IntelliGen® HV20 Dispense System

Installation and use manual

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OVERVIEW

Entegris, Inc. provides this information for end user reference.

Prior to using this manual, the user should verify with the product manufacturer that the user has the most recent copy of the product manual.

This manual is owned by Entegris, Inc., an affiliated company for its suppliers, and the title shall not pass to the user as a result of the use of the manual.

LIABILITY OWNERSHIP

Read the following carefully before continuing:

In no event shall Entegris or its suppliers be liable for any damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or any pecuniary loss) arising out of the use of or inability to use this manual, even if Entegris has been advised of the possibility of such damages.

GENERAL MANUAL NOTES

CHANGES TO THE MANUAL

The manufacturer reserves the right to make changes to the product covered in this manual to improve performance, reliability, or manufacturability.

Although every effort has been made to ensure accuracy of the information contained in this manual, the manufacturer assumes no responsibility for inadvertent errors. Contents of the manual are subject to change without notice.

INTENDED AUDIENCE

This manual is intended for technicians involved in semiconductor manufacturing, and assumes that each individual is familiar with the proper handling of photochemicals and other potentially hazardous materials. Users must also be familiar with installing and using software on a computer running the Windows® operating system.

INTENDED SCOPE AND USE

This manual is intended to be used by experienced technicians for the planning, installation, and operation of the described system. This manual contains basic safety information for the installation and use of the pump system. This manual covers this system only.

MISHANDLING products exposed to a hazardous substance may result in death or serious injury. Always follow the recommendations and guidelines provided by the chemical suppliers and manufacturers. Always wear appropriate personal protective equipment (PPE) as required for the chemicals in use. Refer to the Material Safety Data Sheets (MSDS) for each chemical.

SAFETY

DANGER! Failure to follow these safety instructions may lead to fire, electric shock, chemical exposure, or other injuries, or damage to property. Read all safety information before usage.

REGISTRATION FOR SAFETY UPDATES

The manufacturer requests that the user notifies the manufacturer of equipment installation, usage and status, and provides appropriate contact information for safety alerts and information regarding the system. Please register usage with a local Entegris service center.

CONTACTING THE SUPPLIER WITH EMERGENCY HEALTH ISSUES

Please contact the manufacturer with any emergency safety and health concerns.

WARNING! Safety is designed into every product. When followed, these minimum guidelines provide an acceptable level of safety for operating and maintaining the system but are not a substitute for determining internal safety procedures.

Failure to comply with the safety precautions or warnings indicated in this manual violates the safety standards that form a part of the intended use of this equipment. The manufacturer assumes no liability for the user's failure to comply with these requirements.

WARNING! Use of controls, adjustments, or procedures other than those specified in this manual without consulting a competent safety professional may result in exposure to potential hazards. Always follow established industrial safety practices when operating the equipment.

CAUTION! End of life statement. De-commissioning of the system, or any part of the system shall be in a manner that is consistent with appropriate regulations and guidelines.

WARNING! Chemicals are not supplied with this equipment. Refer to the chemical supplier's MSDS for specific health and safety information.

WARNING! POTENTIAL CHEMICAL LEAK! Use one set of O-rings only. Check that the filter has O-rings or the manifold has O-rings. NEVER use O-rings on both the filter and the manifold or the system may leak chemical.

WARNING! PINCH HAZARD! Keep fingers clear of jaw mechanism to prevent personal injury.

WARNING! PINCH HAZARD! Pump weight in excess of 15.0 kg (33 lbs). Use care in lifting and carrying the pump to prevent personal injury.

WARNING! Wear chemical-resistant garments and eye protection while changing the filter and during start-up. Use additional PPE as directed by facility safety personnel, the MSDS, or chemical safety guidelines.

CAUTION! Only technically qualified personnel should install the equipment.

CAUTION! DO NOT use this equipment in any manner not specified by the manufacturer. If the equipment is used in a manner other than as specified in this document, the safety protections may be impaired.

CAUTION! Fittings and components damage easily; handle all components with extreme care. DO NOT scratch or over-tighten any component.

CAUTION! EQUIPMENT DAMAGE HAZARD! Turn off power before connecting or disconnecting any cable to the device, or damage may occur.

HANDLING

Each dispense system is manufactured with strict assembly, test, and inspection processes to ensure high-quality assembly and protection from unintended chemical release. As with all chemical handling systems, the dispense system has chemical connection points that must be handled with care, including:

- Fluid ports on the top surface
- Filter fittings
- Pressure sensor ports on the back (under the top cover)
- Between valve plate (front) and pump block
- Pump diaphragm mechanism in the pump block

A potential for chemical leak can occur at the above cited points. Use care to ensure that O-rings are either on the filter or on the manifold, never on both, or the system will leak. Refer to filter installation instructions in this manual.

Do not loosen any screws on the mechanism unless specifically directed to do so by an Entegris service engineer. Handle the dispense system with care to prevent damage to any fluid handling point.

Additional points of critical assembly and performance include pneumatic tubing, pressure and vacuum connecting points, and solenoid manifold tubes (inside cover or backplane). Use care to prevent any damage to the unit which could result in chemical leakage.

CHEMICAL LEAKS

In the event of a suspected or confirmed chemical leak from the pump or in the vicinity of the pump, please follow the instructions below:

1. Determine chemical currently in use with pump.
2. Obtain MSDS.
    a. Determine if any incompatible materials may come in contact with the leaking material.
    b. Isolate incompatibles with barriers, including spill containment, closing valves and removing the chemical supply, if it is safe to do so.
    c. Identify appropriate chemical protection equipment requirements, including gloves, face and eye protection, and chemical protective clothing to prevent exposure to or contact with chemicals.
    d. Determine if the chemical has permissible exposure limits or short-term exposure limits:
        – Identify limits requiring respiratory protection.
        – Ensure that appropriate monitoring devices are available to measure air levels.
3. Only personnel properly trained to clean spills of hazardous materials should conduct cleanup activities. Consult local authorities or identified hazardous materials emergency response agencies or contractors for assistance if the facility does not have trained personnel for spill cleanup or containment.
4. Ensure adequate monitoring and protective equipment is available for cleanup of hazardous materials.

5. Obtain supplies for cleanup and containment compatible with the chemical.
6. Obtain compatible containers to collect spilled material and cleanup materials.
7. Ensure adequate ventilation is provided before opening cabinet or equipment where a buildup of vapors could occur. If flammable chemical is in use:
   a. Monitor area for flammable levels with appropriate monitoring devices.
   b. Isolate all power sources or potential sources of sparks.
   c. Use intrinsically safe tools and monitoring equipment.
8. Isolate pump from power sources to prevent fluids from flowing through unit during cleanup of leak or spill.
   a. Use appropriate lockout/tagout procedures to de-energize unit.
   b. De-energize all areas of unit that may be in contact with spilled or leaking material.
   c. When disconnecting nitrogen and/or any pressurized gas, wear appropriate PPE gloves, then close the facility gas supply to prevent gas release when disconnecting lines.
9. If spilled chemical is within equipment, wipe all surfaces carefully with wipes appropriate for the chemical.
10. If chemical is contained in the tubing or the pump, provide collection container under the lines or pump during removal to collect chemical and prevent additional spills.
11. Decontaminate surfaces with appropriate decontamination materials per recommendation of chemical manufacturer.
12. Contain cleanup materials, contaminated debris, and equipment.
13. Dispose of materials in accordance with local, state, and national regulatory requirements.
14. Provide any required service to the equipment and verify all spilled material is collected and cleaned from surfaces.
15. Replace any equipment and secure lines in accordance with normal maintenance and service requirements.
16. Confirm air levels are safe.
17. Return equipment to service per standard procedures.

SPECIFICATIONS

Dispense performance	Volume	0.1 – 20.0 mL in 0.001 mL increments
	Rate	0.1 – 3.0 mL/sec in 0.001 increments
	Repeatability	<0.03 mL 3 sigma
	Viscosity range*	1,000 – 20,000 cP
	Maximum dispense pressure	1.7 MPa (250 psi)
Recharge performance	Fill rate, filtration rate, vent rate, purge rate	0.1 – 3.0 mL/sec in 0.001 increments (automatically controlled)
	Vent frequency	Auto-venting or 1 – 10,000 dispense cycles
Mechanical	Wetted surfaces	Modified PTFE, PTFE, Kalrez®
	Connection type	Insert style, Super Pillar®, Super 300 Type Pillar
	Filter	Optimizer® ST (Long) with Kalrez O-rings
	Inlet, outlet, and vent tubing	OD: 9.53 mm (0.375")
		ID: 6.35 mm (0.250")
	Gas	Inlet gas type: Regulated N_2 or CDA
		Inlet pressure: 448 kPa – 469 kPa (65 psi – 68 psi)
	Vacuum	-68 kPa (20 in-Hg minimum)
Dimensions	Height	354.2 mm (13.95")
	Width	128.0 mm (5.04")
	Depth	328.3 mm (12.92")
Weight	15.0 kg (33 lbs)	
Electrical	Current rating	1.75A
	Input voltage (system)	24 VDC ±10%
	Serial communication	Specifications are dependent on interface module use
	Parallel communication	Triggers and acknowledgments
Certifications	See provided documentation	
Environment	Indoor use only	
	Ambient temperature	5° – 40°C (41° – 104°F)
	Maximum relative humidity	80% for temperatures up to 31°C (88°F) decreasing linearly to 50% relative humidity at 40°C (104°F)
	Mains supply fluctuations	From 22 to 26 VDC
	Transient overvoltages	Category II
	Pollution degree	2

**Depends on tool configuration. Contact Entegris for detailed window of operation.*

***Maximum pressure is a limit on the windows of operation. Actual volumes and rates may be restricted to comply with the pressure limits for a given viscosity, tubing diameter, tubing length, or tubing height.*

COMPATIBILITY

The IntelliGen® dispense system has been optimized for the dispense of photoresists and other photochemicals. The system is uniquely designed to deliver highly accurate dispenses even at very low volumes with high repeatability.

The internal wettable surfaces of the dispense system are PTFE, modified PTFE, and Kalrez.

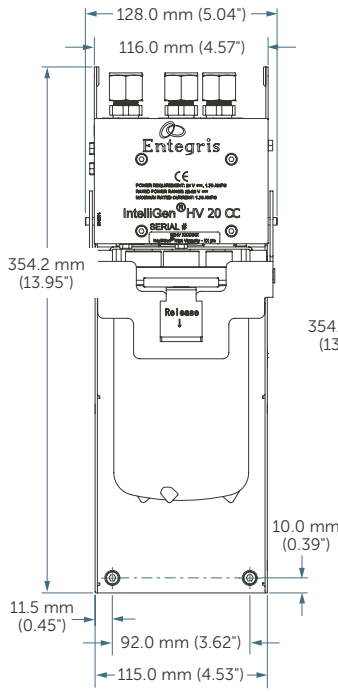
The following is a partial list of compatible solvents. Please contact Entegris for compatibility of a specific solvent that is not included in the list.

- Acetone
- Adamantane (tricyclodecane)
- n-Amyl acetate
- Anisole (methyl phenyl ether, methoxybenzene)
- 2-Butoxyethanol (ethylene glycol monobutyl ether, butyl cellosolve)
- n-Butyl acetate
- Butyl alcohol
- Butyl cyclohexane
- Butyl ether (dibutyl ether)
- Cyclopentanone
- Cyclohexanone
- Developer (positive, 0.26N TMAH)
- Diacetone alcohol
- DI water
- Dichloromethane (methylene chloride)
- Diethyl maleate
- DIGLYME (diethylene glycol dimethyl ether)
- Dimethyl acetamide
- Dimethyl cyclohexane
- Dimethyl maleate
- Dimethyl sulfoxide
- 1,3-Dioxolane (glycol methylene ether)
- EEP (ethyl 3-ethoxypropionate)
- ECA, EEA, EGMEA (cellosolve acetate)
- Ethanone (2,2-dimethoxy-1,2-diphenyl, dimethoxy phenylacetophenone)
- Ethyl acetate
- Ethyl acetyl acetate (ethyl acetoacetate)
- Ethyl alcohol
- Ethyl benzene
- Ethyl cyclohexane
- Ethyl lactate
- Ethyl malonate (diethyl malonate, malonic ester)
- Ethyl pyruvate
- Gamma butyrolactone
- 2-Heptone (methyl amyl ketone)
- Hexane
- 2-Hexanone (methyl butyl ketone, propylacetone)
- HMDS (hexamethyldisilazane)
- Hexamethyldisiloxane
- 1,6-hexanediol diacrylate
- 2-hydroxy-2-methylpropiophenone
- IPA (isopropyl alcohol, 2-propanol)
- Isoamyl acetate
- Isobutyl ketone (2,6-dimethyl-4-heptanone, diisopropylacetone)
- MCA (methyl cellosolve acetate, 2-methoxyethyl acetate)
- Mesitylene (1,3,5 trimethylbenzene)
- Methyl acetate (methyl acetic ester)
- Methyl alcohol
- Methyl ethyl ketone (2-butanone)
- 2-Methoxy-1-propanol (monopropylene glycol methyl ether)
- MIBK (methyl isobutyl ketone, 4-methyl-2-pentanone)
- Mineral oil
- Mineral spirits
- MMP (methyl 3-methoxypropionate)
- Morpholine
- NMP (N-methyl pyrrolidinone)
- Octamethyltrisiloxane
- Orthodichlorobenzene (1,2-dichlorobenzene)
- 2-Pentanone (methyl propyl ketone)
- Petroleum spirits (petroleum ether)
- PGE (propylene glycol monoethyl ether, 1-ethoxy-2-propanol)
- PGME (propylene glycol monomethyl ether, 1-methoxy-2-propanol)
- PGMEA (propylene glycol monomethyl ether acetate, 1-methoxy-2-propyl acetate)
- PGPE (propylene glycol propyl ether, 1-propoxy-2-propanol)
- 2-Propenamide (N,N-dimethylacrylamide)
- 2-Propenoic acid
- Propyl alcohol
- Tetrahydrofuran
- Trichloroethylene
- 2.5% TMAH (tetramethyl ammonium hydroxide) in DI water
- Toluene
- Xylene

