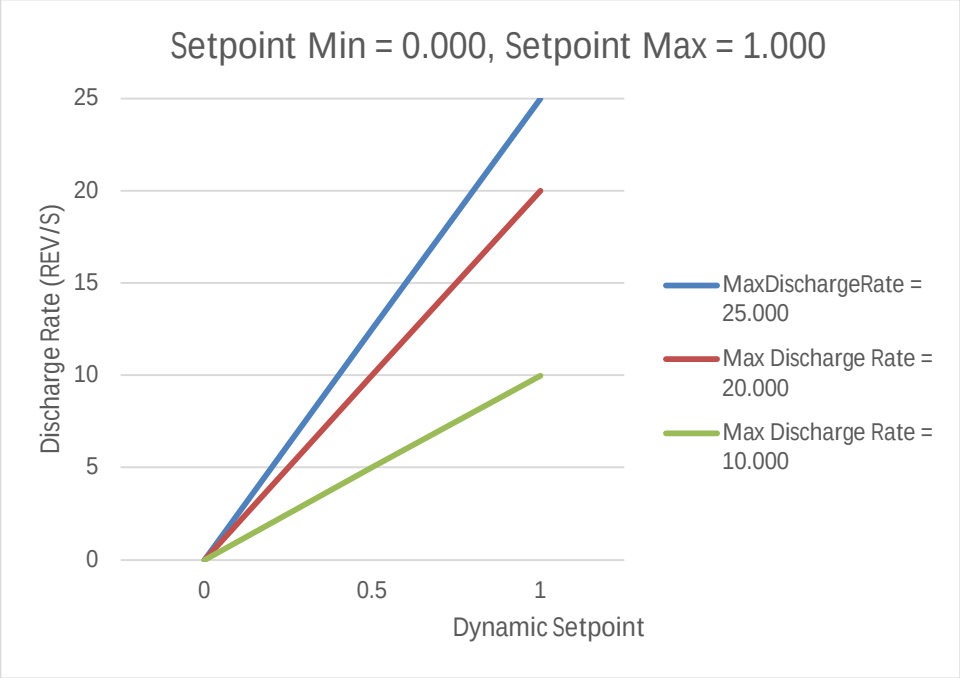


Figure 3.3 – Feeder Operation

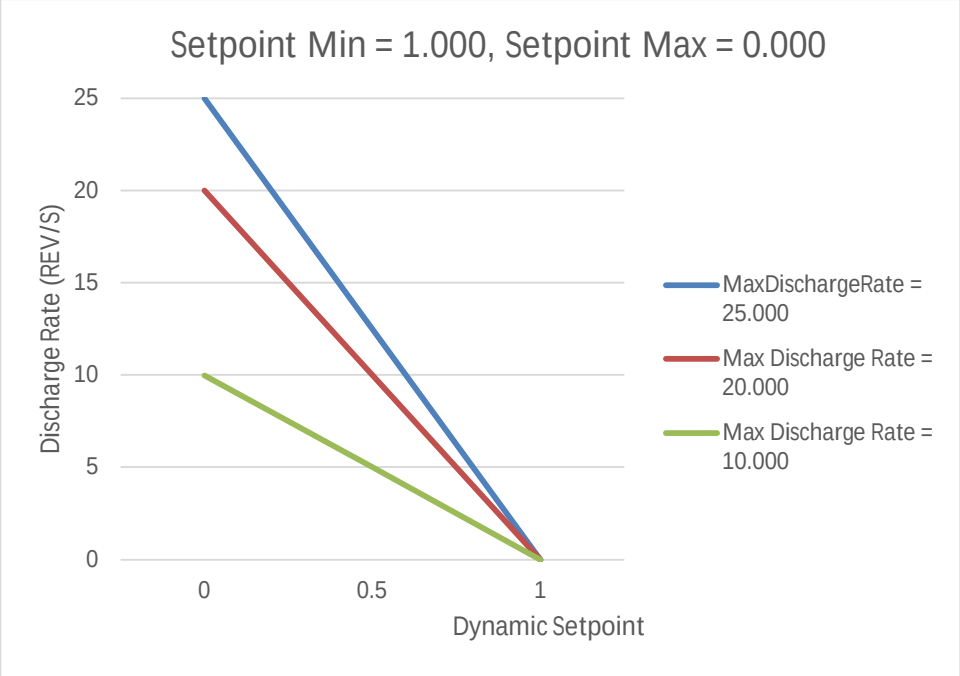


Figure 3.4 – Inverse Feeder Operation

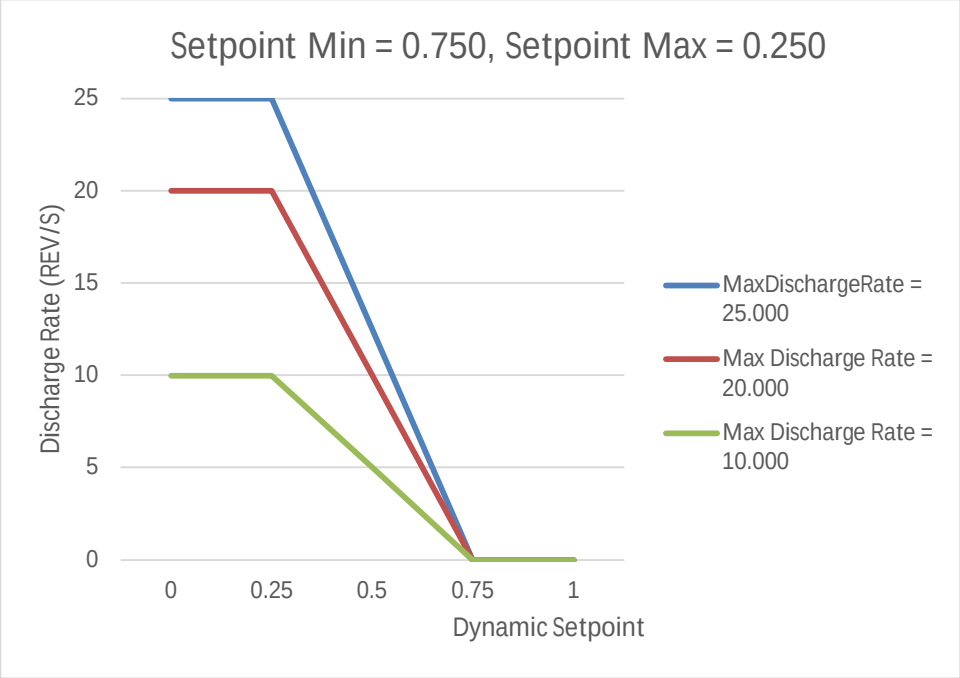


Figure 3.5 – Direct Maintainer Operation

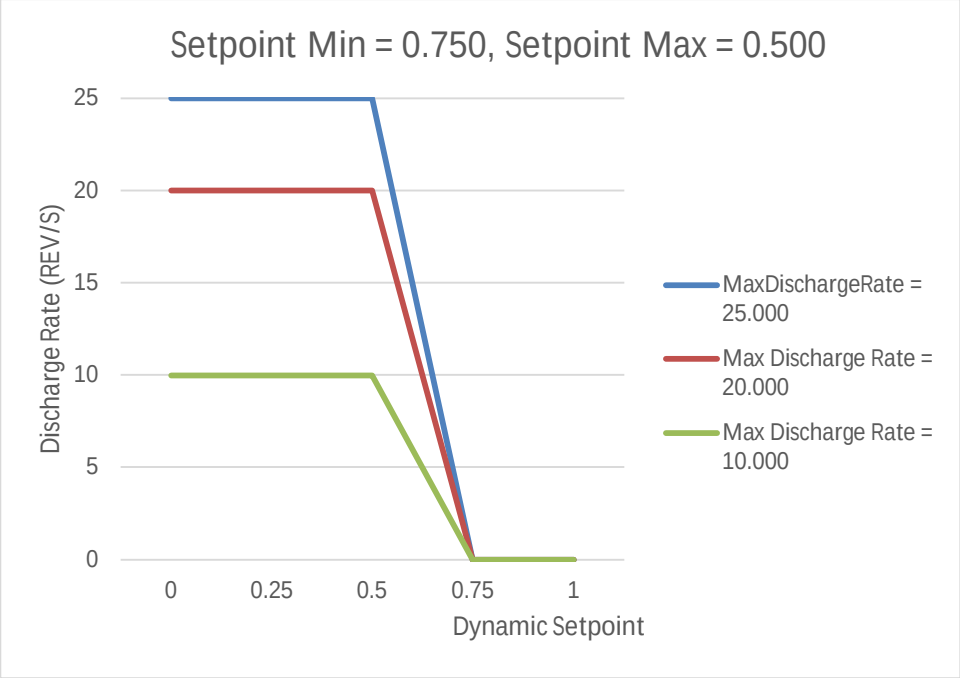


Figure 3.6 – Direct Maintainer Operation

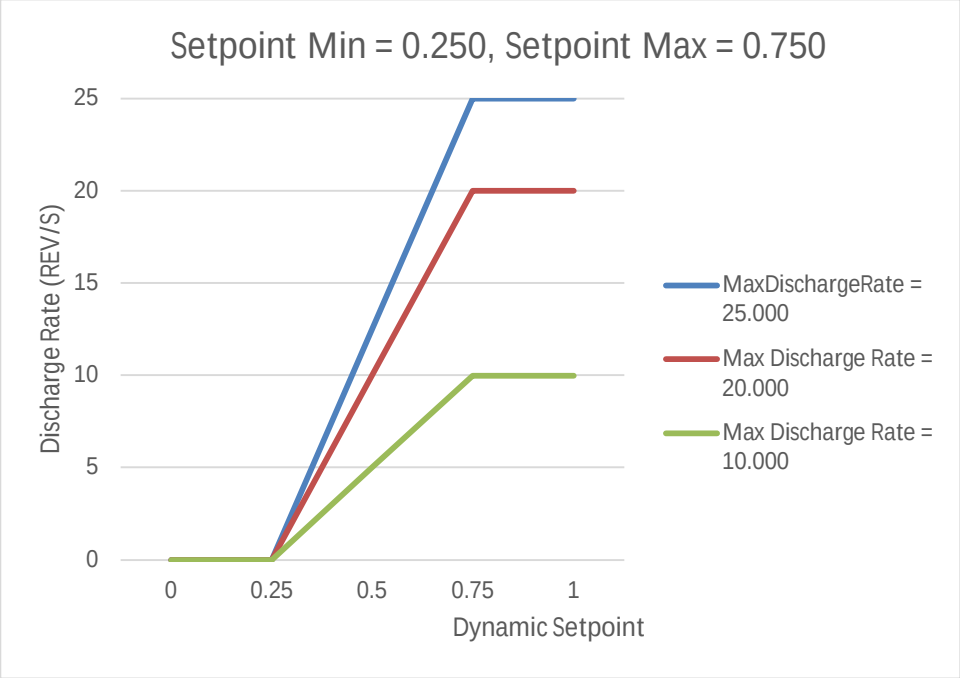


Figure 3.7 – Inverse Maintainer Operation

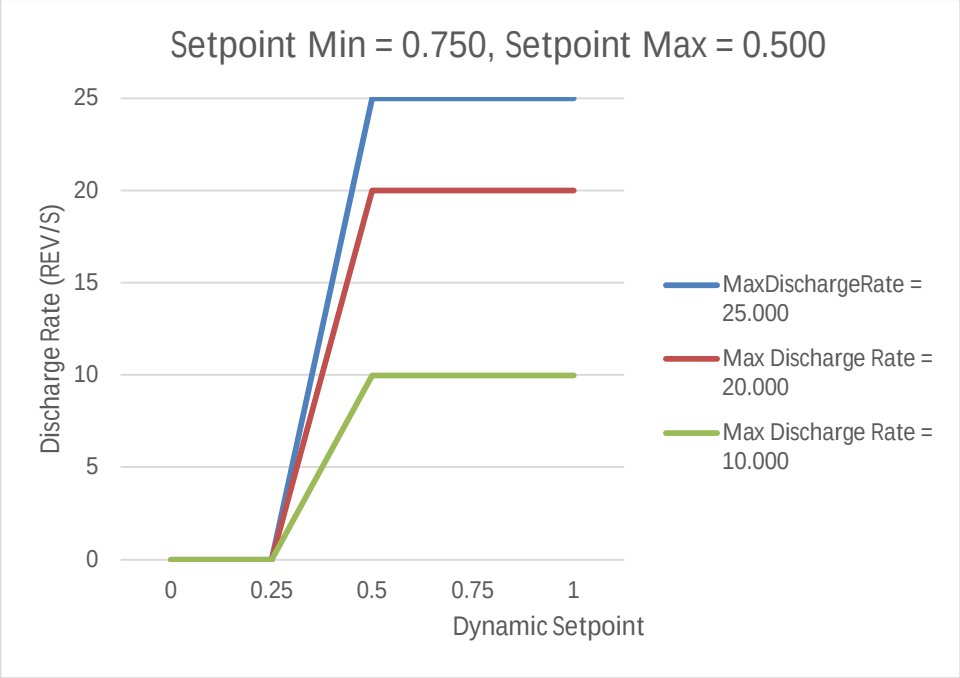


Figure 3.8 – Inverse Maintainer Operation

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.

3.3 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
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.
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.
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.
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 "-" indicates 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 Motor 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
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 would cause 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, Ethernet register (both implicit and explicit)).

NOTES

When the 4-20mA Analog Input is used to control the Feeder Setpoint, or the Ethernet 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 Timed [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]

Not used by DS4000PM. Please leave at default value.

3.3.8.124 Backlight Mode [P124]

Not used by DS4000PM. Please leave at default value.

3.3.8.125 Backlight Intensity [P125]

Not used by DS4000PM. Please leave at default value.

3.3.8.126 Backlight Timer [P126]

Not used by DS4000PM. Please leave at default value.

3.3.8.127 Front Panel Lock Config [P127]

Not used by DS4000PM. Please leave at default value.

3.3.8.128 Front Panel Lock Status [P128]

Not used by DS4000PM. Please leave at default value.

3.3.8.129 Driver OTW [P129]

Not used by DS4000PM. Please leave at default value.

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]

Not used by DS4000PM. Please leave at default value.

3.3.8.151 Interface Bootloader Version [P151]

Not used by DS4000PM. Please leave at default value.

