

# ***DIGISPENSE 1000 CONTROLLED SUBSTANCE DISPENSING SYSTEM***

## ***OPERATING AND MAINTENANCE MANUAL***

### **SERIAL NUMBERS**

CONTROLLER:   
MOTOR/BASE:

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# SPECIFICATIONS

Product: Digispense 1000 Controller Module  
 Model Number: 520260-   
 Line Power: 100V - 240V, 50/60Hz, 1Ø, 300VA  
 Fuse (5 x 20mm): 4.0A • 250VAC • Time Lag and High Ampacity, T4AH  
 Motor Speed: 1800 RPM  
 Baud Rate: 9600  
 Options:

Product: Single End Microspense AP Motor/Base Module with  
 Micro Rotary Pump Module  
 Model Number: 102197  
 Size/Material: A/Alumina

## NOTE

*The serial numbers listed are for the modules shipped with the system.  
 These numbers may have changed if a module was changed.*

Additional parts available for your System

<b>Part#</b>	<b>Description</b>
142251	Glassware, Vol. Flask, 10mL
142247	Tubing Accessory Kit, Methadone
132402-01*	Controlled Substance Dispensing Station (CSDS) Mod, Sty A; PC Clear Cover
132402-02*	Controlled Substance Dispensing Station (CSDS) Sty A; Clear Cover W/O Pump
132426	Wall Mount Kit, CSDS Enclosure; Delrin, Quantity 4
540280-020	Cable Assy, Rotary BLDC Sty 2 to DS1000, Sty A

Refer to Section 2,6 - Options

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**2. DIGISPENSE 1000 CONTROLLED SUBSTANCE DISPENSING SYSTEM**

The Digispense 1000 Controlled Substance Dispensing System, hereafter referred to as the system, contains all the monitoring and interface components for the dispensing operations. The system contains a Controller Module, Motor/Base Module and a Pump Module. The operator indicators are located on the front panel of the Controller Module and the interface connections are located on the rear panel of the Controller Module.

**2.1 GENERAL INFORMATION**

**NOTE**

*This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take measures to reduce interference.*

**2.1.1 Upon Receiving**

**2.1.1.1 Unpacking**

The packing slip identifies the type and number of units included. Verify contents upon receipt and visually check for shipping damage. If damage is evident or shipping container condition indicates possible damage, report this immediately to your purchasing or other appropriate department and, if possible, take photographs of the damage.

**2.1.1.2 Read Manual Completely**

The precision components and systems manufactured by IVEK Corporation are designed for long term, continuous use in many different high technology manufacturing applications. The detailed procedures and specifications included in this manual will insure the proper function and expected longevity of the equipment. It is of the utmost importance that all responsible operating, maintenance and engineering personnel receive the necessary operational and safety training required to correctly operate and maintain the components and/or system. This training must include the reading and understanding of this manual in its entirety.

**2.1.1.3 Packaging**

IVEK Corporation will not be responsible for damage due to improper unpacking upon receipt or any subsequent packaging of equipment returned for repair.

**2.1.2 Environmental Conditions**

Location: Indoor Use Only	Altitude: Up to 2000 meters	Temperature: 5°C to 40°C
Maximum Relative Humidity:	80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C	
Voltage Fluctuations Limit:	Not to exceed ± 10% of the nominal voltage.	
Overvoltage Category:	II	
Pollution Degree:	2	

**2.1.3 Electrical**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Compliance to CAN ICES-3 (A)/NMB-3(A).

**WARNING**

*Hazardous voltages exist inside the Controller Module enclosure. Under no circumstances should any Controller Module be opened.*

There are no user serviceable parts inside the Controller Module enclosure. Any unauthorized access to the inside of the Controller Module will void the warranty. Please contact IVEK Corporation's Technical Service Department for assistance.

All Controller Modules and applicable peripheral devices are equipped with a power connection point. This equipment must be grounded. Connect only to a properly grounded power source. Improper use of the grounding plug may result in electrical shock.

**UNDER NO CIRCUMSTANCES SHOULD THE MAIN FUSE BE TAMPERED WITH OR REPLACED BY ONE THAT EXCEEDS THE RATING FOR ANY SYSTEM COMPONENT. EXTENSIVE DAMAGE MAY RESULT.**

Do not immerse any Controller Module or Motor/Base Module in water or other liquids. Fluids must be located away from the Controller to prevent spillage into the equipment.

**2.1.4 Mechanical**

All mechanical assemblies with moving parts are designed with closure covers and lockout mechanisms, where applicable, to protect operating personnel and the equipment. Never operate the equipment without the appropriate covers in place and lockout mechanisms activated.

Be aware of "Pinch Points" and use extreme caution when operating systems which include peripheral, motion control subcomponents.

Use extreme caution when handling the ceramic components of the Pump Module. Never forcefully insert or remove a piston from the cylinder. Proper training is required prior to removal of any component. For information on training and availability, please contact IVEK's Technical Service Department.