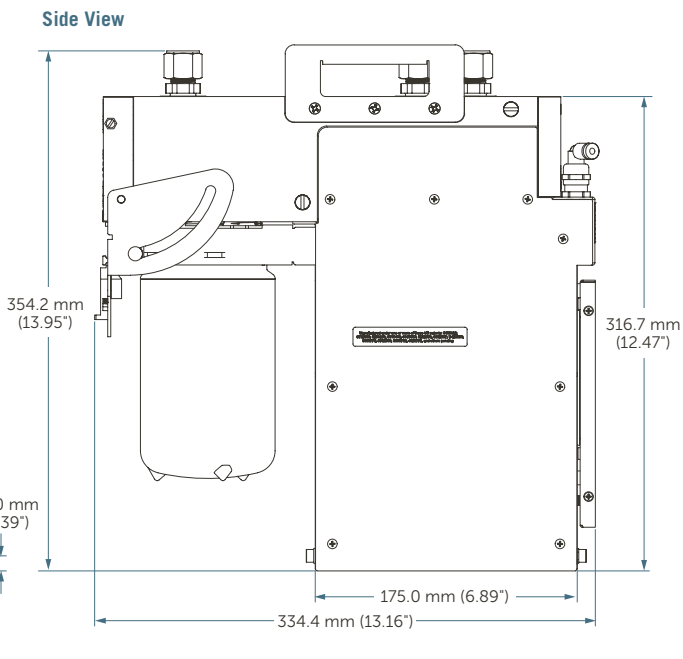
SYSTEM OVERVIEW

APPEARANCE

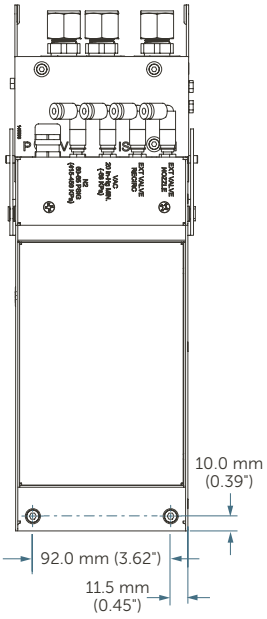
Front View



Side View



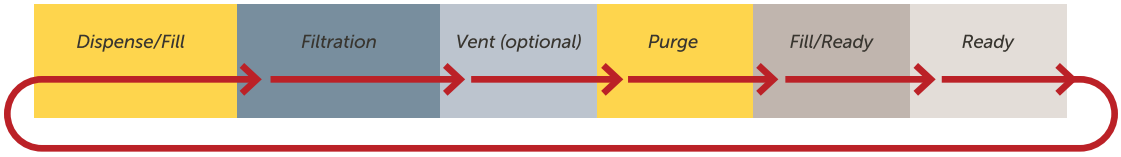
Back View



TWO-STAGE TECHNOLOGY OPERATING PRINCIPLE

The IntelliGen dispense system uses a proven, unique two-stage design to operate dispense and filtration functions independently. Filtration occurs at a reduced rate, which prevents microbubble formation and maximizes filter performance.

The system uses two motors (one for fill and one for dispense) and advanced fluid paths to deliver extreme repeatability at dispense rates down to 0.1 mL/sec. During normal operation, the dispense system cycles through the dispense/fill, filtration, vent, purge, fill/ready, and ready states.



1. **READY** State
   - The inlet, external outlet, vent, and purge valves are closed.
   - The isolate and barrier valves remain open for a time to allow the system to reach ambient pressure, then the valves close.
   - The dispense chamber is full of fluid and is ready to dispense.
2. **DISPENSE/FILL** State
   - The external valve opens as the dispense motor pushes fluid through the outlet and onto the wafer.
   - The dispense rate and volume are motor-controlled and independent of the fill and filtration rate.
   - Simultaneously during dispense, the inlet valve opens and begins filling the inlet chamber.
3. **FILTRATION** State
   - The isolate and barrier valves open and the fill motor pushes fluid through the filter and into the dispense chamber as the dispense motor retracts.
   - At the programmed filtration rate, the dispense chamber fills with filtered fluid.
4. **VENT** State
   - The barrier valve closes and the vent valve opens.
   - The fill motor pushes fluid and bubbles upstream of the filter membrane through the vent port.
5. **PURGE** State
   - The barrier valve closes as the purge valve opens and the dispense motor pushes fluid out of the dispense chamber to the inlet source. This step ensures that the dispense fluid contains no bubbles.
6. **FILL/READY** State
   - The dispense chamber is full of fluid and ready to dispense.

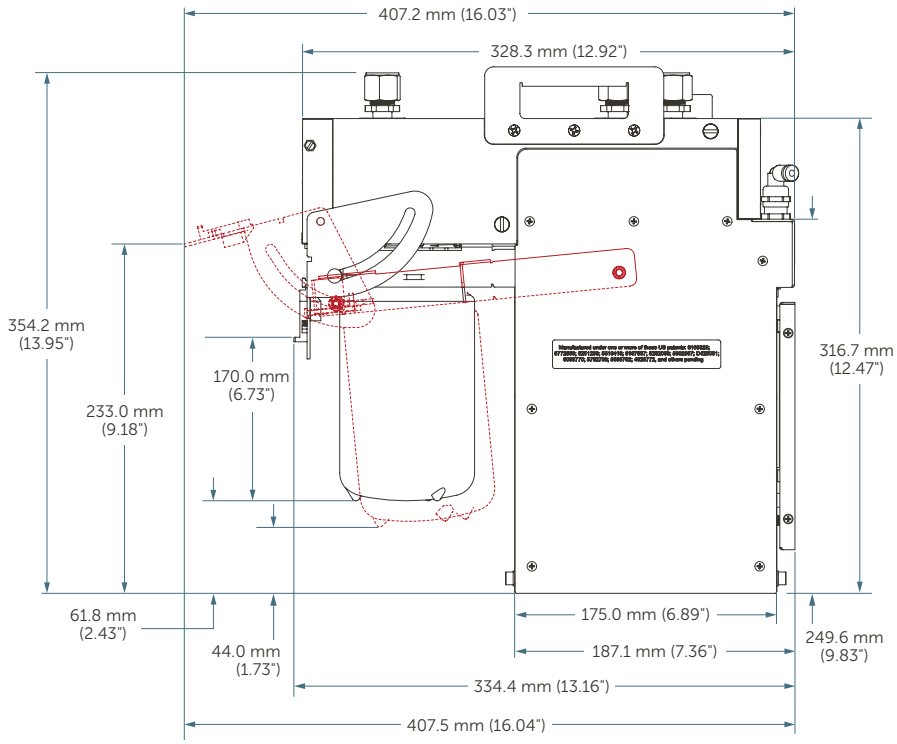
QUICK FILTER CHANGEOUT

Patented Connectology® allows start-to-finish filter changes in under a minute. No tools are required, no photochemical to clean up, and there is minimal personnel exposure to potentially hazardous volatile organic compounds (VOCs). Additionally, the dispense system uses a patented two-stage technology that provides rapid priming of the filter, resulting in significant chemical savings.

The following diagram shows the absolute minimum required clearances for filter replacement (filter jaw clearance highlighted in red). The filter can be placed in the service area, then slid into the manifold. This feature allows easy installation into tight areas with drip trays, etc., below the equipment.

CAUTION! DRIP HAZARD! If the pump has been installed with minimum changeout space, use appropriate wipes, caps, and/or other materials to prevent spilling of fluid from the filter during changeout.

Side View



INSTALLATION

This section covers the site requirements, tools, and equipment to install the system. Technical support is available for all installation types.

NOTE: All components are shipped in protective packaging to prevent damage during transport. If damage is found, please file a damage claim with the transportation carrier and contact customer support immediately.

CAUTION! Avoid particulate contamination. Do not unwrap any cleanroom-packaged item until immediately before installation.

WARNING! Only technically qualified personnel should install the system. Wear chemical-resistant garments and eye protection. Chemicals are not supplied with this equipment. Obtain a chemical MSDS for each chemical used with the system and follow all safety requirements.

CAUTION! Fittings and components damage easily; handle them with extreme care. Do not scratch or over-tighten any part.

HANDLING

Use care when lifting and carrying the pump. The pump weighs in excess of 15.0 kg (33 lbs), has blunt edges, and can cause pinch or other personal injuries.

WARNING! PINCH HAZARD! Pump weight in excess of 15.0 kg (33 lbs). Use care in lifting and carrying the pump to prevent personal injury.

FACILITY REQUIREMENTS

- Filtered N_2 or CDA, 551 kPa (80 psig)
- Vacuum >20 in Hg
- 24 VAC input power

WARNING! Installation location must provide adequate exhaust ventilation and monitoring.

The installation location should incorporate secondary containment and spill detection. Facility must have appropriate alarm and shutdown procedures for the chemical in use.

TOOLS AND MATERIALS

Verify all system facility hookups including liquid and power supplies. The following tools and materials are required:

- Inlet/outlet tubing appropriately sized for the system and compatible with the fluid in use
- Tube cutter
- Adjustable wrench
- 13 mm wrench
- Electrical power cable
- Tie wraps
- Cleanroom wipes
- Pillar insertion tool/fixture
- Flaring tools
- Mounting hardware
- Optimizer ST-long filter (sold separately)
- External stop/suckback

INSTALLING THE PUMP

Step 1: Preparation

1. Use the dimensional drawings as a reference for dimensions and locations.
2. Leave appropriate space around the system to perform any connections, maintenance, or trouble-shooting. Clearance space can be shared space with other equipment.
3. Verify all system facility hookups, including liquid and power supplies. Refer to system specifications.

Step 2: Unpack and Position System

Allow space to make fluid connections, power, and other cable connections. Please consult Entegris with any installation questions.

1. Remove the outer protective bags in the change-room. Wipe the inner bags according to cleanroom procedures.
2. Bring the system components to the installation location. Remove the inner bags.
3. Leave enough clearance around the system to allow service access. Refer to system dimensional drawings on page 10.

Step 3: Connect Electrical Supply

1. Connect power/communications cable. Contact Entegris for any pinout or connection details.

Step 4: Connect N_2 and Vacuum Supplies

1. Connect filtered and regulated N_2 or CDA supply to the inlet connection. Do not turn on the supply at this time.
2. Connect vacuum supply to the vacuum connector. Rating is >20 in Hg.

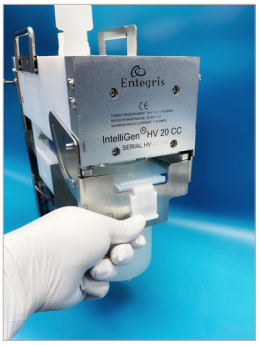
Step 5: Install the Filter

The dispense system cannot operate without a filter or a flushing shell installed.

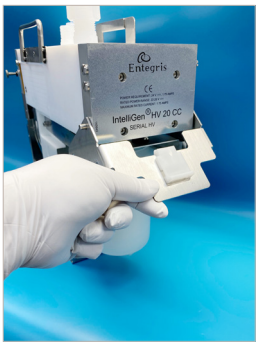
⚠ **WARNING! POTENTIAL CHEMICAL HAZARD! Obtain the chemical supplier's MSDS for specific health and safety information.**

⚠ **WARNING! Always wear chemical-resistant garments and eye protection when working on or near the fluid system. Obtain the chemical supplier's MSDS sheet for specific health and safety information.**

1. Wear PPE.
2. Pull down the tab on the lever until it clears the catch (shown with filter installed for reference).



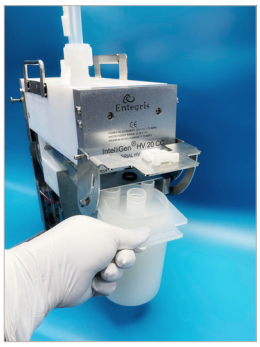
3. Raise the lever to open the filter manifold.