3.3.8.152 Interface Firmware CRC [P152]

Not used by DS4000PM. Please leave at default value.

3.3.8.153 Interface Communication Baud Rate [P153]

Not used by DS4000PM. Please leave at default value.

3.3.8.154 Interface Communication Errors [P154]

Not used by DS4000PM. Please leave at default value.

3.3.8.155 Interface Communication Status [P155]

Not used by DS4000PM. Please leave at default value.

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]

Not used by DS4000PM. Please leave at default value.

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]

Not used by DS4000PM. Please leave at default value.

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]

Not used by DS4000PM. Please leave at default value.

3.3.8.196 Input Debounce [P196]

Not used by DS4000PM. Please leave at default value.

3.3.8.197 I/O Test [P197]

Not used by DS4000PM. Please leave at default value.

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]

Not used by DS4000PM. Please leave at default value.

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]

Not used by DS4000PM. Please leave at default value.

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]

Not used by DS4000PM. Please leave at default value.

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]

Not used by DS4000PM. Please leave at default value.

3.3.8.241 Analog In Configuration [P241]

Not used by DS4000PM. Please leave at default value.

3.3.8.242 Alarm Low Configuration [P242]

Not used by DS4000PM. Please leave at default value.

3.3.8.243 Alarm Low Limit [P243]

Not used by DS4000PM. Please leave at default value.

3.3.8.244 Alarm High Configuration [P244]

Not used by DS4000PM. Please leave at default value.

3.3.8.245 Alarm High Limit [P245]

Not used by DS4000PM. Please leave at default value.

3.3.8.246 Alarm Delay [P246]

Not used by DS4000PM. Please leave at default value.

3.3.8.247 Analog In Calibration Lo [P247]

Not used by DS4000PM. Please leave at default value.

3.3.8.248 Analog In Calibration Hi [P248]

Not used by DS4000PM. Please leave at default value.

3.3.8.249 Reserved [P249]

Reserved.