**2.1.5 Biological**

Specific biological hazards to personnel may exist due to the process application. The end user is completely responsible for the training of personnel for possible biological hazards. For more information contact the local office of the Occupational Safety and Health Administration (OSHA) or appropriate agency for your country.

### 2.1.6 Chemical

Specific chemical hazards to personnel may exist due to the process application. The end user is completely responsible for the training of personnel for possible chemical hazards. For more information contact the local OSHA office or appropriate agency for your country.

**A thorough application analysis must be performed to eliminate the possibility of chemical incompatibility between application liquids (process and cleaning) and the Pump Module ceramics or liquid circuit components.**

### 2.1.7 Warranty

IVEK products when installed properly are warranted to perform in accordance with published specifications. IVEK warrants that the equipment will be free from defects in materials and workmanship for a period of one year from date of shipment, IVEK will correct any defects within the warranty period by repairing or replacing any defective part or parts which are returned freight prepaid. Our liability will not, in any case, exceed the cost of correcting the defect in the IVEK equipment as herein provided; and upon the expiration of the warranty period, all liability will terminate. The foregoing will constitute your sole remedy and our sole liability. In no event shall IVEK be liable for special or consequential damages.

#### **NOTE**

*All chemicals **must** be removed from equipment being returned to IVEK Corporation for repair.*

### 2.1.8 Repair

Equipment returned for repair must be accompanied by a Return Material Authorization (RMA) number. The RMA number will be supplied by IVEK and is used to track incoming shipments through the repair or upgrade process.

Equipment under warranty will be repaired at no charge. Equipment not under warranty will be repaired on a materials and labor basis. A Purchase Order number is due upon completion of the repairs which may be subject to a minimum charge (contact IVEK for the minimum charge). Equipment must be sent to IVEK prepaid. Return transportation will be billed as part of the repair.

IVEK will not be responsible for damage due to improper packaging of equipment returned for repair.

### 2.1.9 Symbols

The following symbols may appear in this manual.

#### **NOTE**

Statements identify hints and instructions.

#### **CAUTION**

Statements identify conditions or practices that could result in damage to the equipment or other property.

**WARNING**

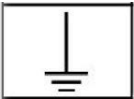
Statements identify conditions or practices that could result in personal injury or loss of life.



Indicates the equipment has been CE Certified.



Identifies a caution area.



Indicates Earth (ground) terminal.

## 2.2 OPERATION

This section provides valuable information and procedures to assist the end user in understanding and solving a variety of problems that may be encountered during the design, development and optimization of their current or future liquid management system.

### 2.2.1 Components

Each liquid management system consists of a Controller Module, Motor/Base and a Pump Module.

#### 2.2.1.1 **Controller Module (Figures 2.1 and 2.2)**

The Controller Module contains the electronics to operate the system. The operator can monitor the operation of the system from the Controller Module.

#### 2.2.1.2 **Motor/Base Module (Figure 2.3)**

The Motor/Base Module provides the drive mechanism for the Pump Module. Different configurations are used to match the requirements of the application.

#### 2.2.1.3 **Pump Module (Figure 2.4)**

The positive displacement piston pump is constructed of precision machined ceramic and other chemically resistant materials. Piston geometry, liquid port locations in the cylinder and piston motion provide positive control of the valving function that provides volumetric

repeatability not found in other designs. The piston/cylinder set has a diametral clearance of about 0.00010 inches, eliminating the need for piston seals or rings.

#### **2.2.1.4 System Interface**

IVEK liquid management systems can easily be interfaced as a whole system sub-component with a computer. The appropriate procedural and specification Documentation for all included system options and accessories are contained in this manual.

### **2.2.2 System Setup**

General operating practices provide the best guidelines for locating the components of the system. The Motor/Base and Pump Modules must be closer to the dispensing location as the volume decreases and desired accuracy increases. The Controller Module should be located for ease of use during all phases of operation and maintenance.

#### **2.2.2.1 Supply Connections**

The supply reservoir must provide an adequate supply of material to the inlet of the pump.

#### **NOTE**

*The supply tubing inner diameter should always be as large as or larger than the discharge tubing.*

#### **2.2.2.2 Discharge Connections**

Discharge tubing requirements are also dependent on the application. For some critical low-volume applications, the relative height of the dispense tip and the supply reservoir is critical to proper performance. Many dispensing applications benefit from a short length of tubing with rigid walls connecting the pump to the dispense tip with any movement of the tubing constrained.

#### **2.2.2.3 Power Connections**

Make sure the power switch is in the "OFF" position. Connect power to the Controller Module. Refer to the Specification section of this manual for the voltage and current requirements of this system.