4. Verify that only **ONE** set of O-rings is used.

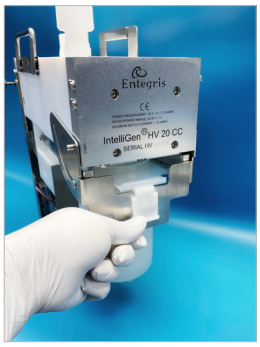
⚠ **WARNING! POTENTIAL CHEMICAL LEAK! Use one set of O-rings only. Check that the filter has O-rings or the manifold has O-rings. NEVER use O-rings on both the filter and the manifold or the system may leak chemical.**

5. Slide in a new filter.



WARNING! PINCH HAZARD! Keep fingers clear of jaw mechanism to prevent personal injury.

6. Keep fingers **CLEAR** of the jaw mechanism, then lower the lever until the tab clicks into place on the filter.



Step 6: Connect Fluid Lines

Minimize tubing lengths whenever possible and maximize fluid tubing size wherever practical to further reduce pressure drop through the tubing.

Use the shortest practical tube length, while providing adequate service loops.

As a rule, minimize the distance between the liquid source and the system, and between the system and the point-of-dispense.

CAUTION! DRIP HAZARD! Do not over-tighten fittings. Excessive force will damage the internal seals. Tighten the fittings by hand, then use a small adjustable wrench to tighten for the final ¼ turn.

1. Insert Pillar sleeve and tube assembly into the fluid fitting adapter.
2. Hand tighten Pillar nut.

3. Use 13 mm wrench to hold the fluid fitting adapter to prevent it from turning when tightening the Pillar nut, sleeve, and tube assembly.

NOTE: This is to hold the nut. DO NOT tighten.

4. While holding the fluid fitting adapter with the 13 mm wrench, tighten the Pillar nut to specified Super 300 Type Pillar manufacturing instructions.

CAUTION! Refer to Super 300 Type Pillar Fitting Instruction Manual No. 048L-1 for fitting insertion instructions.

STORAGE

Short-term "Wet" Storage

A wet pump should be left in auto-recirculation mode to recirculate fluid and avoid problems related to stagnant chemical.

Long-term "Dry" Storage

For long-term storage, the pump should be flushed and cleaned prior to performing a shut-down. See *Flushing the System* section of this manual (page 38).

MMI SOFTWARE

The Man-Machine Interface (MMI) software provides better control at point-of-dispense and accurate information from the dispense.

A mouse-over feature provides a brief description, minimum and maximum limits, and a default value.

INSTALLING SOFTWARE

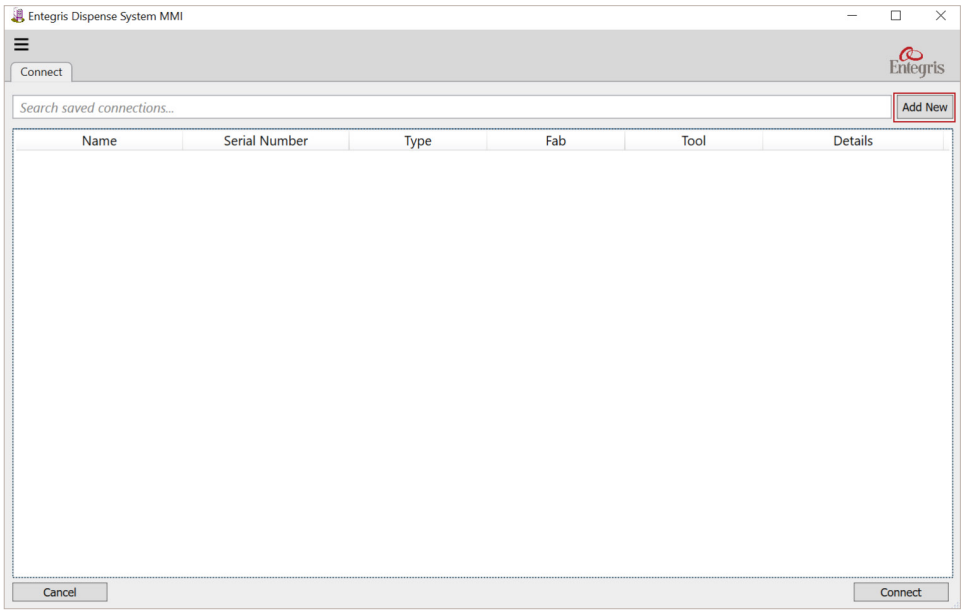
To operate the dispense pump, communication must be established using a host computer, laptop, or similar system using the supplied software. To install the software and establish communication:

1. Verify that a filter has been installed in the pump.
2. Connect the cables as appropriate for user configuration as covered in the *Installation* section of this manual (page 12).
3. Verify that power is being supplied to the dispense system.
4. Install the MMI software into a separate directory on the computer, then double-click on the *.exe file to start the program.

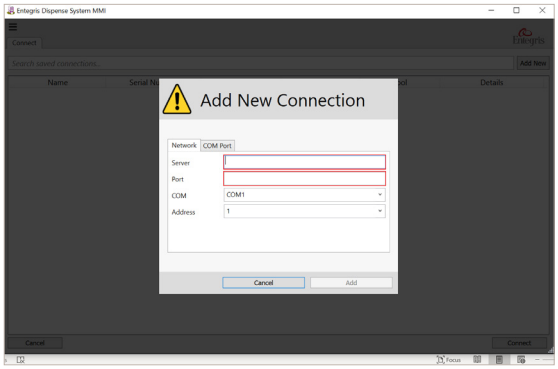
CONNECT TAB

The Connect tab establishes communication between the dispense pump and the MMI software.

1. Press **"Add New"**.

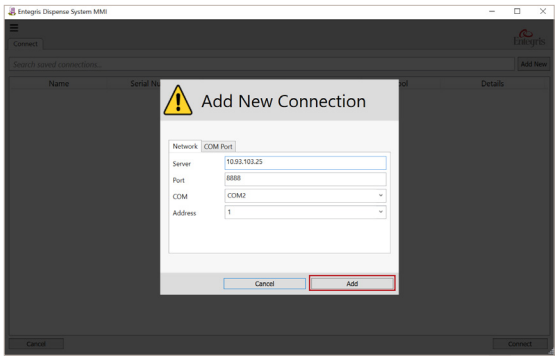


2. **"Add New Connection"** information box opens.

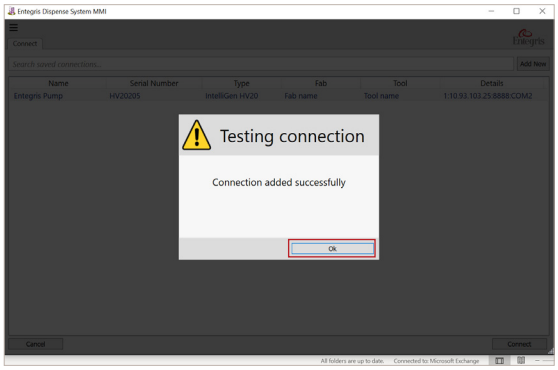


3. Enter Server, COM and Address information into fields. COM port is computer specific. Addresses are from 1 to 63.

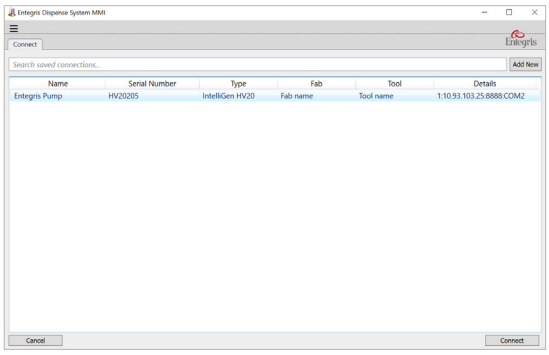
4. Press **"Add"**.



5. Connection verified. If connection fails, ensure the information is correct and the unit is powered up.
6. Press **"OK"**.

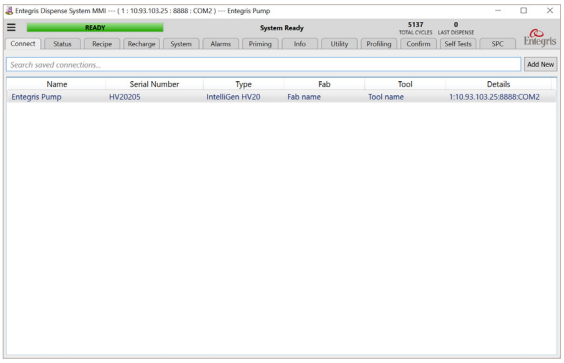


7. Double-click on the listed pump.



8. Communication established.

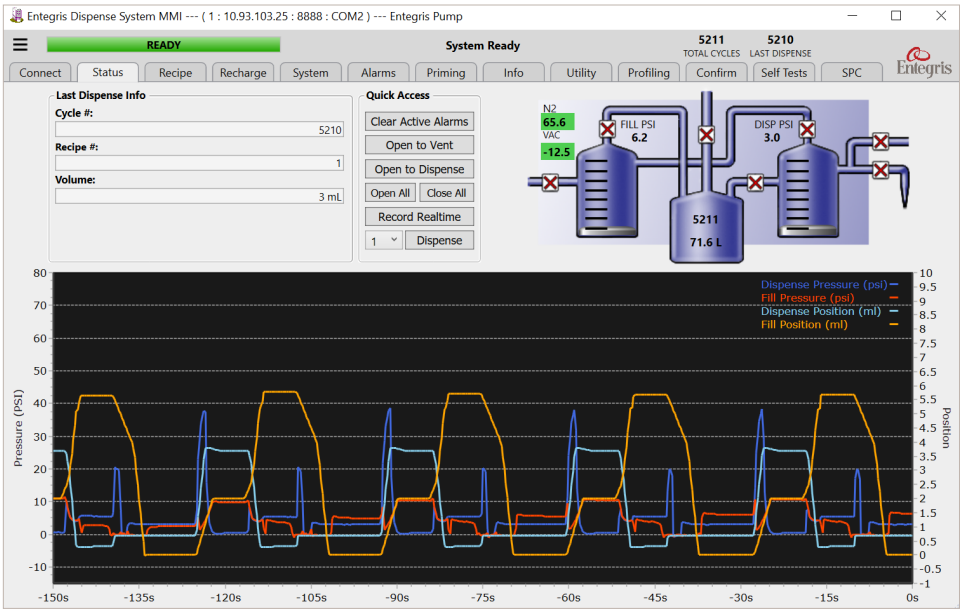
9. Once MMI is connected to a specific pump, all connections will be listed in the field below with the latest connection at the top.



NOTE: A Time Synchronization screen may appear. Read the instructions displayed to synchronize the time stamp.

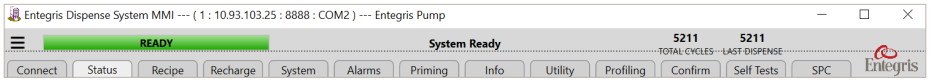
STATUS TAB

The Status page displays a quick snapshot of the pump's current state.

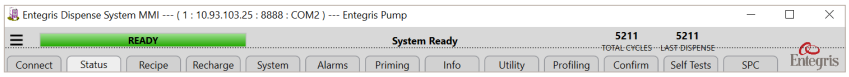


There are five sections to the Status page:

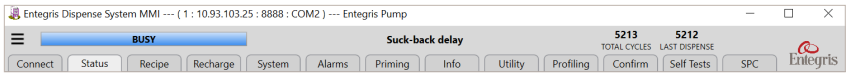
1. Status Information displayed on every page.



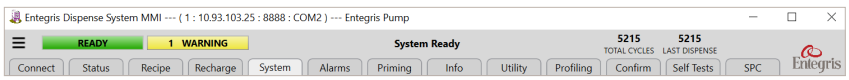
- Pump name and connection information
- Drop down menu icon
- Graphic pump status
  - "**Ready**" – Pump is ready to dispense.



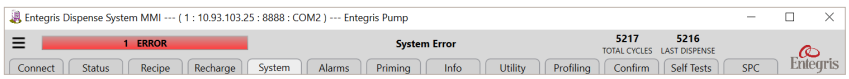
  - "**Busy**" – Pump is in operation.



  - "**Warning**" – Pump operation has triggered a warning.

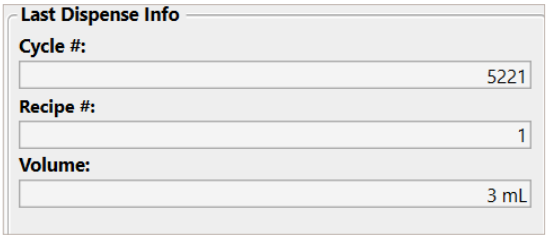


  - "**Error**" – Pump operation has triggered an error.