3.3.8.250 Analog Out Value [P250]

Not used by DS4000PM. Please leave at default value.

3.3.8.251 Analog Out Configuration [P251]

Not used by DS4000PM. Please leave at default value.

3.3.8.252 Force Value [P252]

Not used by DS4000PM. Please leave at default value.

3.3.8.253 Analog Out Calibration Lo [P253]

Not used by DS4000PM. Please leave at default value.

3.3.8.254 Analog Out Calibration Hi [P254]

Not used by DS4000PM. Please leave at default value.

3.3.8.255 Reserved [P255]

Reserved.

3.3.8.256 Liquid Eye Value [P256]

Not used by DS4000PM. Please leave at default value.

3.3.8.257 Liquid Eye Status [P257]

Not used by DS4000PM. Please leave at default value.

3.3.8.258 Liquid Eye Configuration [P258]

Not used by DS4000PM. Please leave at default value.

3.3.8.259 Detection [P259]

Not used by DS4000PM. Please leave at default value.

3.3.8.260 Liquid Threshold [P260]

Not used by DS4000PM. Please leave at default value.

3.3.8.261 Air Threshold [P261]

Not used by DS4000PM. Please leave at default value.

3.3.8.262 Source Intensity [P262]

Not used by DS4000PM. Please leave at default value.

3.3.8.263 Source Offset [P263]

Not used by DS4000PM. Please leave at default value.

3.4 INSTALLATION

The Controller Module has strict spacing guidelines as shown in Figure 3.9. The spacing allows for proper air flow to keep the Controller Module within its operating temperature and to allow for cable connections.

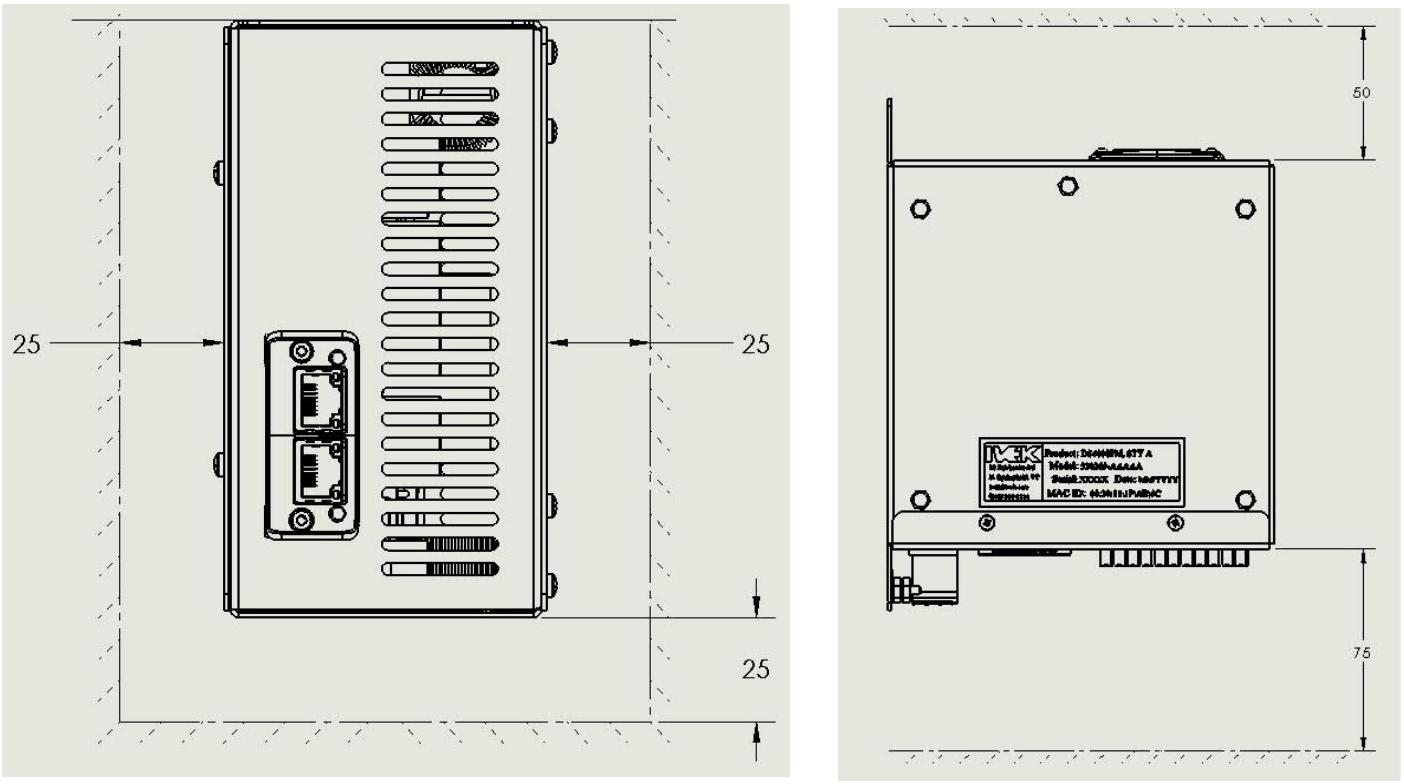


Figure 3.9 – Minimum Installation Requirements (Dimensions are in mm)

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

The EtherNet/IP 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

Technical Bulletin TB-138 describes how to setup the Controller Module for use with a typical Rockwell PLC and software.

The Controller 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.

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.