#### **2.2.2.4 Setup Checks**

Prior to turning the system on, perform the following checks:

- The supply tubing is secured (mechanically and fluidically) to the supply reservoir.
- The supply tubing connection in the supply reservoir is submerged in the liquid.
- No unnecessary loops of supply tubing exist.
- All bends in the supply tubing have a radius large enough to prevent the possibility of kinks or other constrictions in the liquid path.
  
- The supply tubing is secure on the inlet fitting of the pump.
- The discharge tubing is secure on the outlet fitting of the pump.
- No unnecessary loops of discharge tubing exist.



- All bends in the discharge tubing have a radius large enough to prevent the possibility of kinks or other constrictions in the liquid path.
- The discharge tubing is secured (mechanically and fluidically) to the dispense tip holder or directly to the dispense tip.
- The dispense tip is secured in place.

### Digispense HYPERTERMINALCOMMAND Procedure

NOTE: Make sure that your Caps Lock is ON, all hyperterminal commands are uppercase.

Fill an Empty Clean Bottle with ONLY Clean Distilled Water. Insert the INPUT (left) side of the Tubing and secure to the top of the "Bottle. In a large Cup or Flask, insert the OUTPUT (right) side of the Tubing in order to collect the water being dispensed out of the Pump.

### MAKE SURE THE POWER CORD AND COMPUTER ARE PLUGGED IN THEN TURN THE POWER ON

STEP	COMMAND	ACTION	REASON
1	P(enter)	PRIME	To Introduce Water into the Tubing (99 sec.)
2	V500 (enter)	Volume/500 strokes	Initial Dispense (Not Measured)
<p>NOTE: 0.1 mL per stroke, meaning 500 strokes = 50mL or 100 strokes = 10mL</p> <p>Remove the Cup or Flask and hold the OUTPUT Tubing just inside the top of "the 10mL Volumetric Glass Flask (provided by IVEK) at a slight angle in order to "prevent any splashing of water and being careful not to spill during the dispensing.</p>			
	3V100 (enter)	Volume/100 strokes	10mL Flask Calibration Test
<p>NOTE: The water level of the dispense in the flask is called the <u>meniscus</u> and will be shaped like a bowl. The <u>line in the glass flask should pass through</u> somewhere between <u>the top and the bottom of the meniscus (bowl)</u>. Verify that the meniscus is where it should be and then empty the flask of <u>all water and dry completely</u>, inside and out. Repeat Step 3 as many times as needed, but always remember to <u>empty</u> and dry the flask after every <u>10mL</u> Calibration test.</p>			
4	R (enter)	REVERSE	Water will Pump Backwards
5	V350(enter)	Volume/350 strokes	To Empty the Tubing of Water
<p><b>UPON COMPLETION, TURN POWER OFF FIRST AND THEN UNPLUG THE POWER CORD AND COMPUTER CABLE</b></p>			

### **2.2.2.5 Priming Procedure**

Air bubbles can become trapped throughout the tubing and Pump Module when liquid is first introduced into the system. Bubbles create a void in the liquid during the dosing process causing low and/or inconsistent measurements. (Refer to the next page for the Priming procedure when using the terminal emulator)

In order to eliminate these bubbles, the pump must be “Primed” by continuously purging liquid until no bubbles are observed. Bubbles usually accumulate around the fittings (connecting the tubing to the pump module) and along the tubing walls.

Once priming begins and a steady stream is being dispensed, the Operator needs to perform the following:

- Gently squeeze the inlet tubing (left-hand side when facing the pump module with the motor cable in the back) a couple of times to create a vacuum effect inside the pump module. This forces any bubbles trapped inside the pumping chamber to be released.
- Gently tap on the brim of the port fittings to release any bubbles.
- Follow along the entire length of the tubing, on both sides of the pump module, looking for any bubbles attached to the tubing walls. Gently tap the tubing at the location of the bubble until the bubble releases.

### **2.2.3 General Cleaning And Decontamination**

Routine cleaning and (or) decontamination is extremely important in order to prolong the life and ensure the proper function of all liquid management system components.

In the following sections, the terms cleaning and decontamination are differentiated as follows:

**Cleaning** -The removal of gross biological and molecular contamination and (or) process liquids from the liquid path including the pump cylinder, inlet/outlet tubing and respective connectors and dispensing tips or cannula. Cleaning will also refer to the surface cleaning of the Controller and Motor/Base Modules or any critical working surfaces of any additional system components.

Cleaning maybe required when the system is idle for long periods of time to prevent the piston from becoming seized in the cylinder.

**Decontamination** - Recommended procedure for the elimination of biological and (or) molecular contaminants that would have a negative effect on the application process liquids through a qualified sterilization or depyrogenation process including chemical sterilants or steam sterilization.

#### **2.2.3.1 Guidelines**

Due to the large variety of process applications utilizing IVEK liquid management systems, this section provides general recommendations regarding cleaning and decontamination practices and procedures. It is ultimately the responsibility of the end user to ensure that a complete evaluation of cleaning and decontamination of this system and its components is performed. It is also imperative that all operating personnel are correctly trained in the proper methods and are diligent in their maintenance of cleaning and decontamination procedures.