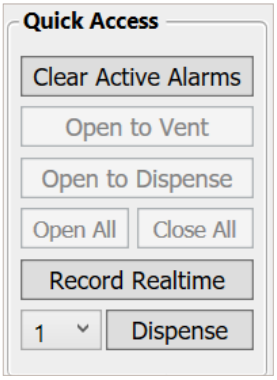
- Written pump status
- Dispense cycle information
- Individual page tabs

2. Last Dispense Information displayed on Recipe, Recharge, Systems, Info, Utility, and Self Tests pages.



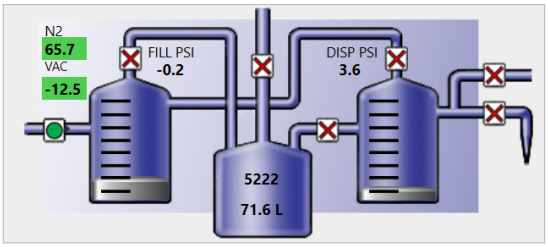
- Cycle count
- Recipe number
- Volume dispensed

3. Quick Access Information displayed on Recipe, Recharge, Systems, Info, Utility, and Self Tests.

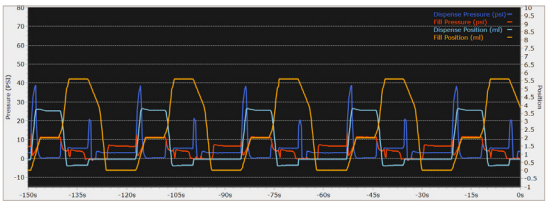


- "**Clear Active Alarms**" – clears active information, warning and error postings.
- "**Open to Vent**" – opens vent valve. Relieves pressure in fill chamber.
- "**Open to Dispense**" – opens external dispense valve. Relieves pressure in dispense chamber.
- "**Open All**" – opens all pump and external dispense valves.
- "**Close All**" – closes any valve that is open.
- "**Record Realtime**" – starts and ends recording of realtime pump operation to a *.csv file.
- "**Menu Selection**" – allows selection of different recipes.
- "**Dispense**" – executes one dispense.

4. Operation Graphic is a realtime illustration of pump operation displayed on Recipe, Recharge, Systems, Info, Utility, and Self Tests pages. Displayed are pump valves, dispense and fill chamber pressures, N_2 and vacuum supply pressures, total pump cycles, and total volume dispensed.

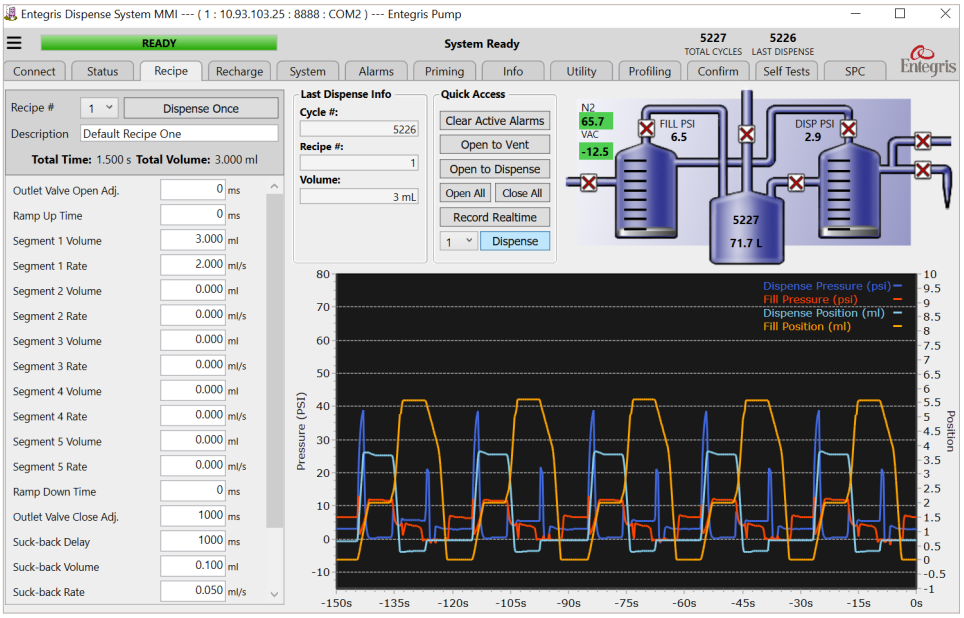


5. Graph plots displayed on Recipe, Recharge, Systems, Info, Utility, and Self Tests pages showing realtime dispense and fill pressures and dispense and fill motor positions.



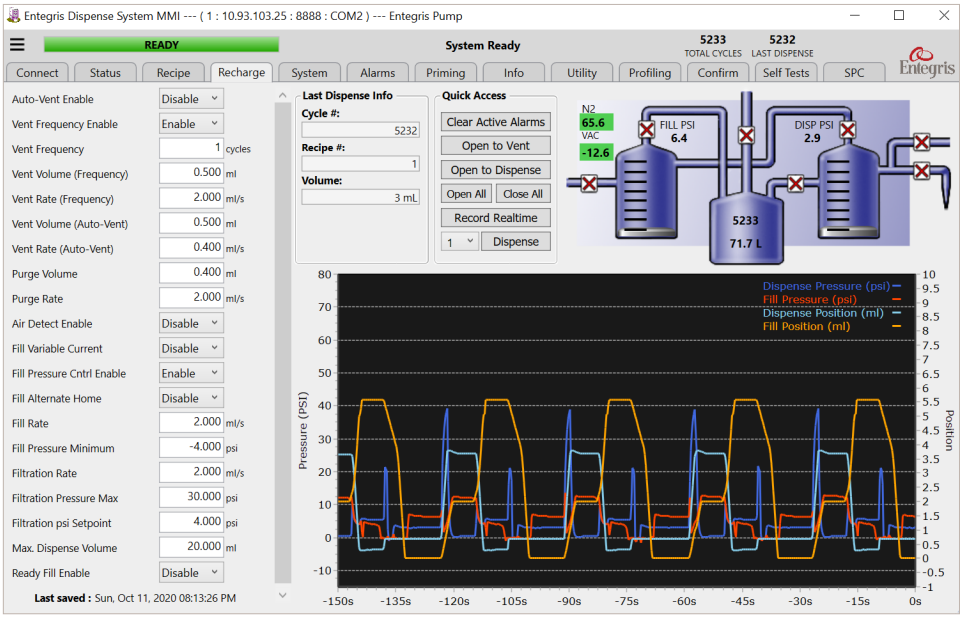
RECIPE TAB

The Recipe page allows the user to set and change dispense cycle variables, and maneuver between recipes. Use the mouse-over feature to obtain more information on displayed variables.



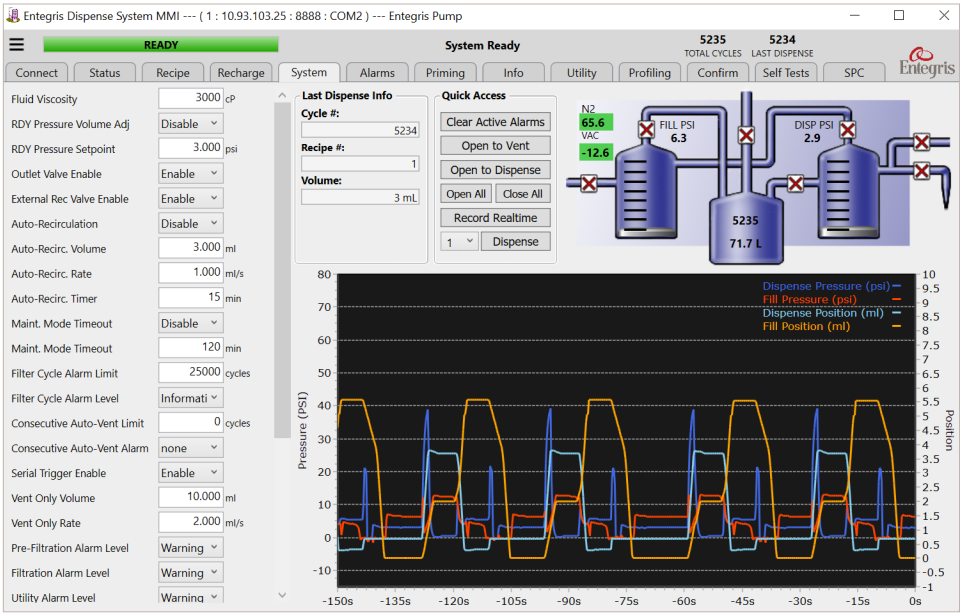
RECHARGE TAB

The Recharge page allows the user to set and adjust variables to control the recharge process of the pump. This includes: vent, purge, fill, filtration, and home position. Use the mouse-over feature to obtain more information on displayed variables.



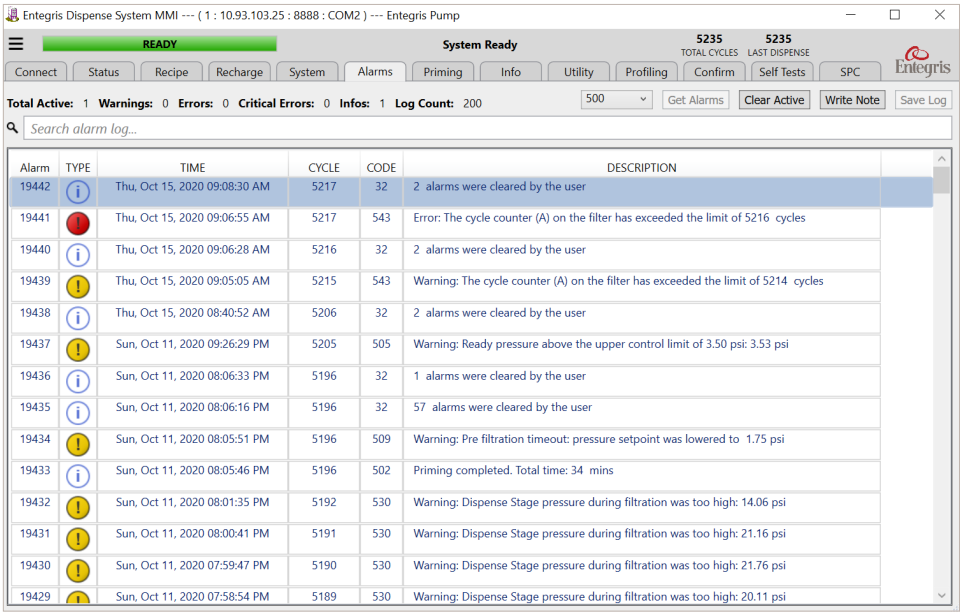
SYSTEM TAB

The Systems page allows the user to set and change variables that effect system operations of the pump. This includes fluid viscosity, ready pressure, auto-recirculation functions, maintenance functions, the enabling and disabling of alarms, and the level of alarm notifications. Use the mouse-over feature to obtain more information on displayed variables.



ALARMS TAB

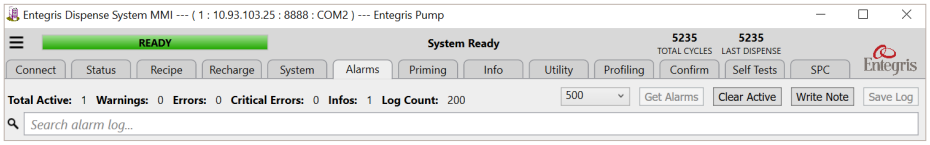
The Alarms page allows the user to see recorded events and alarms that affected pump operation.



There are four sections to the Alarms page:

1. Active alarm information displays total current alarms, including warnings, errors, critical errors, information posts, and log counts.

2. Alarm page commands include:



- "25▼" – requests number of alarms to be retrieved and displayed.
- "Get Alarms" – command to retrieve and display alarms from memory.
- "Clear Active" – clears all active alarms.
- "Write Note" – allows the user to add a note into the log.
- "Save Log" – saves the alarms log to a *.csv file.
- "Search Alarm" – allows the user to enter a key word to search through the log alarm.