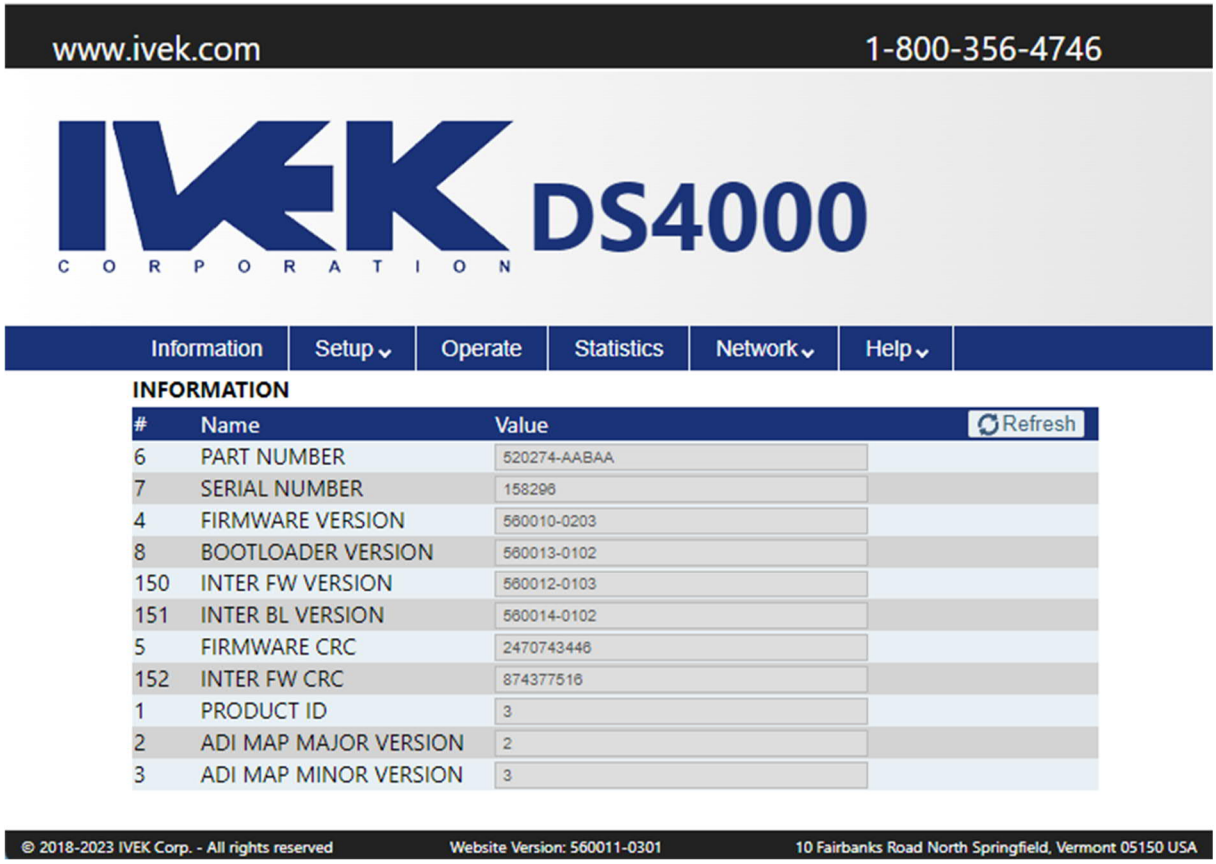


Figure 3.10 – Information Page

3.5.4.2 Setup->Production Page (Figure 3.11)

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

Figure 3.11 – Production Page

3.5.4.3 Setup-> Fluidic Page (Figure 3.12)

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

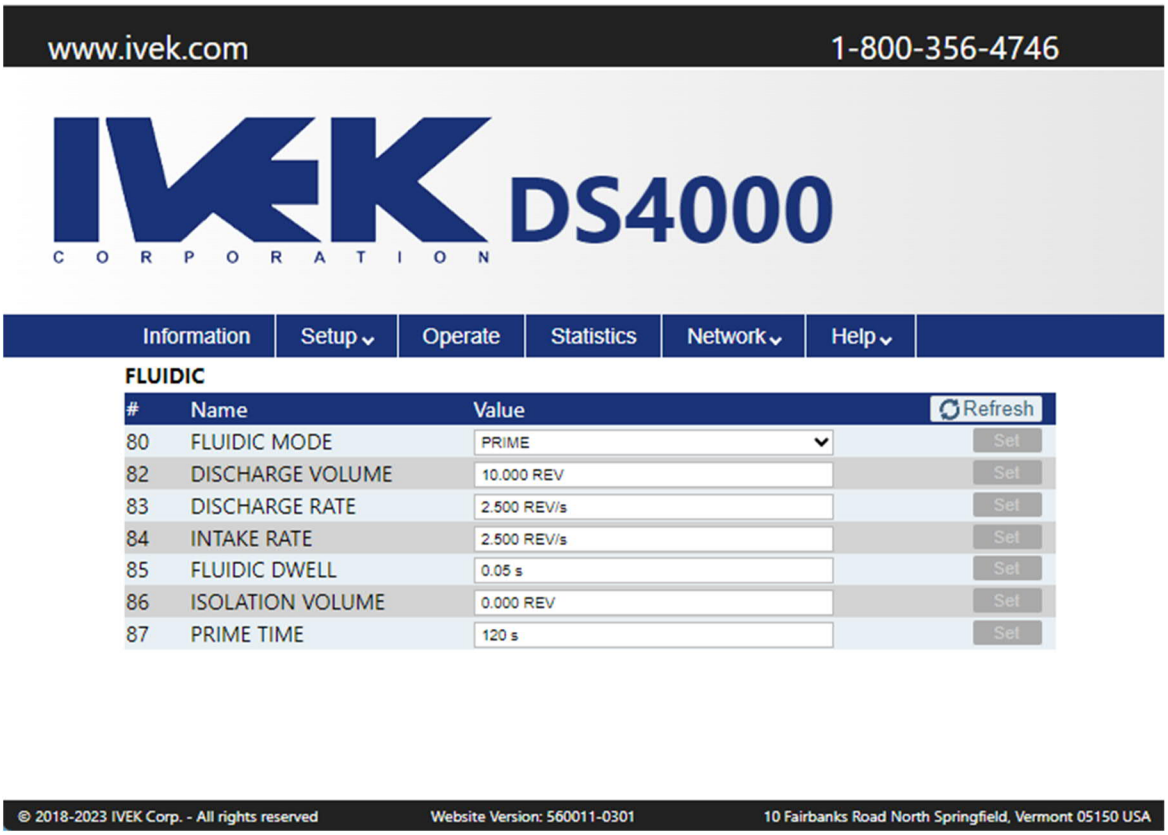


Figure 3.12 – Fluidic Page

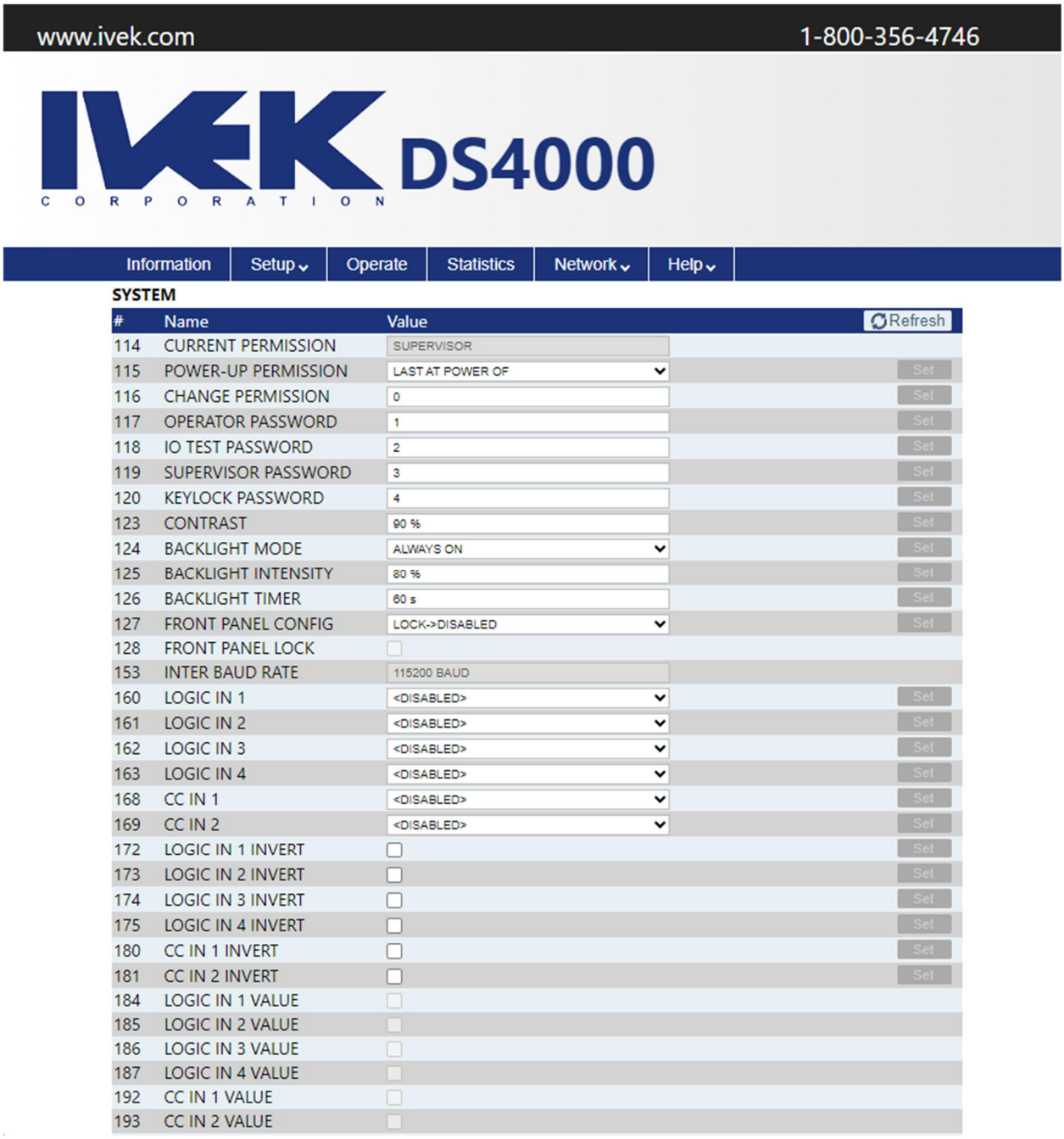
3.5.4.4 Setup->Pump Page (Figure 3.13)