### **2.2.3.2 Cleaning Procedure**

After the liquid system has been emptied as described in Section 2.3.2.4, a suitable cleaning liquid is pumped through the system.

Cleaning can be accomplished with either a forward circulation, forward/reverse circulation or a single-pass procedure. In any case, sufficient cleaning liquid must be used to remove any accumulations of the process liquid from the piston and cylinder.

**Circulation Cleaning** - Connect the supply and discharge tubing to a container of cleaning liquid. The system is operated in the Fill mode in forward until there is confidence the tubing and pump chamber are clean.

The supply of cleaning liquid must be large enough to ensure the application liquid cleaned from the system does not form a significant concentration in the cleaning liquid. It may be necessary to change the cleaning liquid if the concentration of the application liquid is too high.

**Forward/Reverse Circulation Cleaning** - Connect the supply and discharge tubing to a container of cleaning liquid. The system is operated in the Fill mode alternating between forward and reverse until there is confidence the tubing and pump chamber are clean.

**Single-Pass Cleaning** - Place an adequate amount of cleaning liquid in the supply reservoir and place a waste container under the dispense tip to collect the used cleaning liquid. The system is operated in the Fill mode until there is confidence the tubing and pump chamber are clean.

**Recommended Compatible Cleaning Liquids** - Following is a partial list of cleaning liquids. Contact IVEK Corporation for additional recommendations.

- Tepid Distilled Water

### **2.2.4 Decontamination Procedure**

For systems that have been qualified by the end user for a clean or sterilize in place process, follow the instructions for cleaning in Section 2.2.3.2 for application of the liquid sterilant through the liquid circuit and Pump Module.

### **2.2.5 Storage**

Storage refers to any extended time that the system remains idle. The main concern is liquid drying in the piston/cylinder area, causing the piston to seize in the cylinder. The duration of idle time that requires storage procedures are based on the liquid, Pump Module configuration, and operating environment.

Leave the liquid circuit and Pump Module assembled in place. Load the liquid circuit with a compatible cleaning liquid or other liquid and leave the system wet. Prior to the next use, the storage liquid can be purged during setup for operations.

### **2.2.6 Poor Dispense Repeatability**

An air bubble in the pump chamber will reduce volumetric repeatability. The changes in pressure that occur during intake and discharge will change the size of the bubble, and therefore affect the volume of liquid being displaced. In many systems, the pressure is low during the inlet stroke causing the bubble to increase in size, and high during the outlet stroke causing the bubble to decrease in size. In all cases, the bubble will reduce the liquid displaced while all other conditions, such as pump displacement, remain constant.

**Repeat The Priming Procedure** - Watch for air bubbles in the tubing (unless the tubing is opaque). (Reference Section 2.2.2.5)

### **2.2.7 Avoiding Bubble Problems**

#### **2.2.7.1 Sources Of Bubbles**

The familiar bubbles that form on the inside walls of a container of tap water after it stands for a period of time at room temperature demonstrate the typical liquid degassing that results from pressure reduction (water line pressure to atmospheric) and/or temperature elevation (from ground ambient to air ambient). In this case, the bubbles contain air, carbon dioxide, or other gaseous materials carried in the water with only small quantities of vaporized water present.

Some liquids respond to agitation, pressure changes, and/or temperature changes by chemically separating into liquid and gas fractions. Other liquids simply vaporize, physically changing from liquid to gaseous form. Examples of liquids releasing gas or changing from liquid to gaseous form in response to agitation and/or temperature/pressure changes are numerous in the modern technical environment.

#### **2.2.7.2 Errors Produced**

A common cause of trouble in metering pump applications requiring low flow rates is a gas bubble trapped within the cylinder of the Pump Module. It expands on the suction stroke and contracts on the discharge stroke, allowing little, if any, liquid to pass through the pump. Such bubbles, though often attributed to leaks in fittings and seals, can sometimes be traced to gases released by the pumped liquid in response to pumping agitation or pressure/temperature changes. This potential source of metering pump error can be effectively controlled in most liquid circuits.

#### **2.2.7.3 Guidelines**

**The following guidelines should be followed to avoid air bubbles.**

- Avoid application liquid temperature/pressure fluctuations.
- Assess the system's physical setup. A vertical alignment of ports, with inlet port down and discharge port up will assist with the removal of air bubbles during initial priming and subsequent operations.
- Avoid multiple connection points where bubbles can be trapped.

**2.3. DIGISPENSE 1000 CONTROLLERMODULE**

**2.3.1 Description**

The Digispense 1000 Controller Module, hereafter referred to as the Controller Module, contains all the control, monitoring, and interface components for the dispensing operations. The Controller Module measures 8 1/4" (210mm) wide, 11 1/2" (292mm) deep, 5 3/4" (146mm) high (feet included) and weighs approximately 9.5 pounds (4.3 kilograms).