3. Display field shows the alarms. Alarms can be arranged by double-clicking the header of each category.

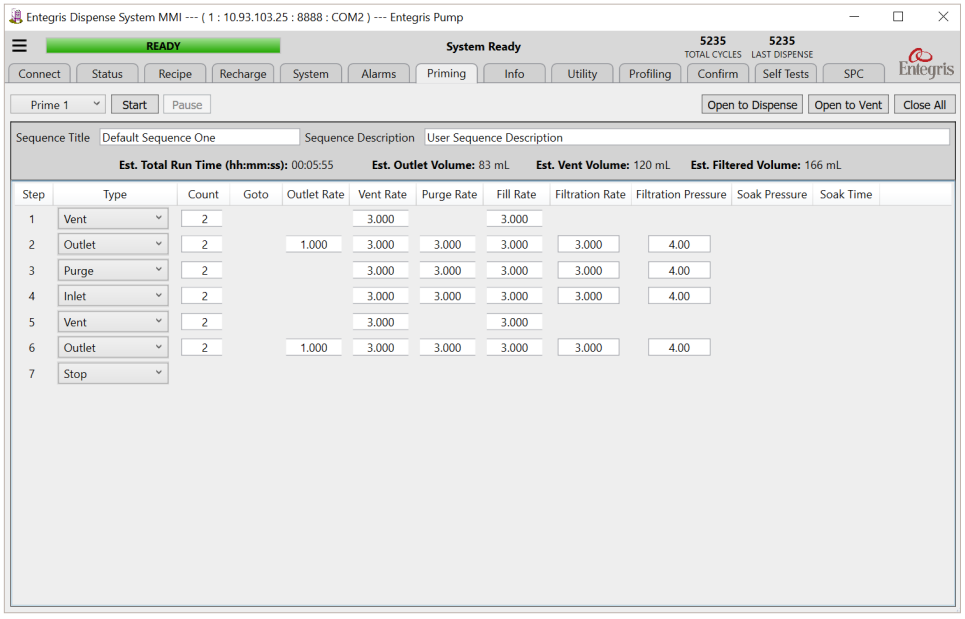
- "Alarm" – displays the alarm number in numerical order.
- "Type" – graphic display of the alarm type.
- "Time" – displays the time the alarm occurred.
- "Cycle" – displays the cycle number the alarm occurred.
- "Code" – displays the code associated with the alarm.
- "Description" – describes the event that occurred.

Types of Alarms

	ALARM TYPE	ACTION	SOLUTION
	Critical error	Pump shuts down immediately. Motors are disabled.	Clear alarm. If problem persists, call Entegris support.
	System error	Pump stops dispensing after completing the cycle. Motors are not disabled.	Clear alarm. Investigate for changes in the system.
	System warning	Event occurred but did not affect the system. Pump continues normal operation.	Investigate cause of warning. Clear alarm.
	Information	Event occurred but did not affect the system. Pump continues normal operation.	No effect. Alarm log only.

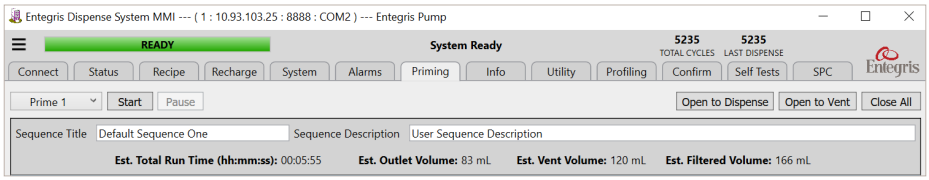
PRIMING TAB

The Priming page allows the user to set and change variables that affect priming operations. This includes: type of priming function, the number the type occurs, and the variable rates or pressures associated with the type.



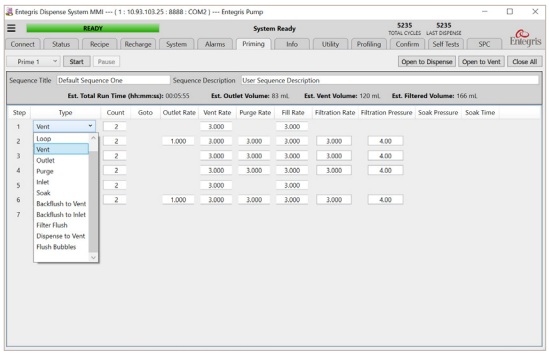
Priming Command Descriptions

1. Priming commands include:



- "Prime 1▼" – priming recipe selection.
- "Start" – starts the priming recipe selected.
- "Stop" – stops the priming recipe selected.
- "Open to Dispense" – opens the external valve.
- "Open to Vent" – opens the vent valve.
- "Close All" – closes any open valve.

2. Priming recipe menu display allows the user to set and change variables that affect the priming operation.



- "Sequence Title" – allows the user to name the priming recipe.
- "Sequence Description" – allows the user to give a brief description of the priming recipe.
- "Est. Total Run Time" – displays the expected total run time of the priming recipe in hours, minutes, and seconds.
- "Est. Outlet Volume" – displays the expected volume to outlet in milliliters.
- "Est. Filtered Volume" – displays the expected volume to pass through the filter in milliliters.
- "Step" – displays the sequenced step order of the priming recipe.
- "Type" – displays the priming function. There are twelve functions:
  - "Stop" – the last function of any priming recipe.
  - "Loop" – allows steps of the priming recipe to be repeated.
  - "Vent" – pushes volume upstream of the filter out the vent line.
  - "Outlet" – pushes volume through the filter out the outlet line.
  - "Purge" – pushes volume from the dispense chamber to the fill chamber and out the vent line.
  - "Inlet" – pushes volume from the dispense chamber to the fill chamber and out the inlet line.
  - "Soak" – pushes volume from fill chamber out the vent line, then saturates upstream of the filter at the soak pressure setting for the time duration.
  - "Backflush to Vent" – barrier valve opens for the duration of the soak time setting and then discharges through the vent line.
  - "Backflush to Inlet"– barrier valve opens for the duration of the soak time setting and then discharges through the inlet line.
  - "Filter Flush" – pushes volume from fill chamber out the vent line, then volume back and forth through the filter from chamber to chamber.
  - "Dispense to Vent" – pushes volume from the dispense chamber out through the vent valve.

  - — **"Flush Bubbles"** – pushes bubbles from downstream filter through dispense chamber into fill chamber, then from fill chamber through filter and dispense chamber out the outlet line.

- **"Count"** – the number the selected priming function occurs (1 – 999).
- **"Goto"** – used with the Loop function only, the step in repeating the sequence.
- **"Outlet Rate"** – the rate of volume out the outlet valve (0.1 – 3.0 mL/sec).
- **"Vent Rate"** – the rate of volume out the vent valve (0.1 – 3.0 mL/sec).
- **"Purge Rate"** – the rate of volume out the purge valve (0.1 – 3.0 mL/sec).
- **"Fill Rate"** – the rate of volume into the fill chamber (0.1 – 3.0 mL/sec).
- **"Filtration Rate"** – the rate of volume through the filter (0.1 – 3.0 mL/sec).
- **"Filtration Pressure"** – the pressure allowed during filtration (1 – 20 psi).
- **"Soak Pressure"** – the pressure allowed during the soak function (1 – 50 psi).
- **"Soak Time"** – the soak length in minutes (1 – 120 minutes).

Creating a Sequence

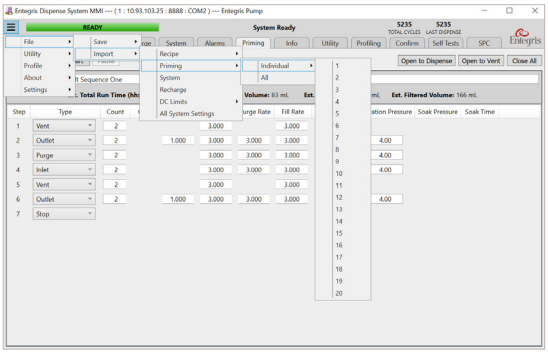
A priming sequence can be created with multiple steps to provide the most efficient sequence for a specific fluid and viscosity.

1. Select the priming function.
2. Enter the number of times the function should be performed.
3. Adjust the rates accordingly based on application requirements.
4. Continue to add priming steps and functions to purge the system of air.
5. Press **"Apply"**.
6. Press **"Start"** to begin priming.
7. The sequence can be saved to an external *.csv file by following the instructions in the next segment.

Loading and Saving Existing Sequences

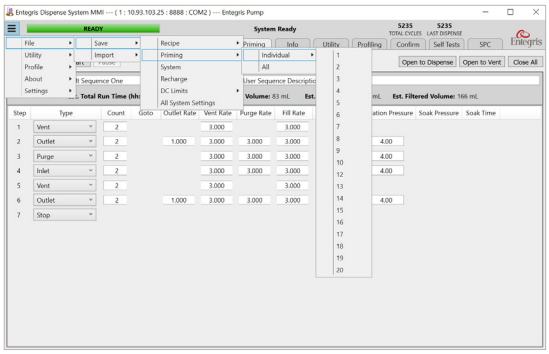
To load a priming sequence already saved to a file directly to the pump:

1. Click on the menu logo in the top left corner.
2. Select **"File"**.
3. Select **"Import"**.
4. Select **"Priming"**.
5. Select **'Individual"** and a corresponding number to be assigned.
6. Select priming file to be downloaded.
7. Press **"Open"**.
8. Press **"Start"** to begin priming operation.



To save a priming sequence to a file, it can be read directly from the pump:

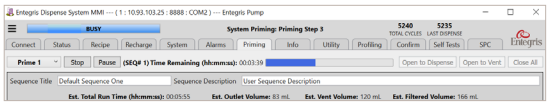
1. Click on the menu logo.
2. Select **"File"**.
3. Select **"Save"**.
4. Select **"Priming"**.
5. Select **"Individual"** and the corresponding number to be saved.
6. Assign a name for the priming file to be saved as.
7. Press **"Save"**.



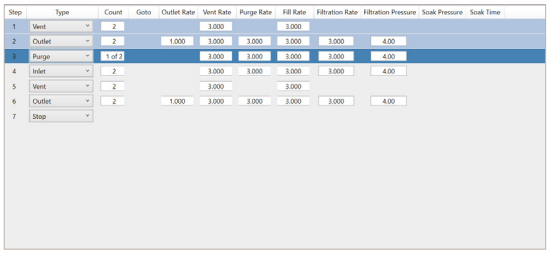
Priming Operation

During priming operations:

- The estimated total run time begins a countdown.



- The current step is highlighted in dark blue.
- The count of the current step is counted down.
- Completed steps are highlighted in faded blue.



- In a looped sequence, the loop step is highlighted along with the step being repeated.

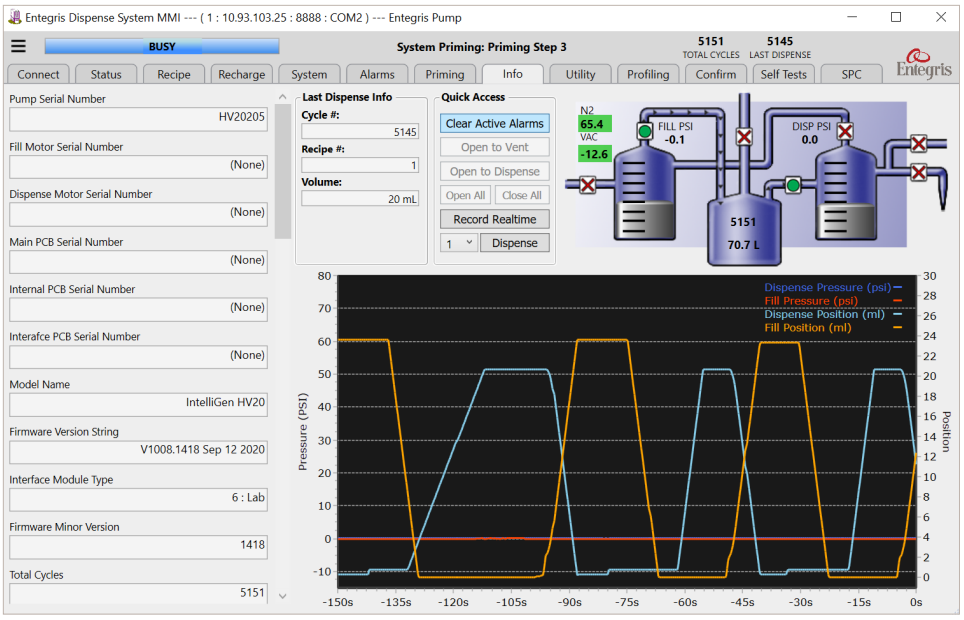
Guidelines for Priming a New Filter

A filter consists of three areas where air needs to be replaced by chemical: upstream of the membrane, downstream of the membrane, and in the porous area of the membrane itself.