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

Figure 3.13 – Pump Page

3.5.4.5 Setup->System Page (Figure 3.14)

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



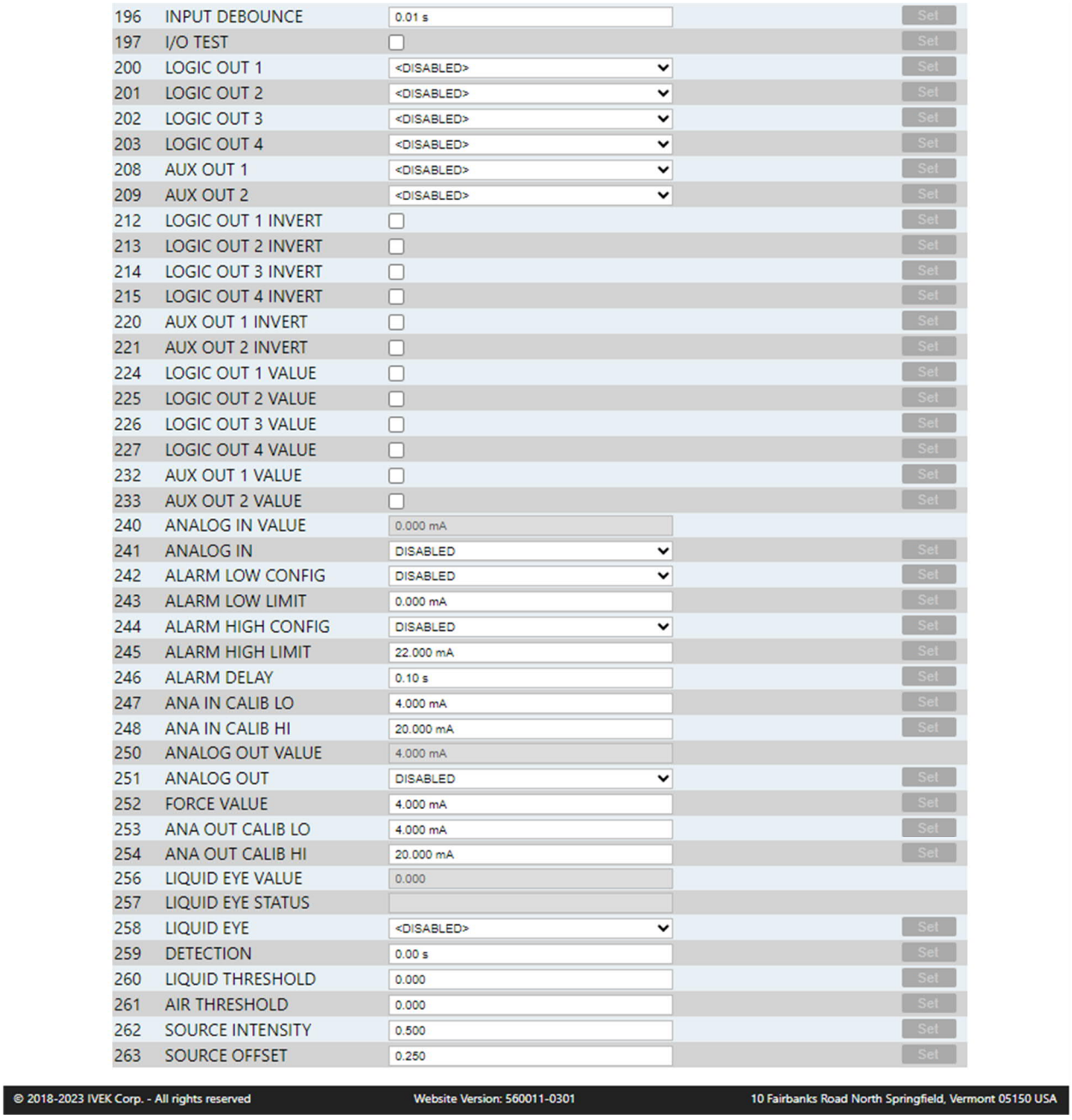


Figure 3.14 – System Page

3.5.4.6 Operate Page (Figure 3.15)

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

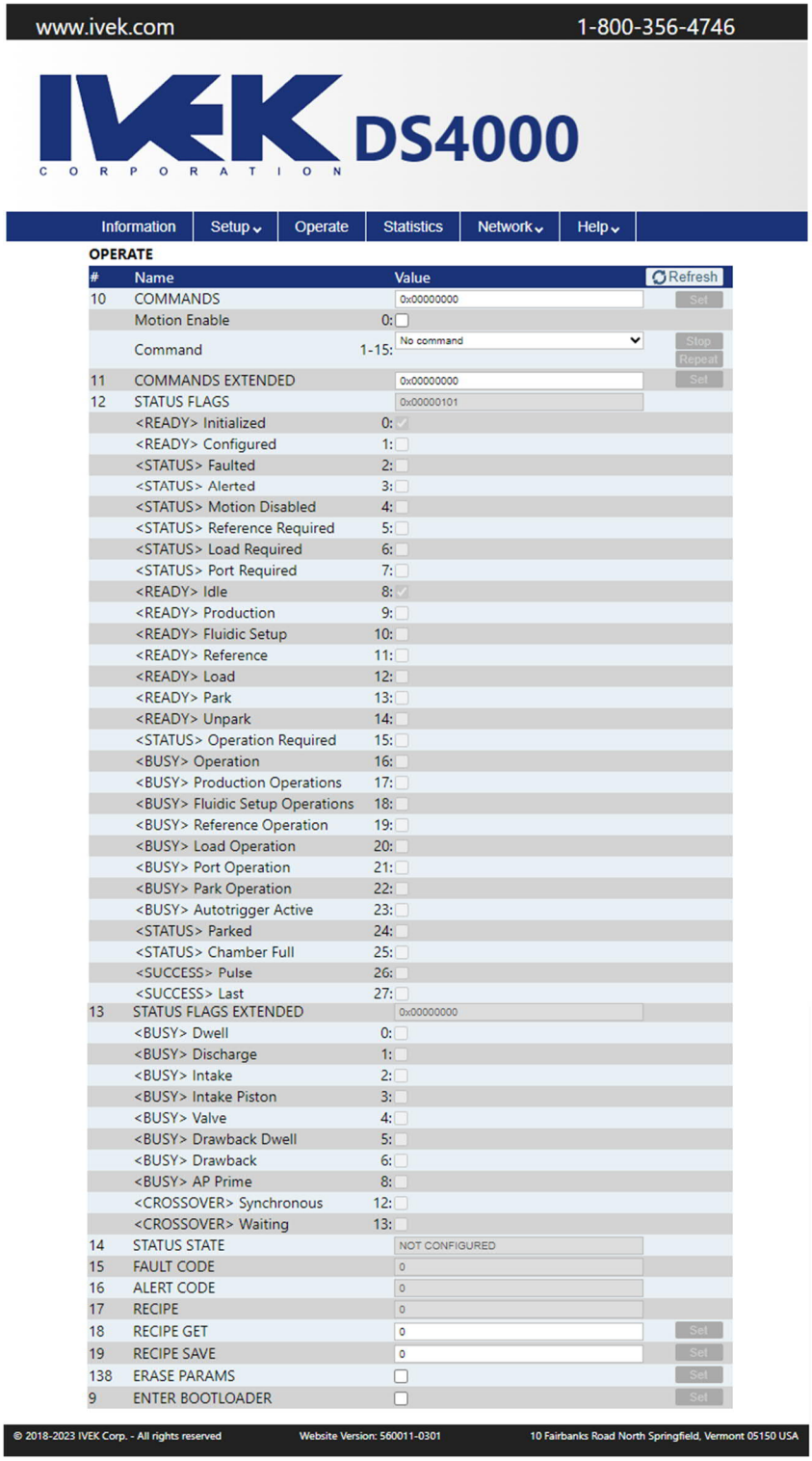


Figure 3.15 – Operate Page

3.5.4.7 Statistics Page (Figure 3.16)

The Statistics Screen displays a variety of useful information pertaining to the operation of the system. See Appendix A for additional information.