The interface connections are located on the rear panel.

**2.3.1.1 Front Panel Indicators (Figure 2.1)**

The front panel contains the indicators for monitoring the system. The following standard indicators are located on the front panel.

- |   |          |   |         |
|---|----------|---|---------|
| 1 | FAULT    | 5 | PRIME   |
| 2 | WAIT     | 6 | FORWARD |
| 3 | READY    | 7 | REVERSE |
| 4 | DISPENSE |   |         |

**FAULT Indicator (Figure 2.1 Item 1)** - The FAULT Indicator illuminates when the system has faulted.

**WAIT Indicator (Figure 2.1 Item 2)** - The WAIT Indicator illuminates when a cycle has been started and has not yet been completed.

**READY Indicator (Figure 2.1 Item 3)** - The READY Indicator illuminates when the unit is ready for its next cycle.

**DISPENSE Indicator (Figure 2.1 Item 4)** - The DISPENSE Indicator illuminates when the system is in Dispense mode.



**Figure 2.1 Digispense 1000 Front Panel**

**PRIME Indicator (Figure 2.1 Item 5)** - The PRIME Indicator illuminates when the system is in Prime mode.

**Forward Indicator (Figure 2.1 Item 6)** - The FORWARD Indicator illuminates when the system is in Forward.

**REVERSE Indicator (Figure 2.1 Item 7)** - The red REVERSE Indicator illuminates when the system is in Reverse.

**2.3.1.2 Rear Panel Detail (Figure 2.2)**

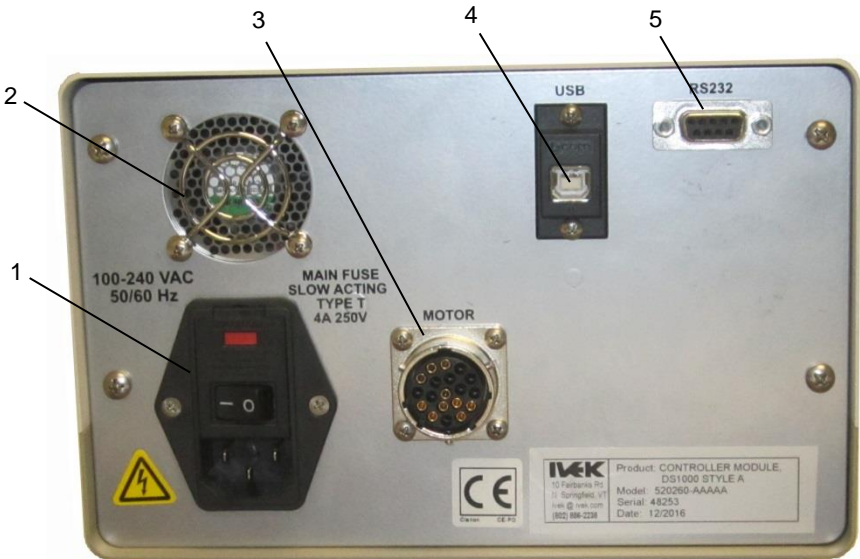
The rear panel contains the interface connections for the system. The following components are located on the rear panel.

- |   |                            |   |                       |
|---|----------------------------|---|-----------------------|
| 1 | Power Entry Module         | 4 | USB Cable Connector   |
| 2 | Fan                        | 5 | RS232 Cable Connector |
| 3 | Motor/Base Cable Connector |   |                       |

**Power Entry Module (Figure 2.2 Item 1)** - The power entry module contains a receptacle for a standard IEC power Cord, an On (1) Off (O) Switch, fuse holder and fuse.

The design of the power entry module requires the line cord to be disconnected before the line fuse is removed.

Refer to the Title Page section of this manual to determine the power connection and fuse specifications for this Controller Module.



**Figure 2.2 Digispense 1000 Rear Panel**

**Fan (Figure 2.2 Item 2)** - The fan keeps the devices in the Controller Module from getting too hot. Make sure the area around the fan is clear of obstructions.

**Motor/Base Cable Connector (Figure 2.2 Item 3)** - The Motor/Base connector is used for making the electrical connections to the Motor/Base Module.

### **CAUTION**

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

**USB Cable Connector (Figure 2.2 Item 4)** - The USB Cable Connector provides an interface to control a variety of functions. The connector is a type-B device connector. Refer to section 2.3.2.1 for additional information.

**RS232 Cable Connector (Figure 2.2 Item 5)** - The RS232 Cable Connector provides control of all available functions. The hardware is configured as Data Communications Equipment (DCE) standard Refer to Section 2.3.2.1)

## **2.3.2 Operation**

The Controller and Motor/Base Modules are electrically connected together by a cable. The pump is activated when a command is received through the serial interface. The operation of the Controller Module is divided into three sections; Filling, Dispensing and Emptying operations.