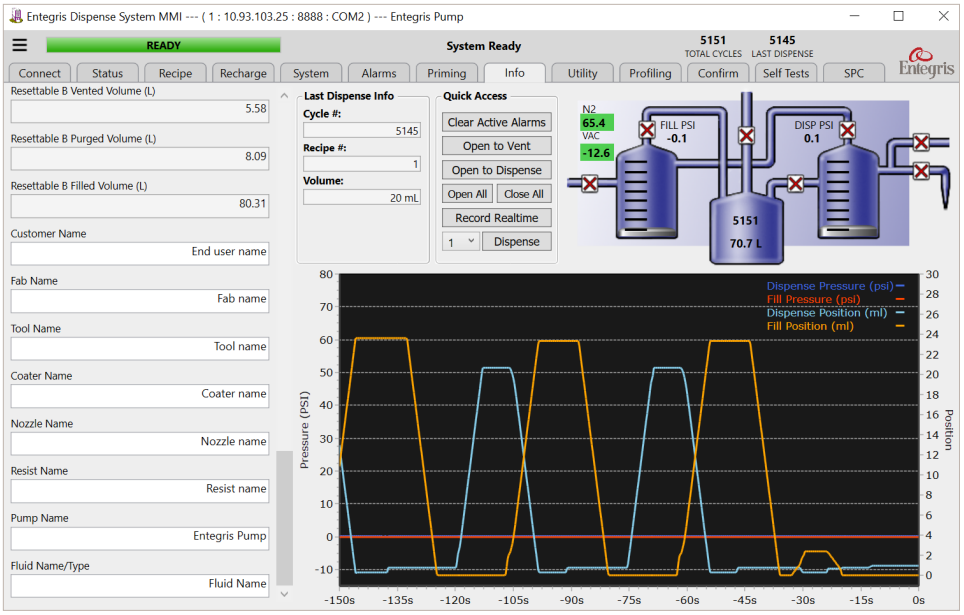
- Priming vent cycles will fill the upstream area of the filter. Cycle until a solid stream of chemical fills the vent line.
- Priming purge cycles will begin the wetting of the porous areas of the membrane and remove air from downstream area of the filter.
- Priming inlet cycles will recirculate chemical through the membrane, completely wetting the membrane without excess use of chemical.

INFO TAB

The Information page is mostly read-only information that is assigned during manufacturing regarding pump motors, PCBs, modules, firmware, pump cycles and volume, filter cycles and volumes, and resettable cycles and volumes.

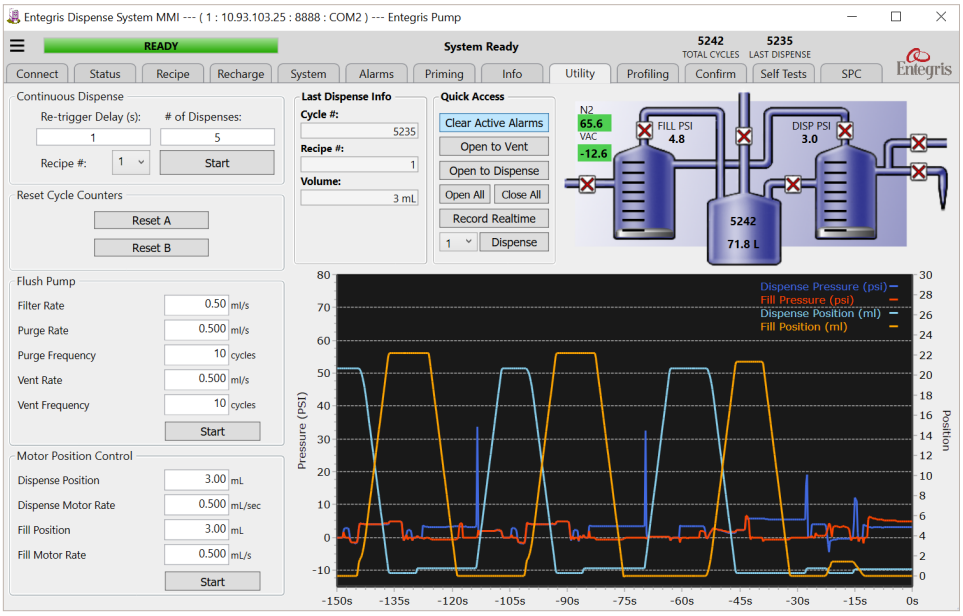


NOTE: At the bottom of the page, the user should add pump identification and location descriptions. These identifying markers are used as references on the Connect page and in saved profiles.



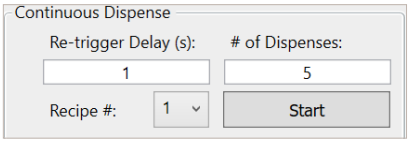
UTILITY TAB

The Utility page hosts three functions considered pump utilities. They are continuous dispense, reset cycle counters, and flush pump.



Continuous Dispense

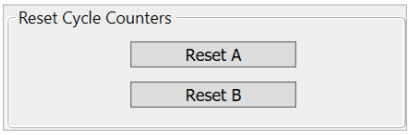
This utility allows the user to set up a continuous dispense of any established recipe up to 999 cycles with a trigger delay between dispenses. This utility is primarily used for cycling the pump independently of the track.



Reset Cycle Counters

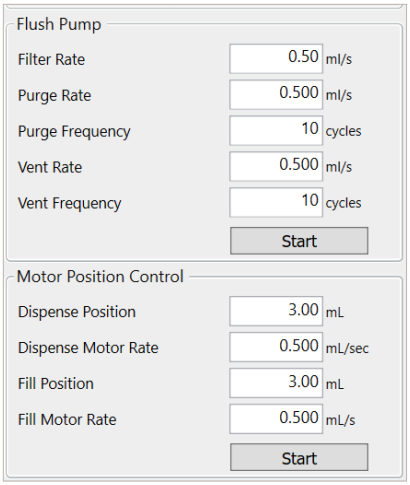
This utility allows the user to reset pump cycle counters (A and B), that are listed in the information page as read only. Each cycle counter records the cycles, power cycles, dispensed volume, filtrated volume, vented volume, purged volume, and filled volume since the last reset.

These cycle counters are independent of the total cycle counter that cannot be reset.



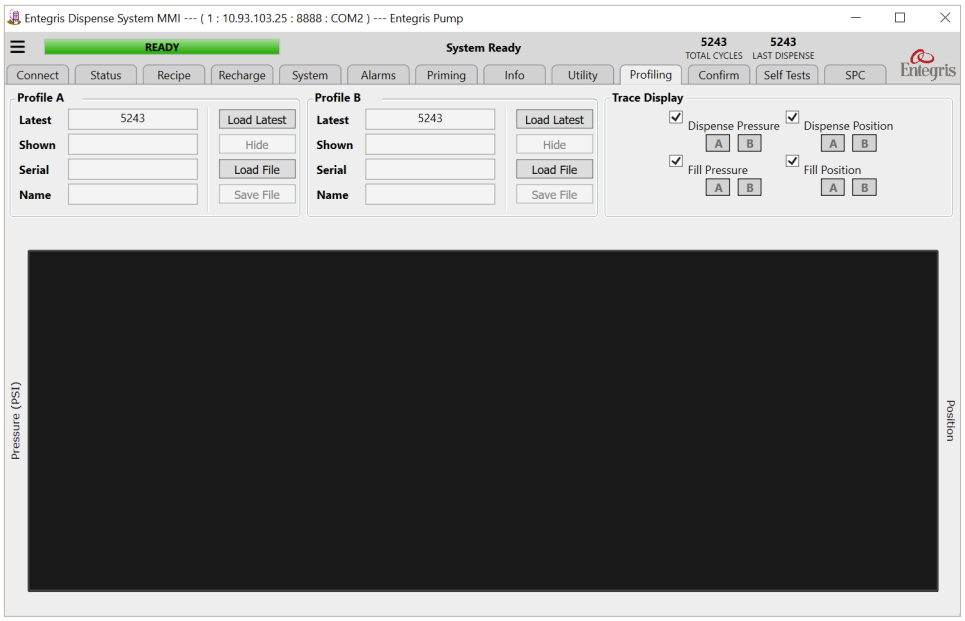
Flush Pump and Motor Position Control

This utility gives the user a quick method to flush fluid from the pump system through the purge and vent functions. Purge, vent, and filter rates and frequencies can be modified depending on the fluid to be flushed. Motor position control is used during flushing to control flow direction from a specified position and a given rate.



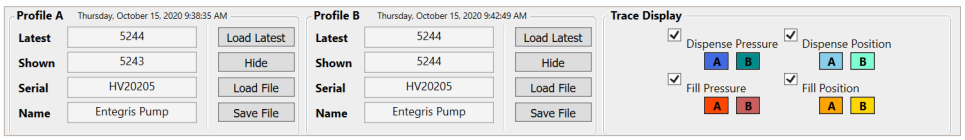
PROFILING TAB

The Profiling page allows dispense profiles to be plotted, saved, and imported individually for comparison. The traces display dispense pressure, dispense motor position, fill pressure, and fill motor position. Individual traces can be shown or hidden.

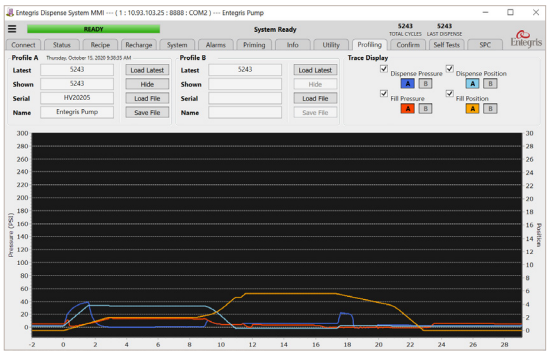


Using Profile Command

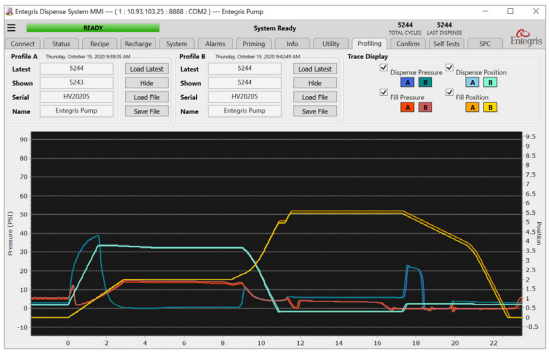
One (Profile A) or two (Profile B) profiles can be displayed for comparison purposes.



1. In Profile A, press **"Load Latest"** to load the last dispense.



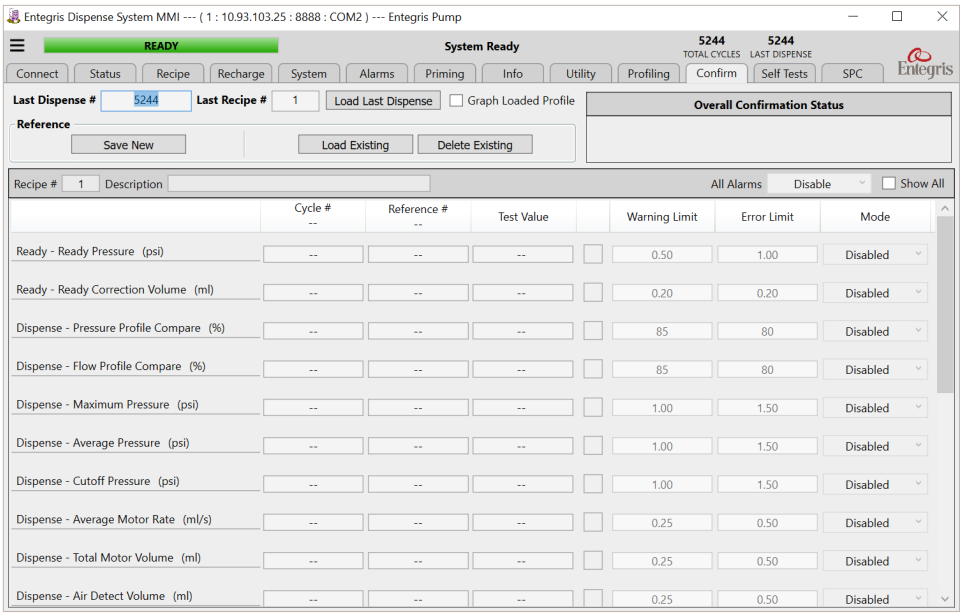
2. The **"Shown"** field populates with the cycle profile being displayed. The **"Pump Name"** and **"Serial"** fields populate with name information from the Info page and the pump serial number.
3. Traces are displayed in the graph below the profile command area.
4. The **"Hide/Show"** function allows the user to hide Profile A traces or show the traces.
5. The **"Load File"** function allows the user to load a previously saved *.csv profile.
6. The **"Save File"** function allows the user to save the displayed Profile A profile to a *.csv file.
7. Dispense one cycle.
8. In Profile B, press **"Load Latest"** to load the last dispense.
9. The **"Shown"** field populates with the cycle profile being displayed. The **"Pump Name"** and **"Serial"** fields populate with name information from the Info page and the pump serial number.



10. On the right of the profile command, the user can hide and show any of the four traces by checking and unchecking the **"Trace Display"** boxes.

CONFIRM TAB

The Confirmation page allows the user to compare dispense profiles with a saved reference profile by means of settable criteria.

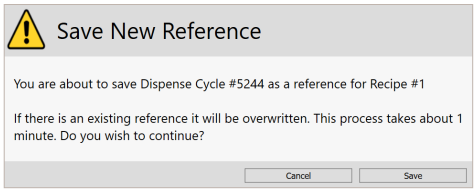


Using Confirmation

1. Define Warning and Error Limits to trigger alarms when changes to the dispense occur. Limits can be adjusted based upon the amount of control the user prefers.