Figure 3.16 – Statistics Page

3.5.4.8 Network->Status Page (Figure 3.17)

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

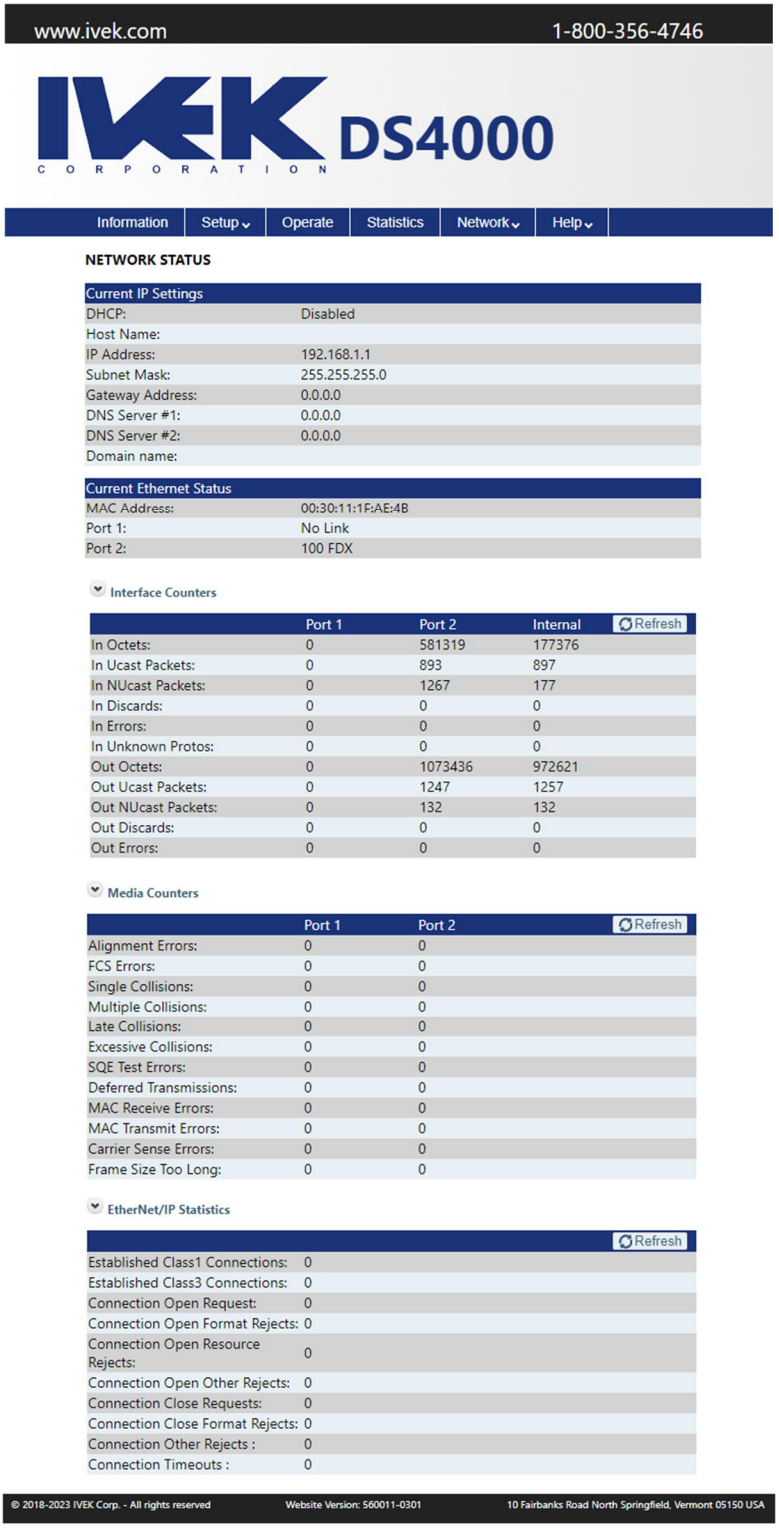


Figure 3.17 – Network Status

3.5.4.9 Network->Configuration Page (Figure 3.18)

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

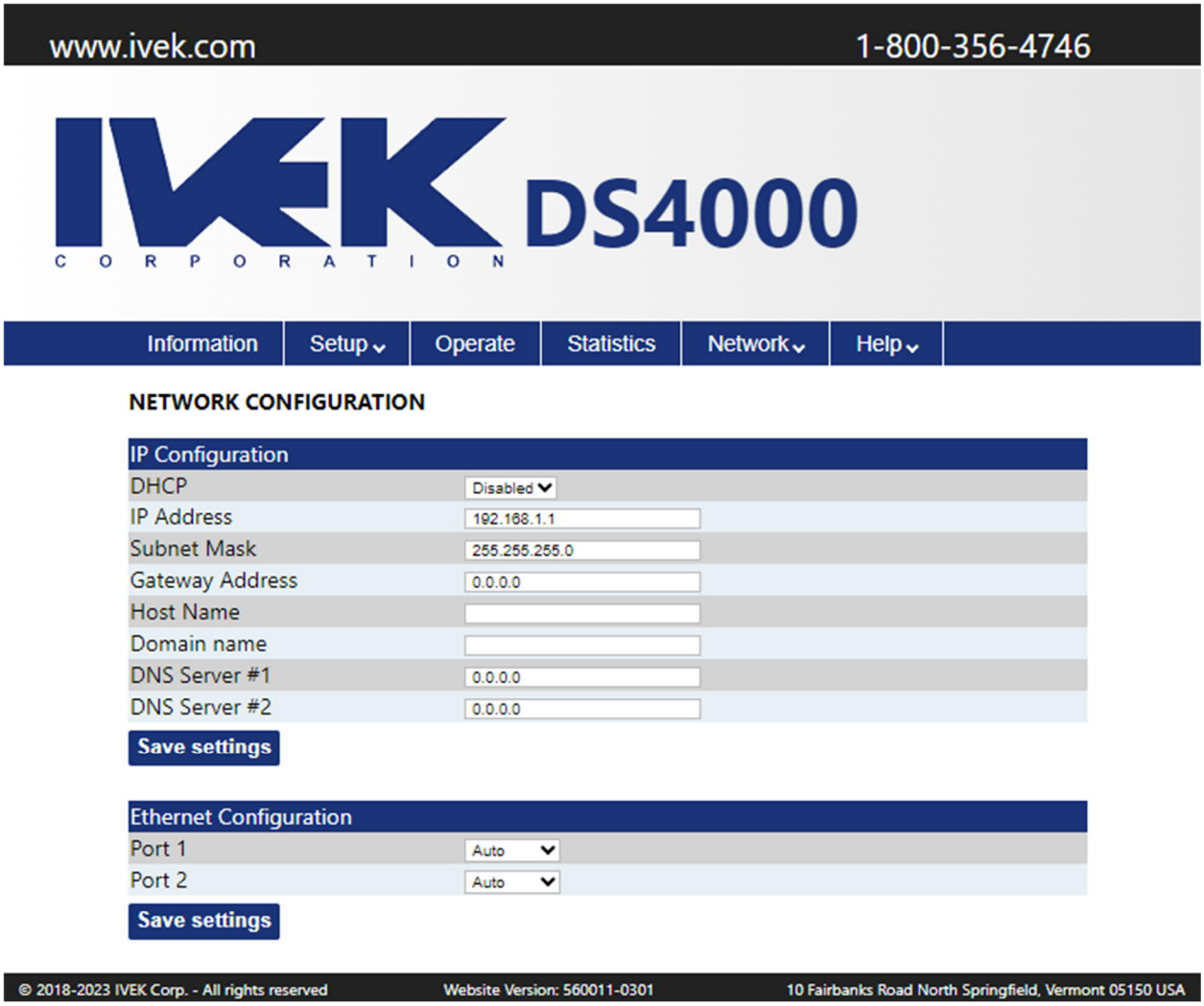


Figure 3.18 – Configuration Page

3.5.4.10 Network->CPU Page (Figure 3.19)

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

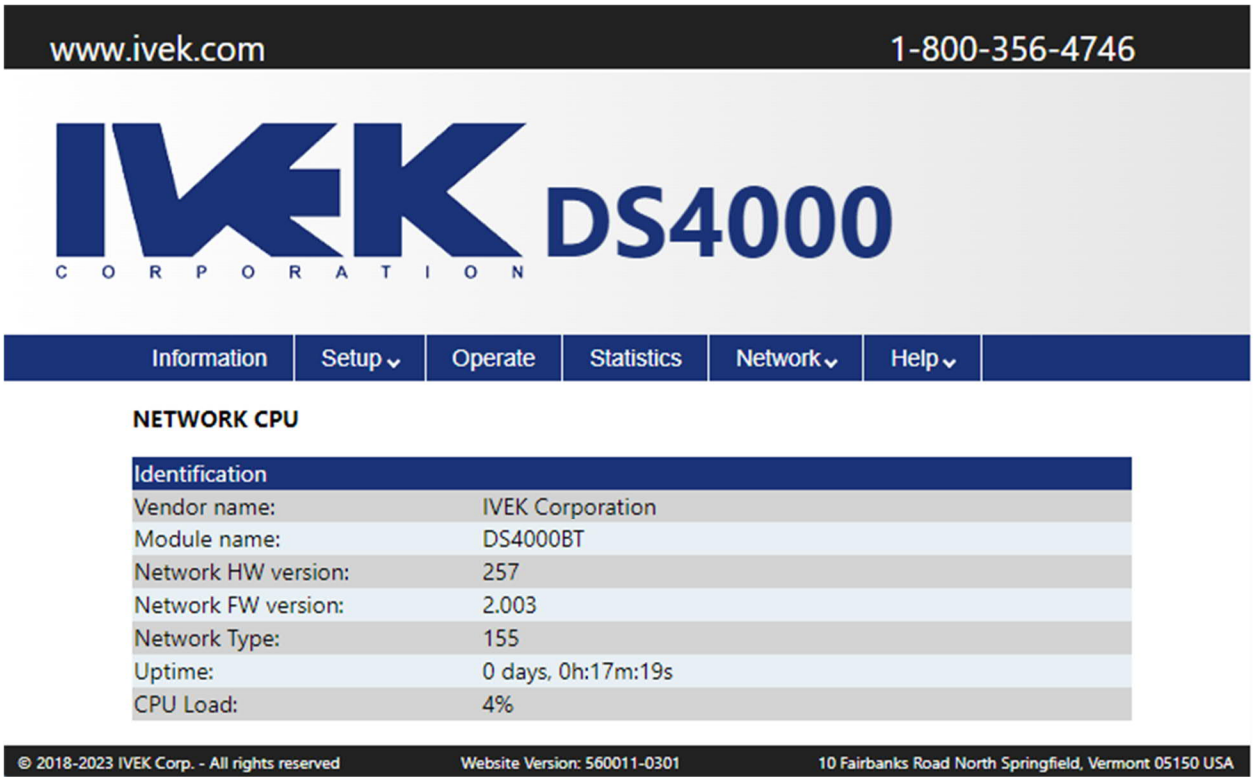


Figure 3.19 – Network CPU Page

3.5.4.11 Help->Manual Page (Figure 3.20)

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

Figure 3.20 – Manual Page

3.5.4.12 Help->Units & Decimal Points Page (Figure 3.21)

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

Figure 3.21 – Units & Decimal Points Page

3.5.4.13 Help->Backup/Restore DS4000 Page (Figure 3.22)

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.

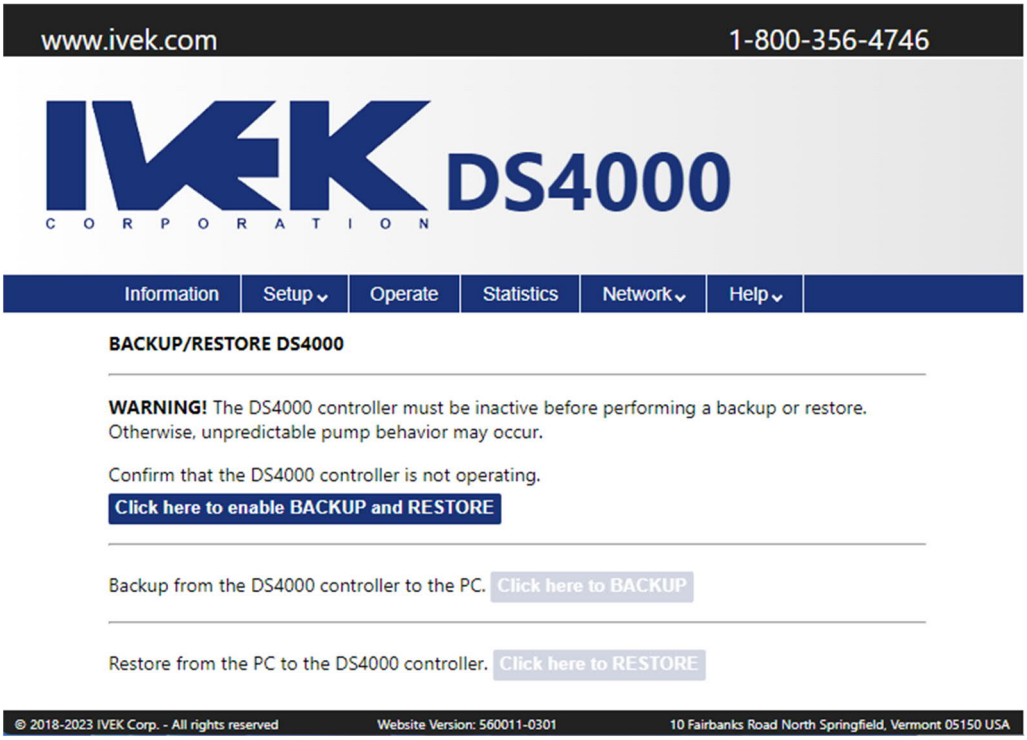


Figure 3.22 – Help->Backup/Restore DS4000 Page

3.5.4.14 Help->Contact Us Page (Figure 3.23)

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

Figure 3.23 – Contact Us Page

3.6 ALERTS

Alerts are a result of the system detecting an issue with a parameter. 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. 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.

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

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

3.8 LIQUID EYE SYSTEMS

Not used by DS4000PM. Please leave at default values.

3.9 ANALOG IN/OUT (4-20MA)

Not used by DS4000PM. Please leave at default values.

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.

- None.

3.11 PROBLEM GUIDE

Table 3.1 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 3.1 – Common Operational Problems and Solutions

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