### **2.3.2.1 USB Serial Interface**

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

### **2.3.2.2 RS232 Serial Interface**

The RS232 Serial Interface may be attached to a dedicated terminal or may be treated as a peripheral using an appropriately written driver program. The unit uses a standard RS-232 interface through a DB9 connector to communicate to the outside world.

The terminal or driver program used for this application should be configured as follows:

8 data bits No parity 1 or 2 stop bits (the Digispense sends 1)  
Full Duplex  
9600 baud

In addition, the Digispense sets the CTS (Clear To Send) line false when busy, though it does not recognize an RTS (Ready To Send) or any other handshaking. Refer to the chart on the following pages for a listing of commands.

**Commands** - Commands must be entered in upper case. A list of command procedures and commands are shown on the following pages.

If more than 3 digits are sent in the volume "V" command, only the first three are accepted and the rest are ignored.

If more than 2 digits are sent in the prime/empty "C" command, only the first two are accepted and the rest are ignored.

Every command in the following chart must be followed by a CR (carriage return) and a LF (line feed) character, and every reply is preceded and followed by those characters as well. The Digispense prompts with a CR, LF "COMMAND ?" and signals via the CTS line when it is ready for further input from the host with the following exception: during a fill or empty cycle, the CTS signal will be true and the Digispense is ready to process and break signal, though there will be no prompt.

COMMAND	IVEK REPLY	EFFECT
"A" or SPACE	"ABORT"	Stops any dispense cycle immediately
"V###" (### is a 1-3 digit value)	"VOLUME:###"	Sets dispense volume to the number given and begins a dispense cycle in the current pump direction unless the pump is busy.
"X"	"REPEAT"	Begins a dispense cycle for the current dispense volume or a default of one rotation if it has not been set.
"F"	"FORWARD"	Sets the pump direction to forward.
"R"	"REVERSE"	Sets the pump direction to reverse.
"P"	"PRIME"	Sets the dispenser to fill the system for a programmed time ("T").
"E"	"EMPTY"	Sets the dispenser to empty the system by reversing the flow back to the reservoir for a programmed time ('T').
"C##"	"command?"	## is a 1-2 digit value. Sets the prime/empty time between 0 and 99 seconds.
"T"	"CURRENT EMPTY/PRIME TIME (SECONDS): [THE CURRENT]" "NEW EMPTY /PRIME TIME/"	Displays current time in seconds for a prime/empty cycle and prompts for a new time. Enter any number from 0 - 99 followed by a CR & LF.
"S"	"STATUS" "[FORWARD OR REVERSE] DIRECTION" "VOLUME:###" "PUMP [BUSY OR READY]"	Digispense reports its status in its reply.
Undefined Character	"WHAT?"	No effect.
Any Command during dispense operation, (except "A", "ESC", or space	"PUMP BUSY"	No effect.



Any Command sent during Fill/Empty	"ABORT1	Digispense scans serial port during cycle and interprets any character as an abort command.
------------------------------------	---------	---

### 2.3.2.3 Filling

In Fill mode, the rate of liquid flow is directly controlled, but the volume of liquid displaced is not directly controlled. The volume of liquid dispensed is the result of the Pump Module calibration setting, rate and the length of time the system is activated.

**Controller Setup** - Set the switches to the following settings:

- Switch the ON/OFF power switch to "OFF".

### Filling Operation

- Switch the ON/OFF power switch to "ON".
- Enter the "F" command: The system will reply "FORWARD".
- Lift the cap-tubing assembly on the fluid container and hold the discharge outlet tip over the neck of the container pointing inward.
- Enter the "P" command: The system will reply "PRIME". (The pump will run for approximately 90 seconds.)
- Continue to enter the "P" command until liquid exits the nozzle.
- Enter a "V10" command: The system will reply "VOLUME 10". (This dispenses 1000 microliters and positions the piston for Dispensing.)

### 2.3.2.4 Dispensing

Dispense is used to deliver a discrete, specific volume of liquid. The displacement has been preset to 100 microliters per stroke.

The Controller Module provides an accurate adjustment of the rate of the dispense. The exact volume of liquid dispensed is dependent on the displacement of the Pump Module.  
Controller Setup - Set the switches to the following settings:

- Switch the ON/OFF power switch to "OFF", (not required)

### Dispensing Operation

- Switch the ON/OFF power switch to "ON".
- Enter the "V###" command with the ### indicating the dispense volume. (The number entered represents hundreds of microliters, i.e. 23=2300 microliters.)

### 2.3.2.5 Emptying

Empty is used to change the flow direction during dispense or empty the pump inlet tubing, pump chamber, and outlet tubing of liquid when priming and (or) dispensing operations are completed. This mode can be used to return liquid to the supply reservoir rather than forward into a waste container.