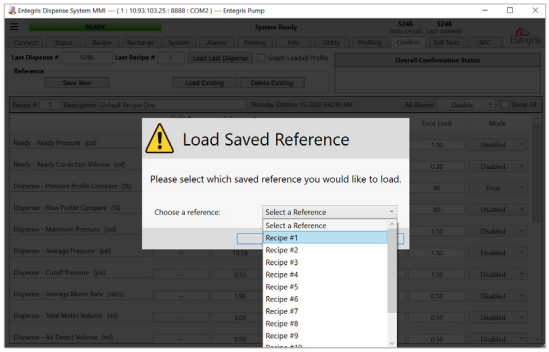
2. When the user has set an optimum dispense, press **"Save New"**.

3. When prompted, press **"Save"**.

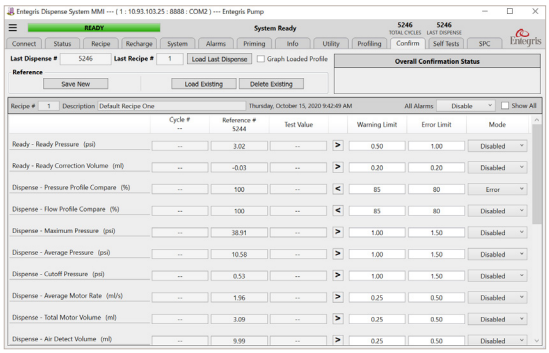


4. Press **"Load Existing"** to set reference parameters.

5. When prompted, select the corresponding recipe and press **"Load"**.



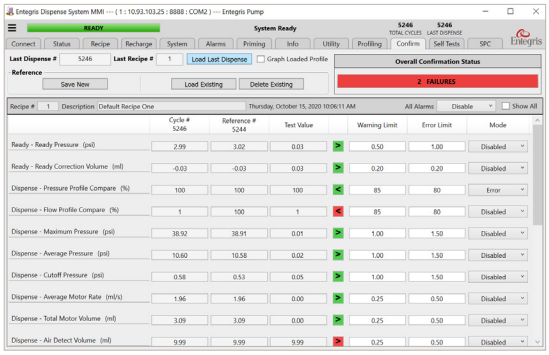
6. Confirmation field will populate the reference column.



7. Dispense one cycle.

8. Press **"Load Last Dispense"**.

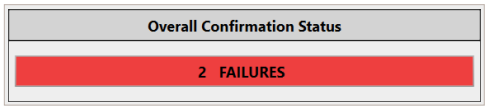
9. Confirmation field will populate the dispense column.



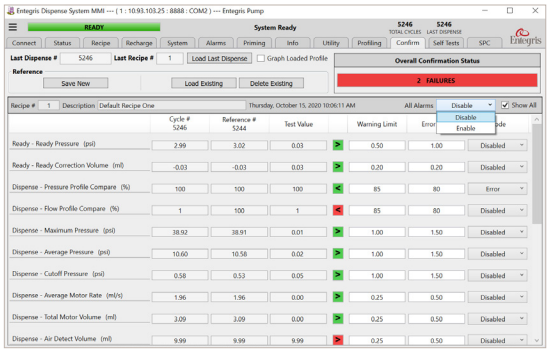
10. Check the **"Graph Loaded Profile"** box and press **"Load Last Dispense"**.

11. Both the last dispense and the reference profile will be displayed on the Profiling page. The reference profile is always shown as Profile B.

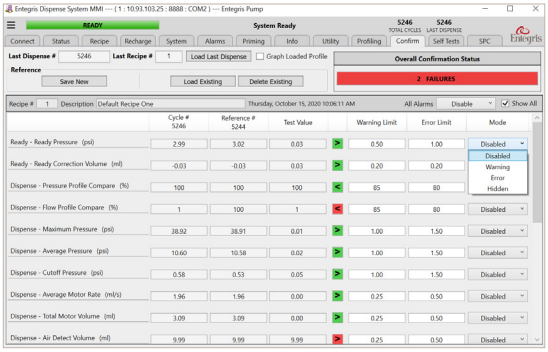
12. The **"Overall Confirmation Status"** shows the results of the confirmation tests. In this example, 17 individual tests passed while two show failures. Enabled and disabled test parameters should be systematic to a particular fluid and application. Tests are for the user to track changes in the system and dispense repeatability. Initially, parameters should be set to "tight" standards, but once the criteria is established, some parameters can be eased or even disabled. In the example shown, the two tests that failed are out of the "tight" parameters set, but do not affect the dispense quality.



13. The confirmation tests can be enabled or disabled individually or collectively. If enabled, an error will stop dispensing. A warning will allow dispensing to continue. To enable confirmation control, set **"All Alarms" to "Enable"**. With the individual tests still set at **"Disabled"**, the confirmation tests are not yet enabled.



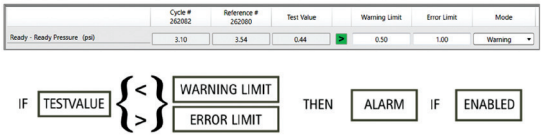
14. Confirmation tests are enabled individually set to **"Warning"** or **"Error"**.



15. **"Hidden"** hides the confirmation test from the list.
16. Check the **"Show All"** box and the hidden test reappears.

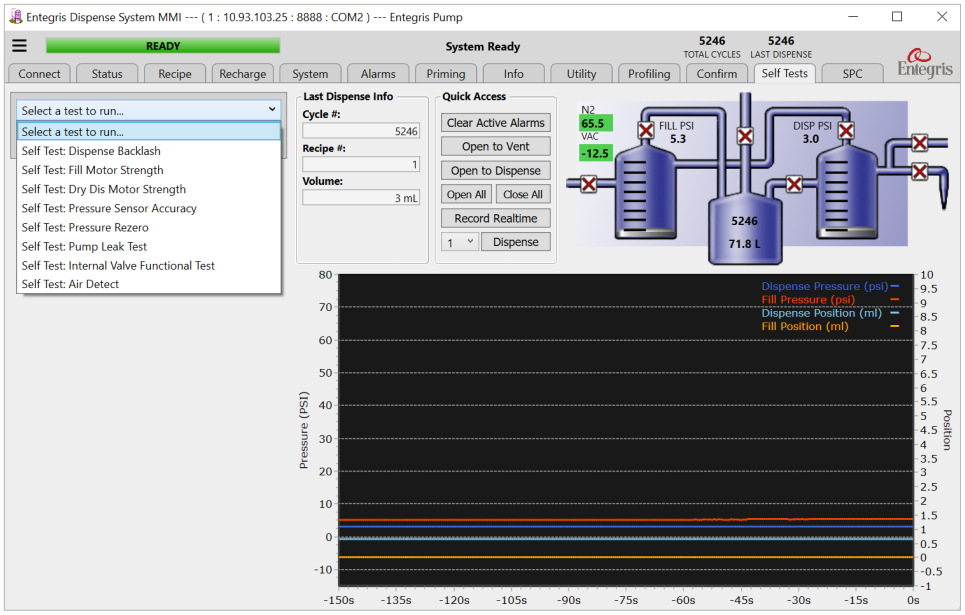
Reading the Results

1. Read the result as a sentence.

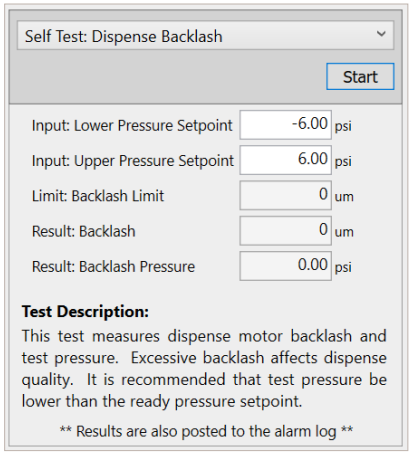


SELF-TESTS TAB

The Self-Tests page allows the user to perform self-diagnostic tests to check the functionality of the system, including: dispense motor, fill motor, pressure sensors, pump integrity, and internal pressure valves. Follow the instructions given in the Test Description for each test.

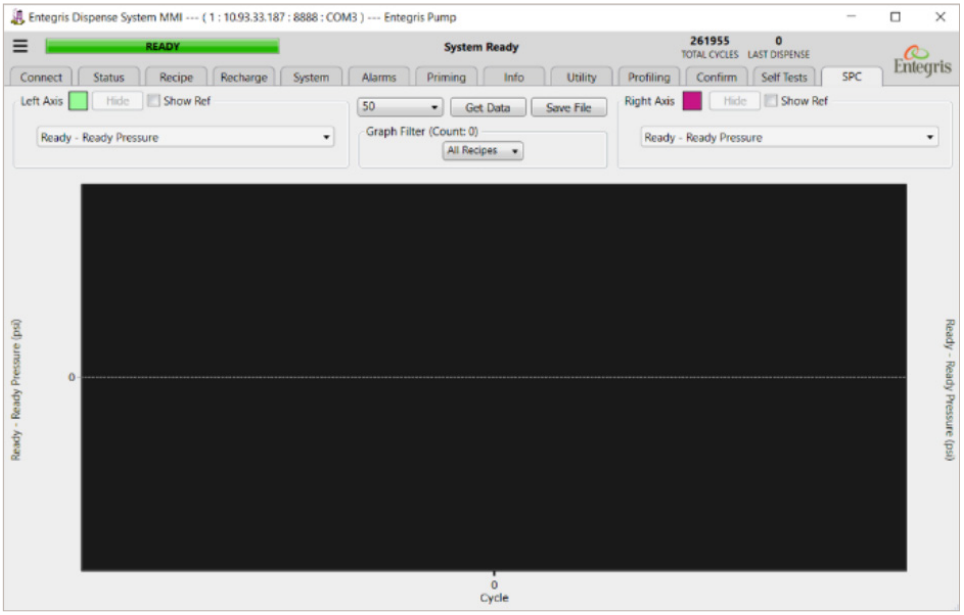


CAUTION! Only a qualified technician should perform these tests. Improper application of these tests may result in the loss of system calibration.



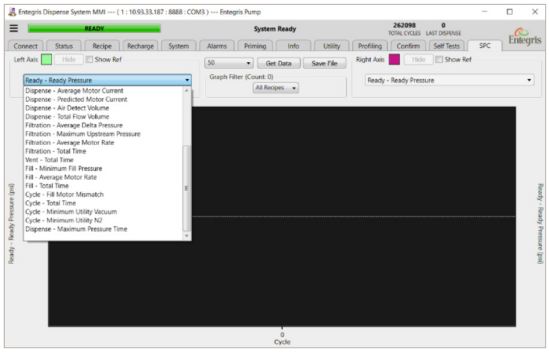
SPC TAB

The Statistical Process Control (SPC) page archives profile data, including ready, dispense, filtration, vent, and fill. The SPC page allows the user to graph two data sets from a series of consecutive cycles.

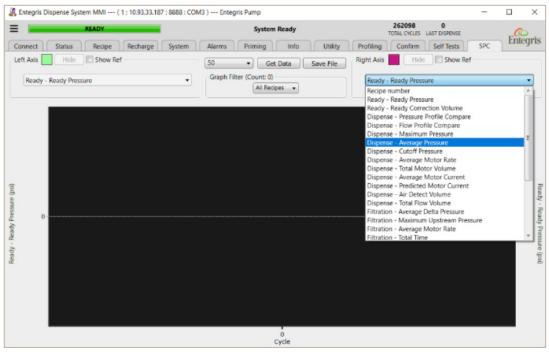


Using SPC

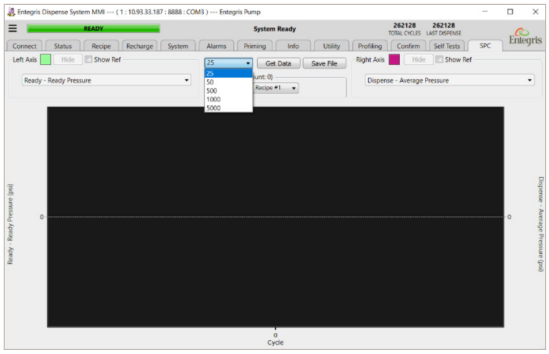
1. Select the data point to graph for the left axis.



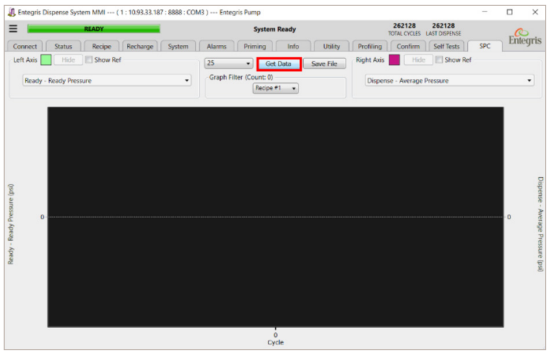
2. Select the data point to graph for the right axis.



