# IntelliGen® LV 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 | 0.01 – 10.0 mL in 0.001 mL increments |
| | Rate | 0.01 – 3.0 mL/sec in 0.001 mL/sec increments |
| | Repeatability | ≤0.02 mL 3 sigma |
| | Viscosity range* | 1 – 100 cP or at higher viscosities when dispense pressure does not exceed 29 psi |
| | Maximum dispense design pressure** | 0.20 MPa (29 psi) |
| **Recharge performance** | Fill rate, filtration rate, vent rate, purge rate | 0.1 – 3.0 mL/sec in 0.001 mL/sec increments |
| | Vent frequency | Auto-venting or 1 – 10,000 dispense cycles |
| **Mechanical** | Wetted surfaces | Modified PTFE, PTFE, Kalrez® |
| | Connection type | Insert style, Super Type Pillar®, or Flowell™ 60 Series |
| | Filter | Impact® 8G or Impact 2 V2 (OF style) |
| | Inlet, outlet and vent tubing | OD: 6.35 mm (0.25") or 6.0 mm (0.24")<br>ID: 3.97 mm (0.156") or 4.0 mm (0.16") |
| | Inlet gas type | Regulated $N_2$ |
| | Operating conditions | Minimum operating pneumatic pressure: 0.26 MPa (38 psi)<br>Maximum operating pneumatic pressure: 0.28 MPa (40 psi)<br>Pneumatic leak pressure: 0.30 MPa (43 psi) |
| | Vacuum | -68 kPa (20 in-Hg min) |
| **Dimensions** | Height | 200.1 mm (7.878") |
| | Width | 60.7 mm (2.39") |
| | Depth | 209.17 mm (8.235") |
| **Weight** | Approximately 5 kg (11 lbs) | |
| **Electrical** | Current rating | 1.25A maximum |
| | 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 | |
| | Altitude below 2000 m (2187.22 yd) | |
| | 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) | |
| | Main supply fluctuations from 22 – 26 VDC | |
| | Transient overvoltages of overvoltage category II | |
| | Pollution degree 2 | |

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

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

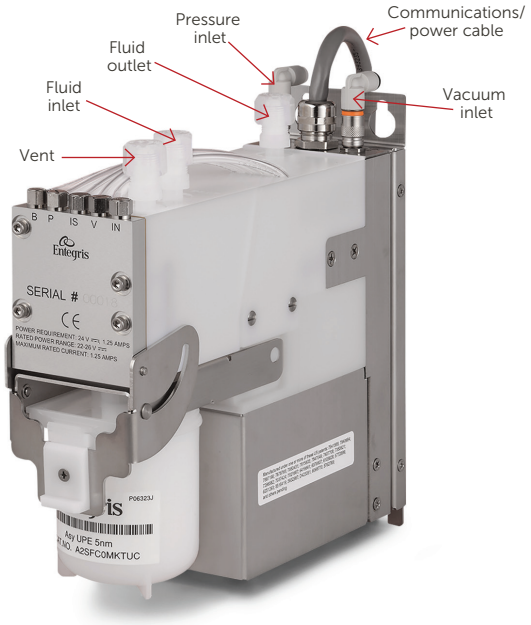
The internal wettable surfaces of the dispense system are PTFE, modified PTFE, and Kalrez.

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.

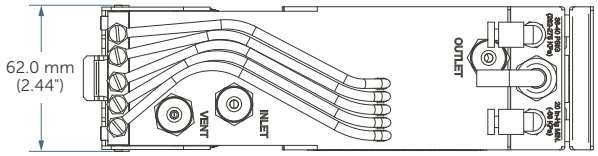
- Acetone
- Adamantane (tricyclodecane)
- n-Amyl acetate
- Anisole (methyl phenyl ether, methoxybenzene)
- 2-Butoxyethanol (ethylene glycol monobutyl ether, butyl cellosolve)
- n-Butyl acetate
- Butyl alcohol
- Butyl cyclohexane
- Butyl ether (dibutyl ether)
- Cyclopentanone
- Cyclohexanone
- Developer (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