Power is on, Status indicator blinking red.	Unit is in bootloader mode.	Program a new firmware image or power-cycle to exit bootloader mode.
	A fault exists on the unit.	Clear the fault condition.
Power LED is not illuminated.	No DC power to the unit or blown internal fuse	Ensure DC power is properly supplied to the unit and that fuse is expected value.
Power LED is red	DC Power is out of range	DC voltage is either well above 48V or well below 24V.
Power LED is green	Normal operation	
Network LED is green	Normal operation, fieldbus master connected to unit.	NOTE: Network LED does not indicate whether web browser is connected. NOTE: When fieldbus master is present, the COMMAND and COMMAND EXT parameters are being written by the fieldbus master and the web pages may not be able to change these values.
Network LED is orange	Fieldbus master not connected to the unit.	Make sure cabling is secure. Make sure fieldbus scanner has correct address configured and that I/O data sizes match. NOTE: Network LED does not indicate whether web browser is connected
Network LED is red	Errant fieldbus module	Power cycle unit to see if the issue clears. Make sure fieldbus module is properly seated on the circuit board.
Status LED is green	Normal operation, idle pumping operation	
Status LED is orange	Normal operation, pumping operation is active	
Status LED is blinking green	Alert is present	An alert is present. Read code from Alert Code register and clear the alert using the clear alert command bit.
Status LED is blinking red	Fault is present	A Fault is present. Reda code form Alert Code register and clear the fault using the clear fault command bit.
Power is on, controller accepts a trigger, 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.
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 INPUT POWER Requirements

Input Power Requirements: 24-48VDC, 8ADC Max. Recommended input voltage is 48VDC for most applications since motor torque decreases as rotational speed increases due to back EMF.