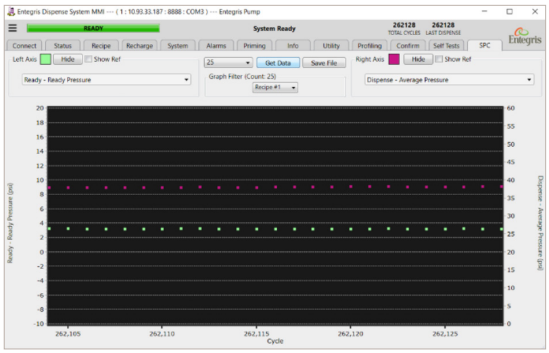
3. Select the number of data points to be graphed.



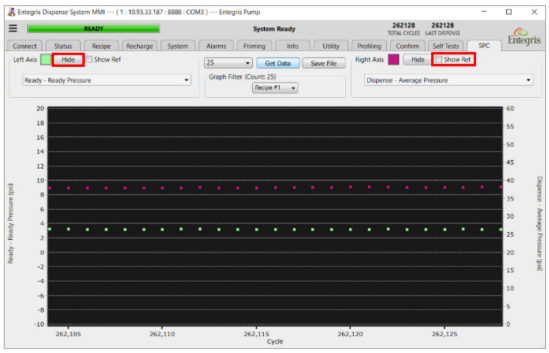
4. Press **"Get Data"** to retrieve data from archive. For additional data points, press **"Get Data"**. The number of data points will increment by the number displayed.

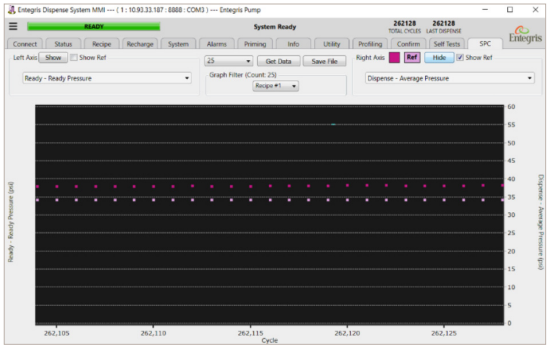


5. The graph will populate with the data selected.



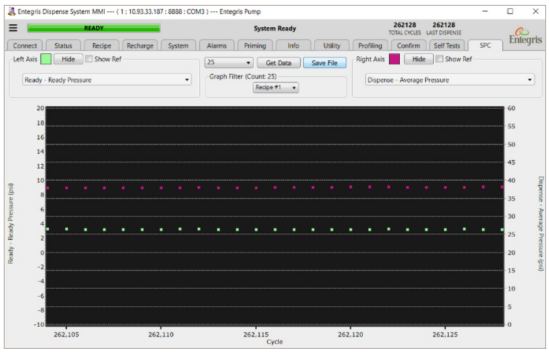
6. Pressing the **"Hide"** button will hide the data plot. Checking the **"Show Reference"** box will show the reference data point for each cycled dispense.



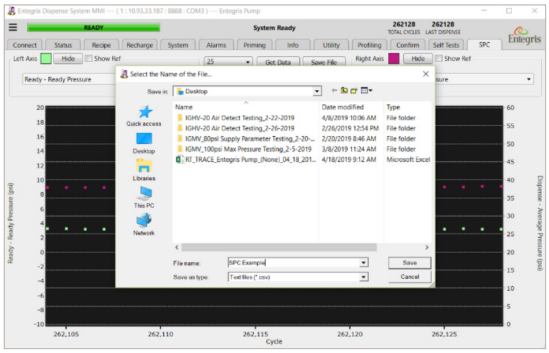


Saving SPC

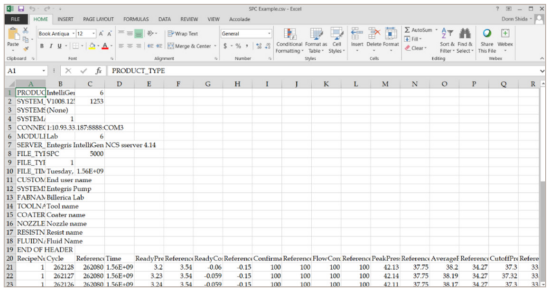
1. To save the SPC data to a *.csv file, press **"Save File"**. Only the cycles selected to be displayed will be saved to the *.csv file.



2. When the dialogue box opens, give the SPC file a name and press **"Save"**.



3. Open the *.csv file. The file contains all archived data for the cycles selected, including the reference data.



MAINTENANCE

No special maintenance is required for this system besides periodically changing the filter when necessary.

CHANGING THE FILTER

A filter replacement schedule can be set using the "Filter Cycle Alarm" function on the Systems page, page 20. Refer to "Quick Filter Changeout" section in this manual, page 10.

⚠ **WARNING! POTENTIAL CHEMICAL HAZARD! Obtain the chemical supplier's MSDS sheet for specific health and safety information.**

⚠ **WARNING! Wear chemical-resistant garments and eye protection while draining the system, changing the filter and during start-up. Dispose of the used filter in a manner consistent with approved regulations and guidance from the chemical supplier.**

NOTE: UPE filter membrane does not require prewetting for use with most photochemicals. Consult Entegris for additional information on filter selection and compatibility.

FLUSHING THE SYSTEM

Clean and flush the dispense system when the chemical is changed, when the system is removed from service for an extended period, or when the dispense system and lines require flushing to remove particulates.

⚠ **WARNING! Wear chemical-resistant garments and eye protection while flushing the dispense system.**

The following procedure covers most photochemical applications, but chemicals used for flushing and cleaning must be compatible with the chemical in the pump. Contact the photochemical manufacturer to verify the flushing and cleaning chemicals will not cause an adverse reaction.

⚠ **WARNING! Isopropyl alcohol (IPA) may react adversely with photochemical. Pumps and filters flushed with IPA should be flushed first with the photochemical base solvent before usage in the pump.**

Typically, the amount of solvent used during flushing is between the 500 mL and 750 mL range. Dependent on pump setup, the first 200 mL can be recycled through the system to dissolve any residue. Remove and discard this fluid, then pass fresh flushing chemical through the pump and discard.

⚠ **WARNING! When changing photochemical, the chemical manufacturer may recommend a full tubing change to avoid cross contamination. Contact the photochemical manufacturer for the recommended procedure.**

⚠ **WARNING! To remove photoactive compound precipitates (PAC), contact the photochemical manufacturer to determine the proper solvent for dissolving PAC crystals. Some crystals may not dissolve in the solvent base and a stronger solvent may be required.**

Flushing a Working Pump

1. Remove the filter and replace with a flushing shell.
2. Connect the inlet line to a photoresist solvent or a manufacturer recommended stripper or thinner.
3. Use a priming operation sequence to flush out the pump, then continue to dispense until the bulk of the original chemical is removed.
4. Connect the inlet line to a container of a manufacturer recommended cleaning solvent.
5. Use a priming operation sequence to flush out the pump, then continue to dispense until the bulk of the cleaning chemical is removed.
6. Connect the inlet line to a container of isopropyl alcohol (IPA) and flush the pump to remove previous cleaning chemicals.
7. Using the MMI, manually open all the pump valves and external outlet valve.
8. Blow-dry the pump using compressed or filtered dry nitrogen. (A blow-down valve is available on the prewet system.)
9. After 10 minutes, close the vent valve and blow-dry for another 10 minutes.
10. Close the purge valve and open the vent valve for 10 minutes.
11. Reopen the purge valve and continue blow-drying for 10 minutes.
12. Turn off the nitrogen blow-dry valve.
13. Close all pump valves.

Flushing a Non-working Pump

Use this procedure to flush and dry a pump that is not properly functioning and needs to be returned to the pump manufacturer for repair. Contact Entegris prior to returning any pump for service and to obtain appropriate forms to certify proper decontamination and handling of the dispense system by all personnel.

1. Remove all tubing connections. Drain and flush separately.
2. Remove the filter and replace with a flushing shell.
3. Remove pressure source from the pump to unseat the valves.
4. Reattach tubing to the pump to avoid splattering of photochemical.
5. Empty the tubing lines as follows:
   - Pressurize the inlet line with N_2 or CDA to push photochemical through the inlet of the flushing shell.
   - Pressurize the purge line to push photochemical through the dispense line.
   - Pressurize the vent line to push photochemical through the flushing shell vent port.
6. Discharge solvent, followed by IPA, through the pump using the same steps above.
7. Blow-dry the pump by applying N_2 or CDA through the inlet, purge, and vent lines.

UPDATING FIRMWARE

When the MMI detects a firmware mismatch between the pump and controller, a firmware warning will display.

WARNING! Although it is not required to update firmware, it is recommended that the latest firmware be used in the pump and controller. Occasionally, firmware mismatches are incompatible with each other due to system upgrades.

To update, select "Download" and follow the screen prompts.

CAUTION! Do not interrupt the download process. If the pump is powered down during the flash process it may cease to operate. If this occurs, please contact Entegris for assistance.

TROUBLESHOOTING

This section covers common problems and solutions for the dispense system. For event codes, error codes, and other details, please contact Entegris.

Pump Does Not Dispense

PROBLEM	SOLUTION
Pump is not responding	Check electrical connections between pump, interface module, and track. Check that the N_2 or CDA supply is connected.
External stop valve not operating	Verify pneumatic connections to the external valve.
Pump is in error state	Clear alarms. If condition persists, contact Entegris technical support.
Improper N_2 or CDA pressure or vacuum	Verify N_2 or CDA and vacuum supply pressure.
No chemical in pump	Replace source bottle and prime pump. Replace filter if chemical has dried out.
Bubbles in tubing	Check fitting connections and tubing for leaks.

Poor Quality Dispense

PROBLEM	SOLUTION
Air trapped in lines	Perform multiple dispenses using high volume and rate.
Nozzle too high or nozzle ID too large	Adjust nozzle height and size for dispense rate and viscosity.

Poor Start of Dispense

SYMPTOM	PROBLEM	SOLUTION
Fluid pulls up in nozzle before dispense starts	External stop valve opening too soon	Slow down valve with the external stop valve setup on Recipe page.
Dispense starts, stops, and proceeds with dispense	External stop valve opening too late	Open valve more quickly through the external stop valve setup.

Poor End of Dispense

SYMPTOM	PROBLEM	SOLUTION
Droplet hangs down or drips	External stop valve closing too late or parameters require adjustment	Close the valve earlier using the Outlet Valve Control or suckback settings on the Recipe page.
Fluid cuts off too high in the nozzle	External stop valve closing too quickly	Close the valve later using the Outlet Valve Control or suckback settings on the Recipe page.
No suckback	Bubbles in dispense line	Ensure no bubbles in dispense line.
	Inappropriate suckback	Ensure there is time for the chemical to flow back. Higher viscosity chemicals require longer time.

High Particle Counts on Wafer

PROBLEM	SOLUTION
Filter media is too open	Use smaller pore size filter.
Filter not being fully wetted during installation or priming	Perform multiple purge cycles using higher than normal filtration to completely wet the filter.
Filter lifetime exceeded	Replace filter.
Contaminated or old photoresist	Drain, flush, and clean the entire system and fluid path.

Resist Thickness

SYMPTOM	PROBLEM	SOLUTION
Resist thickness non-uniform	Delay between end of dispense and the final wafer spin	Correct wafer spin timing.
	Nozzle not centered above wafer	Center nozzle.
	Dried chemical on nozzle	Clean nozzle.
	Nozzle too high or too low above wafer	Adjust nozzle height. (Typically 6 to 9 mm above wafer. Fluid viscosity dependent.)

MANUFACTURING INFORMATION

System Relocation Notice

If a CE marked system that corresponds to this technical manual is moved from the original designated country of installation to another country, please contact Entegris.

Spare Parts

Please contact Entegris for replacement filters, flushing shells, and spare parts.

Technical Support

For technical support, contact Entegris at +1 800 394 4084. Please have the complete model number, chemical, and application information ready when calling.

PRODUCT WARRANTIES

For Product Warranties, visit *www.entegris.com* and select the Legal Notices link from the footer.

Repair Service

Rebuild and warranty service is available through Entegris. Call +1 800 394 4084 or contact your Regional Customer Service Center for more information. Entegris will expedite processing by providing a Return Materials Authorization (RMA) number, MSDS requirements, and important cleaning and packaging details.

If the unit being returned was exposed to a hazardous substance, it must be flushed and cleaned in accordance with the provided flushing requirements. A copy of the MSDS for each hazardous substance, including cleaning fluids, must be included with the returned product. See the *Flushing the System* section of this manual.

LIMITED WARRANTY

Entegris' products are subject to the Entegris, Inc. General Limited Warranty. To view and print this information, visit entegris.com and select the Legal & Trademark Notices link in the footer. Entegris does not warrant any failure in the case of customers using unapproved foreign components.

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Visit entegris.com and select the Contact Us link to find the customer service center nearest you.

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