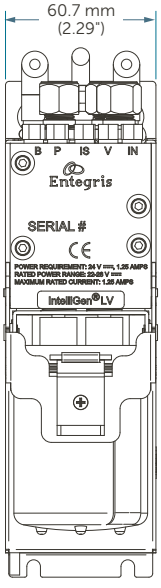
## APPEARANCE



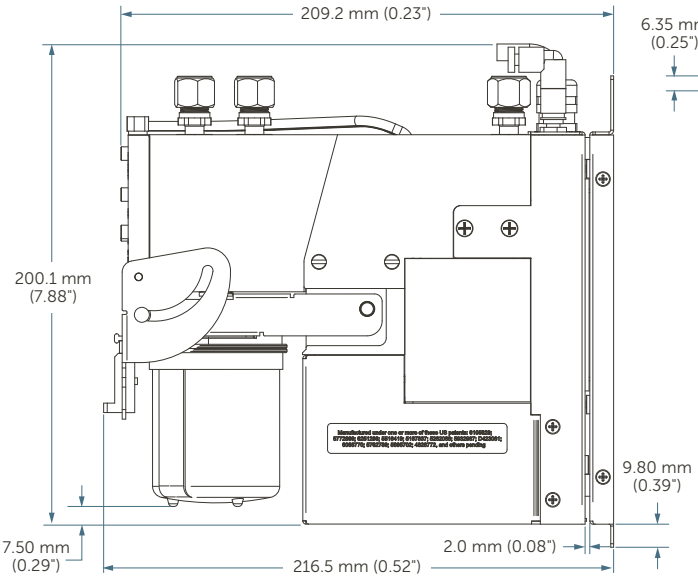

### Top View



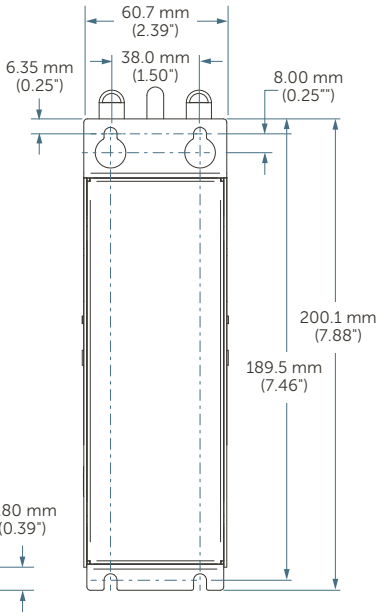

### Front View




### Side View



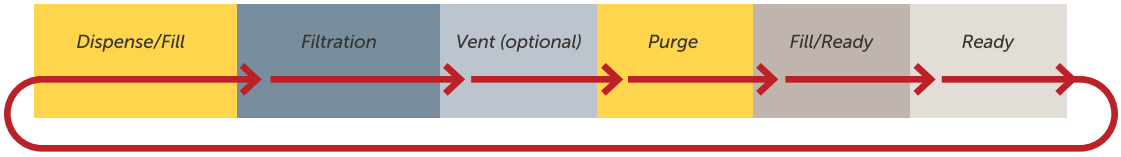

### Back View



## 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.



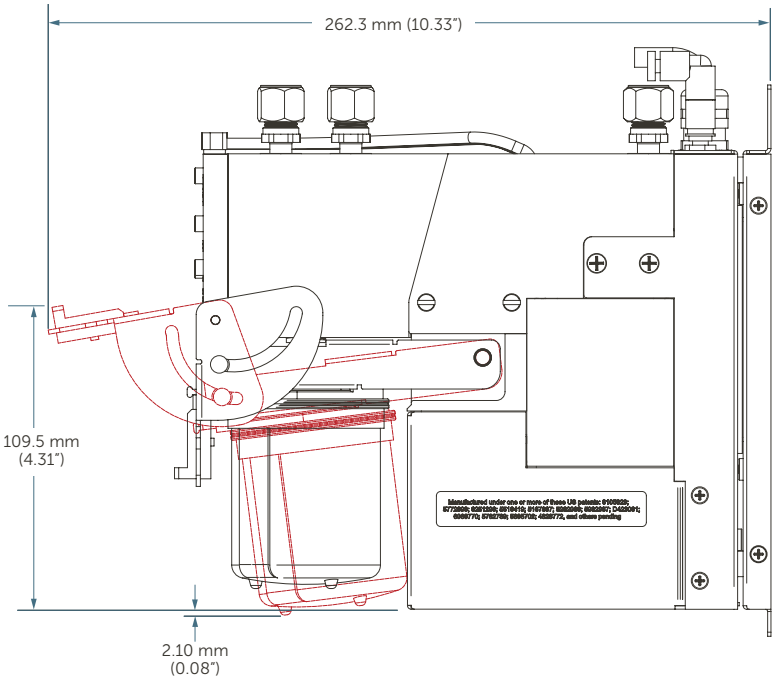

1. **READY** State
   - The inlet, external outlet, vent, and purge valves are closed.
   - The isolate and barrier valves remain open for a time to allow the system to reach ambient pressure, then the valves close.
   - The dispense chamber is full of fluid and is ready to dispense.
2. **DISPENSE/FILL** 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.**



## 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 5 kg (11 lbs), has blunt edges, and can cause pinch or other personal injuries.

**WARNING! PINCH HAZARD! Pump weight in excess of 5 kg (11 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
- Impact 8G and Impact2 V2 (OF style) (sold separately)
- External stop/suckback valve

## 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.

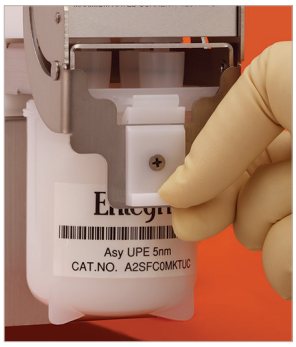

4. Verify that only **ONE** set of O-rings is used.

⚠ **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

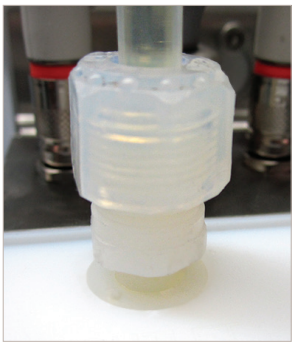
Minimize tubing lengths whenever possible and maximize fluid tubing size wherever practical to further reduce pressure drop through the tubing.

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 the Flushing the System section of this manual (page 33).

## MMI SOFTWARE

The new and improved user-friendly MMI (Man-Machine Interface) Software provides more information at the point of dispense for better control of the dispense.

New features include:

- A pressure sensor on the fill side of the dispense pump to better understand what is occurring during the fill stage. This allows better recharge control and also provides an indication of when filter replacement is necessary.
- An improved dispense confirmation page with additional tests to determine the changes that occur between dispenses with the ability to compare dispenses and the referenced dispense assigned to the recipe number.
- An improved profiling page that allows side-by-side comparisons between last dispense profile, any saved dispense profile, or any referenced dispense profile (accessed from the Confirmation page) for four traces: dispense pressure, dispense motor position, fill pressure, and fill motor position.
- A self-test page with tests designed to evaluate the status of the dispense pump.
- An improved alarms page that allows the user to search and sort alarms history to determine changes to the system. Every header column can be sorted.
- An information page that allows the user to assign names for fab, tool, coater, resist, or fluid. This page also is a quick reference pump information page.
- A mouse-over feature that provides a brief description, the minimum and maximum limits, and the default value.
- The ability to record pump information in real time and save to csv file.

### INSTALLING SOFTWARE

To program the pump, you must establish communications with a host computer, laptop or similar system, using the supplied software.