Table 3.2 – Power Requirements per Motor/Base or Actuator

Motor/Base or Actuator	Description	Recommended Power Supply Wattage
032037-#####	LINEAR ACTUATOR MODULE, DIGISPENSE® 2000-40; STANDARD STEPPER	48W
032038-#####	LINEAR ACTUATOR MODULE, DIGISPENSE® 2000-40; STANDARD STEPPER	60W
032241-1#####	DS2000 LINEAR ACTUATOR MODULE, PANEL MOUNT; 40-PITCH MCV	48W
032241-2#####	DS2000 LINEAR ACTUATOR MODULE, PANEL MOUNT, 20-PITCH MCV	60W
032241-5#####	DS2000 LINEAR ACTUATOR MODULE, PANEL MOUNT; 40-PITCH; NO ENC, OPT LIN	48W
032241-6#####	DS2000 LINEAR ACTUATOR MODULE, PANEL MOUNT; 40-PITCH; ENC, OPT LIN	48W
032241-7#####	DS2000 LINEAR ACTUATOR MODULE, PANEL MOUNT, 20-PITCH; NO ENC, OPT LIN	60W
032241-8#####	DS2000 LINEAR ACTUATOR MODULE, PANEL MOUNT, 20-PITCH; ENC, OPT LIN	60W
032254-#####	LINEAR ACTUATOR MODULE, DIGISPENSE, 2000-20 MCV, STYLE A	60W
032255-#####	LINEAR ACTUATOR MODULE, DIGISPENSE, 2000-40 MCV, STYLE A	48W
082214-#####	MOTOR/BASE MODULE, SINGLE END, MEGASPENSE; STANDARD STEPPER	200W

082216-#####	MOTOR/BASE MODULE, DOUBLE END, MEGASPENSE; STANDARD STEPPER	200W
032255-#####	LINEAR ACTUATOR MODULE, DIGISPENSE, 2000-40 MCV, STYLE A	48W
092117-##1#	MOTOR/BASE MODULE, SINGLE END, HEAVY DUTY; 1-STACK STEPPER	100W
092117-##2#	MOTOR/BASE MODULE, SINGLE END, HEAVY DUTY; 2-STACK STEPPER	100W
092117-##3#	MOTOR/BASE MODULE, SINGLE END, HEAVY DUTY; 3-STACK STEPPER	120W
092117-##5#	MOTOR/BASE MODULE, SINGLE END, HEAVY DUTY; HIGH TORQUE BIPOLAR STEPPER	120W
092128-##1#	MOTOR/BASE MODULE, DOUBLE END, HEAVY DUTY; 1-STACK STEPPER	100W
092128-##2#	MOTOR/BASE MODULE, DOUBLE END, HEAVY DUTY; 2-STACK STEPPER	100W
092128-##3#	MOTOR/BASE MODULE, DOUBLE END, HEAVY DUTY; 3-STACK STEPPER	120W
092128-##5#	MOTOR/BASE MODULE, DOUBLE END, HEAVY DUTY; HIGH TORQUE BIPOLAR STEPPER	120W
102006-2###	MOTOR/BASE MODULE, ROTARY ADJUST, SIZE 23, DOUBLE ENDED; RARE EARTH UNIPOLAR STEPPER	48W
102006-4###	MOTOR/BASE MODULE, ROTARY ADJUST, SIZE 23, DOUBLE ENDED; HIGH TORQUE UNIPOLAR STEPPER	48W
102006-5###	MOTOR/BASE MODULE, ROTARY ADJUST, SIZE 23, DOUBLE ENDED; HIGH TORQUE BIPOLAR STEPPER	72W
102009-2###	MOTOR/BASE MODULE, ROTARY ADJUST, SIZE 23, SINGLE END; RARE EARTH UNIPOLAR STEPPER	48W
102009-4###	MOTOR/BASE MODULE, ROTARY ADJUST, SIZE 23, SINGLE END; HIGH TORQUE UNIPOLAR STEPPER	48W
102009-5###	MOTOR/BASE MODULE, ROTARY ADJUST, SIZE 23, SINGLE END; HIGH TORQUE BIPOLAR STEPPER	72W
102118-2###	MOTOR/BASE MODULE, MICROSPENSE-AP, SINGLE END; RARE EARTH UNIPOLAR STEPPER	48W
102118-4###	MOTOR/BASE MODULE, MICROSPENSE-AP, SINGLE END; HIGH TORQUE UNIPOLAR STEPPER	48W
102118-5###	MOTOR/BASE MODULE, MICROSPENSE-AP, SINGLE END; HIGH TORQUE BIPOLAR STEPPER	72W
102144-2###	MOTOR/BASE MODULE, MICROSPENSE-AP, DOUBLE END; RARE EARTH UNIPOLAR STEPPER	48W
102144-4###	MOTOR/BASE MODULE, MICROSPENSE-AP, DOUBLE END; HIGH TORQUE UNIPOLAR STEPPER	48W

102144-5###	MOTOR/BASE MODULE, MICROSPENSE-AP, DOUBLE END; HIGH TORQUE BIPOLAR STEPPER	72W
102150-2####	MOTOR/BASE MODULE, MICROSPENSE-AP, PANEL MOUNTED; RARE EARTH UNIPOLAR STEPPER	48W
102150-4####	MOTOR/BASE MODULE, MICROSPENSE-AP, PANEL MOUNTED; HIGH TORQUE UNIPOLAR STEPPER	48W
102150-5####	MOTOR/BASE MODULE, MICROSPENSE-AP, PANEL MOUNTED; HIGH TORQUE BIPOLAR STEPPER	72W

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.

520269 – # # # # #

Drive Interface
- **A** – 1500 RPM, 24-48 VDC, 5 Arms Output

Logic I/O
- **A** – No I/O

Fieldbus Module
- **A** – EtherNet/IP, no bootloader, v1.x parameters
- **B** – EtherNet/IP, bootloader, v2.x parameters
- **E** – EtherCAT, bootloader, v2.x parameters
- **F** – PROFINET, bootloader, v2.x parameters

Enclosure
- **A** – Steel, Grey/White

Connectors
- **A** – Standard

3.14 ILLUSTRATED PARTS BREAKDOWN

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

3.15 ACCESSORIES

The following accessories are available for your Controller Module.

Linear Actuator Cables

540294-###	Cable Assy, Linear, DS4000PM, Std, Sty A; ### = Length in decimeters (010 = 1 meter)
540295-###	Cable Assy, Linear, DS4000PM, Enc, Sty A; ### = Length in decimeters

Rotary Motor/Base Cables

540293-### Cable Assy, Rotary Step, Mcrsp, Sty 2 To DS4000PM, Sty A;
= Length in decimeters
540292-### Cable Assy, Rotary Step, STD & HD Sty 2 to DS4000PM, Sty B
= Length in decimeters
540288-### Cable Assy, Rotary Step, MB3 to DS4000PM, Sty A;
= Length in decimeters

Adaptor Cables

540297-### Cable Assy, Lin & Rot, DS4000PM, Panel, Sty A;
= Length in decimeters (010 = 1 meter)

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, f1, f2, k0, l0, l1, p3,	W	Available in assembly instance 0x96 0x00000000 = Min (Default) 0xFFFFFFFF = Max
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 = 082214-##### 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=032241-8#####
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 TIMED	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

172 173 174 175 180 181	LOGIC IN 1 INVERT LOGIC IN 2 INVERT LOGIC IN 3 INVERT LOGIC IN 4 INVERT CC IN 1 INVERT CC IN 2 INVERT	BOOL	System 5	System	h31 h32 h33 h34 h30 h39	R/W	0 = Disabled (Default) 1 = Enabled
184 185 186 187 192 193	LOGIC IN 1 (VALUE) LOGIC IN 2 (VALUE) LOGIC IN 3 (VALUE) LOGIC IN 4 (VALUE) CC IN 1 (VALUE) CC IN 2 (VALUE)	BOOL	I/O Test	System	h51 h52 h53 h54 h50 h59	R	0 = False (Default) 1 = True
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
200 201 202 203 208 209	LOGIC OUT 1 (CONFIG) LOGIC OUT 2 (CONFIG) LOGIC OUT 3 (CONFIG) LOGIC OUT 4 (CONFIG) AUX OUT 1 (CONFIG) AUX OUT 2 (CONFIG)	ENUM	System 6	System	h21 h22 h23 h24 h20 h29	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

							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

D	01/15/2025	Updates per DCRN 22448 to include PROFINET, and MCV, among other things
C	08/13/2024	Updates per DCRN 22020
B	08/11/2023	Updates per DCRN 21730
A	3/15/2022	Added Cyclic Data Exchange information per DCR/N 21065
-	5/13/2021	Initial release