The rate of liquid flow is directly controlled. The volume of liquid metered is the result of the rate, the length of time the system is activated and the pump displacement.

**NOTE**

*It is not necessary to shut the power off before switching to the Empty mode.*

**Emptying Operation**

- Enter the "R" command: The system will reply "REVERSE".
- Lift the cap-tubing assembly on the fluid container and hold the discharge outlet tip over a container.
- Enter the "P" command: The system will reply "PRIME".

**2.3.3 Installation**

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

**2.3.4 Options**

IVEK Corporation offers a variety of options to best meet the customer's 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.

**2.3.4.1 Line Cord**

IVEK offers either a domestic or international line cord.

**2.3.5 Maintenance**

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

**2.3.5.1 Assembly/Disassembly Procedures**

The Controller Module contains the following replaceable parts.

- Main Power Fuses

**Main Power Fuses (Figure 2.2 Item 1)** - The main power fuses are located in the Power Entry Module on the rear panel. The proper fuse value is described in the Specification section of this manual.

**Disassembly**

1. Remove the power cord.
2. Using a small flat blade screwdriver, open the power entry module's cover.
3. Using a small flat blade screwdriver, slide the fuse tray out and remove the fuse.

**Assembly**

1. Install the new fuses into the fuse tray and slide the tray in.
2. Close the power entry module's cover.
3. Connect the power cord.

**2.4 SINGLE END MICROSPENSE AP MOTOR/BASE MODULE****2.4.1 Description (Figure 2.3)**

The Single End Microspense AP Motor/Base Module, hereafter referred to as the Motor/Base Module, is comprised of the motor to drive a Pump Module, the base for support, the displacement adjustment mechanism and the cable with a connector. The motor provides accurate control. The displacement adjustment mechanism changes the angle between the axis of the motor and the axis of the Pump Module piston thus changing the pumped volume. The cable connector provides a connection point for the cable from the Controller Module.

**2.4.2 Operation**

The Motor/Base Module is factory calibrated and fixed. Contact IVEK Corporation Technical Service Department if the unit is believed to be out of calibration.

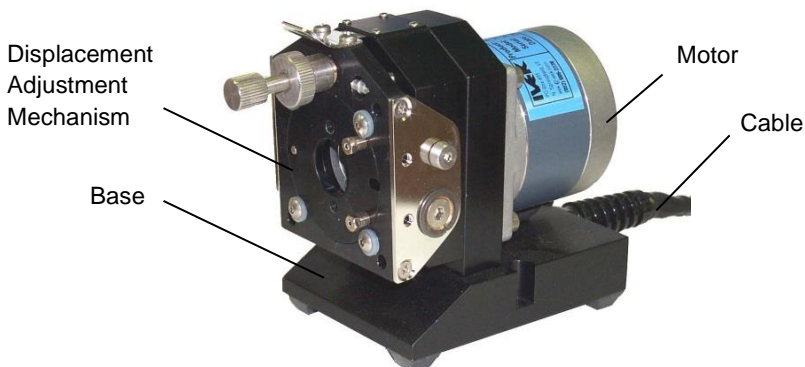
**2.4.3 Installation**

The Motor/Base Module includes two clearance holes for # 8-32 mounting screws. These holes can be used for mounting the Motor/Base Module onto various apparatuses. The orientation of the Pump Module should be considered when mounting the Motor/Base Module. Plan the mounting so the intake and discharge tubing and the Pump Module can be easily accessed. Always keep the discharge of the Pump Module even with or higher than the intake and never mount the Motor/ Base Module so the Pump Module's cylinder end cap faces upward. If mounting to a solid surface, remove the four rubber feet.

**2.4.4 Maintenance****CAUTION**

*Never connect or disconnect the cable from the Motor/Base Module connector while power is on. Damage to the equipment may result.*

Minimal maintenance is necessary for this Motor/Base Module. Occasionally inspect the Motor/Base Module for damage and clean if necessary.



**Figure 2.3 Single Ended Microspense AP Motor/Base Module**

**2.5 MICRO ROTARY PUMP MODULE****2.5.1 Description (Figure2.4)**

The Micro Rotary Pump Module, hereafter referred to as the Pump Module, is comprised of the following major components; a ceramic piston fabrication and a cylinder pressed into a case having intake and discharge ports. The intake and discharge ports accept 1/4-28 male threaded fittings.

**2.5.2 Operation**

When the Pump Module is mounted on the Motor/Base Module, the piston is driven by a spherical bearing mounted within a rotating spindle. This drive arrangement imparts both reciprocating and rotary motion to the piston. The magnitude of the piston's stroke is adjustable by varying the angle of the axis of the pump head relative to the axis of the motor drive shaft. This displacement range is infinitely adjustable within the pump specifications (refer to Table 2.1). Repeatability of 0.1% is obtainable once the stroke length is established.