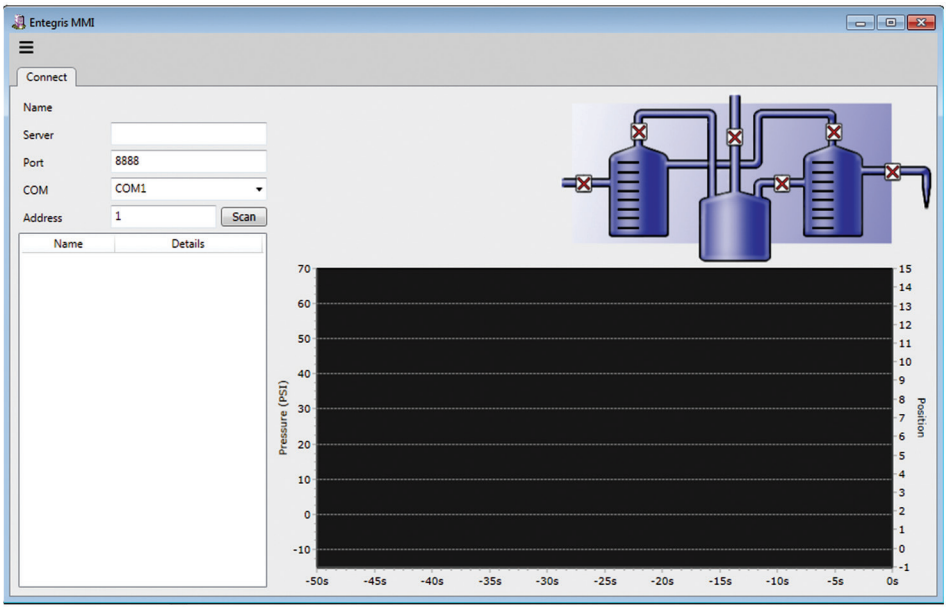
To install the software and establish communications with the dispense system:

1. Verify that a filter has been installed in the pump.
2. Connect the cables as appropriate for your 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 your computer, then double-click on the *.exe file to start the program.

## CONNECT TAB

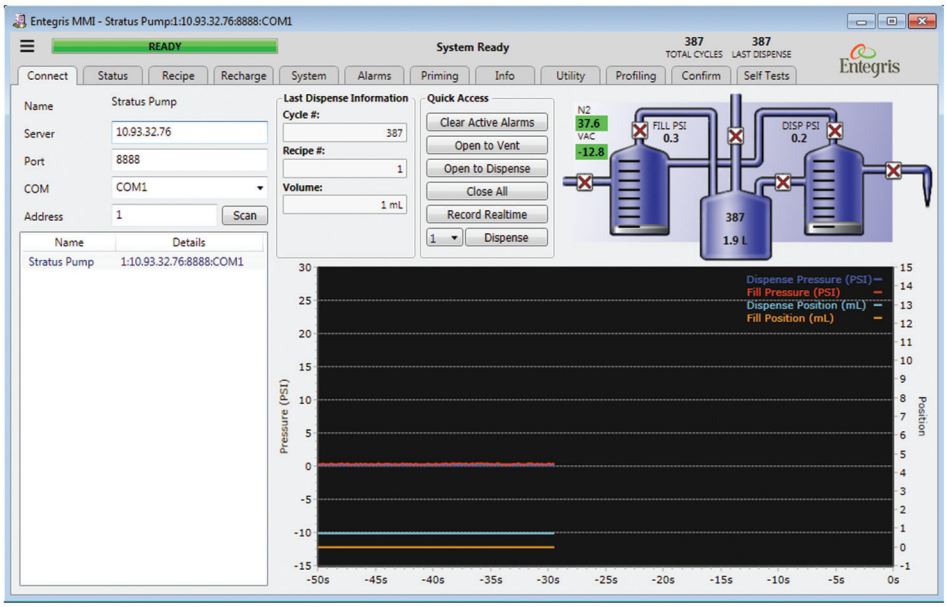
The Connect tab establishes the connection between the dispense pump and the MMI software.

1. Enter the Server, Port, and COM information.
   - The exact COM port will depend on the specific computer connection and system setup.
2. Enter the Address, or click "Scan" to search for pump connections.
   - Each IntelliGen LV system can be assigned a unique address from 1 to 63.
3. Click "Connect" to connect to the pump.
   - The Connect tab will record all previous connections with the latest connection at the top.



4. A Time Synchronization screen may appear. Read the instructions displayed to synchronize the time stamps between the computer and the dispense system.