The end of the piston is never drawn back beyond the intake and discharge ports in normal operation. The piston flat allows only one port to communicate with the interior of the pump cylinder at any time. The effect of this is positive mechanical valving, eliminating the need for check valves under normal operations.

The pump, which cannot be driven by liquid pressure, essentially acts as a closed valve when the unit is not in operation.

**2.5.2.1 Piston/Cylinder Set**

The piston/cylinder set is constructed of high density alumina ceramic. The ceramics are compatible with most acids and bases. The piston/cylinder set has a clearance between the piston and cylinder wall of approximately .00005" which minimizes fluid slip.

The ceramic piston operates within the ceramic cylinder with no lubrication other than the liquid being dispensed or metered. The natural crystalline structure of the ceramic displays zero porosity ensuring zero retention and carry over of one liquid to the next.

The ceramic material's mechanical and thermal stability allows the Pump Module to be sealed by virtue of a close running clearance between the piston and the cylinder bore. This means that no compliant dynamic seals are used eliminating a part requiring frequent replacement in traditional pump designs.



**Figure 2.4 Micro Rotary Pump Module**

**2.5.3 Maintenance**

Minimal maintenance is necessary for this Pump Module. Occasionally inspect the Pump Module for damage and clean if necessary.

**2.5.4 Specifications**

Table 2.1 lists the volumetric output of the Pump Module.

**Table 2.1 Volumetric Output  
Per Rotation Of Micro Rotary Pump Module**

Size	Displacement Per Stroke ( $\mu$ l)
1A	100

**2.6 OPTIONS****2.6.1 Enclosure (Figure 2.5)**

IVEK offers an enclosure to house the Motor/Base and Pump Modules. The enclosure part number is 132402-02. If you would like to order this option for your current system it may be necessary to return your equipment to IVEK. If you are ordering a new system and would like your Moto/Base and Pump Module in an enclosure order IVEK part number 132402-01. Please call Technical Service at 802-886-2238 if you have any questions.



**Figure 2.5 Enclosure with Motor/Base and Pump Installed**

**2.6.2 Wall Mount Kit**

IVEK offers a wall mount kit for mounting the enclosure.

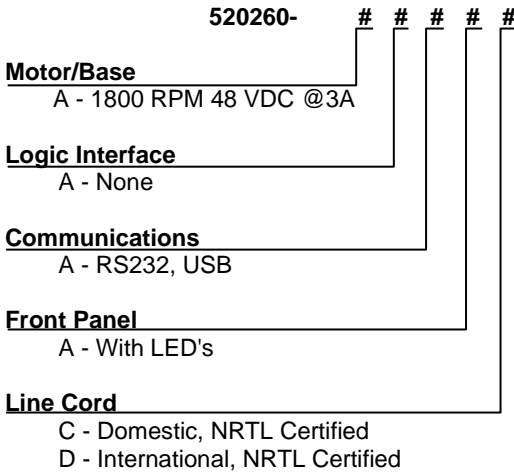
**CAUTION**

*Make sure the enclosure is properly secured to the wall. Damage to the system could occur.*

**2.7 MODEL NUMBER**

The model number provides important information about the specifics of your Controller Module.

The model number provides important information about the specifics of your Controller Module. 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.



**2.8 PROBLEM GUIDE**

Table 2.2 contains a list of possible problems, causes and solutions for the Controlled Substance Dispensing System.

Table 2.2 Common Operational Problems And Solutions

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
No power, nothing works.	AC power may be absent or inadequate. Unit not plugged in.	Turn Power switch OFF. Ensure AC power cord is plugged into a properly grounded three-prong outlet capable of supplying the voltage and current specified in the Title Page section of this manual.
	Fuse is blown.	Turn Power switch OFF. Unplug main power cord from outlet. Remove fuse from rear panel fuse holder. Test fuse conductivity. Install good fuse in rear panel fuse holder. Turn Power switch ON.
	Supply Breaker is tripped.	Turn Power switch OFF. Check or reset breaker at panel .Turn Power switch ON.
Liquid leaks are present.	Connections are loose.	Check connections, replace tubing if worn.
	Tubing may be cracked or damaged or kinked.	Replace tubing, (see page 2-2)
Controller not responding to computer.	Controller Module power not on.	Turn Controller Module power ON.
	Caps Lock not on.	Turn on caps lock.
	Interface cable connection loose.	Check connections at computer and Controller Module.
	Bad interface cable.	Replace Interface Cable.
	Wrong baud rate setting.	Reset software to match Controller Module.
Inaccurate dose volume.	Connections are loose.	Check connections, replace tubing if worn.
	Tubing may be cracked or damaged or kinked.	Replace tubing, (see page 2-2)
	Air in fluid lines.	Inspect tubing for air bubbles. Repeat Priming operation.
	Pump needs calibrating	Call IVEK Technical Service Department.





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## DRAFT DOCUMENT CARRIER SHEET

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