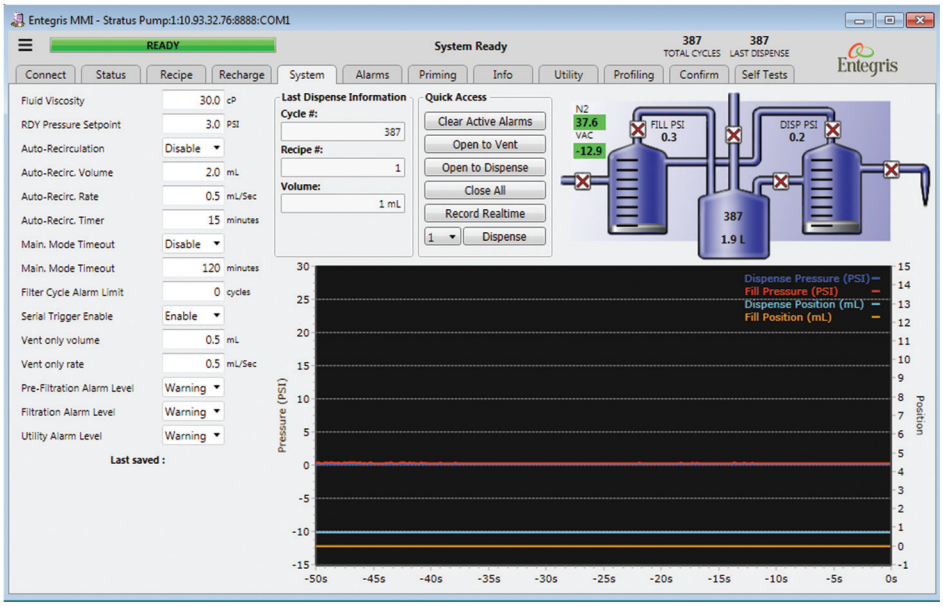
   When communications have been established, the MMI display will come alive with real-time dispense.



## SYSTEM TAB

The System tab provides variables relating to the system management of the pump. Variables can be changed from the default values to optimize the dispense system.

Use the mouse-over feature to obtain more information on displayed variables.



## PRIMING TAB

The Priming tab provides the ability to purge the dispense pump and system of air using a "priming sequence" of steps.

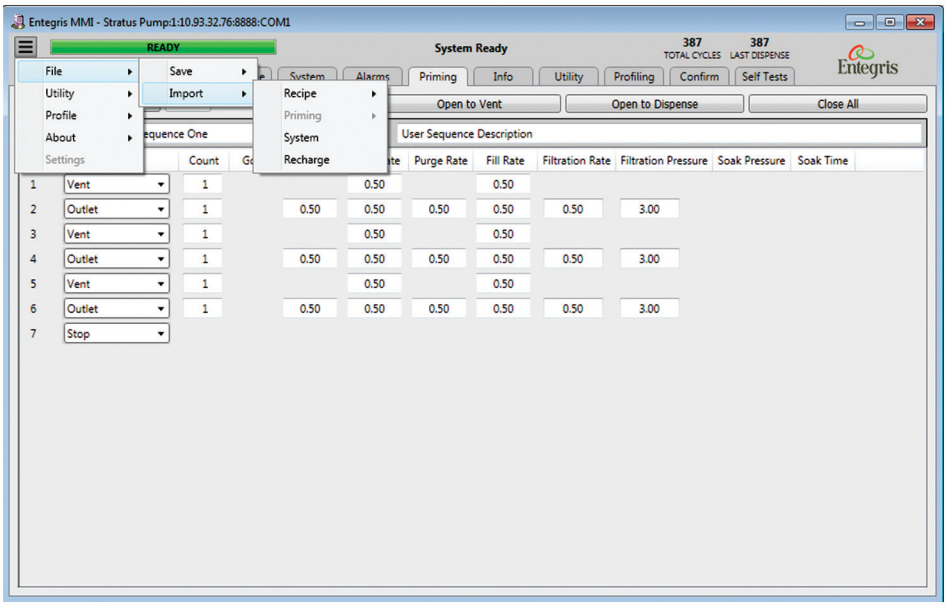
- Use "Loading a Sequence from a Saved File" to load an existing priming sequence.
- Use "Creating a Sequence" to create a new priming sequence.

Samples of priming sequences are provided in the Appendix (page 37).

### Loading a Sequence from a Saved File

A priming sequence can be loaded from a previously created sequence:

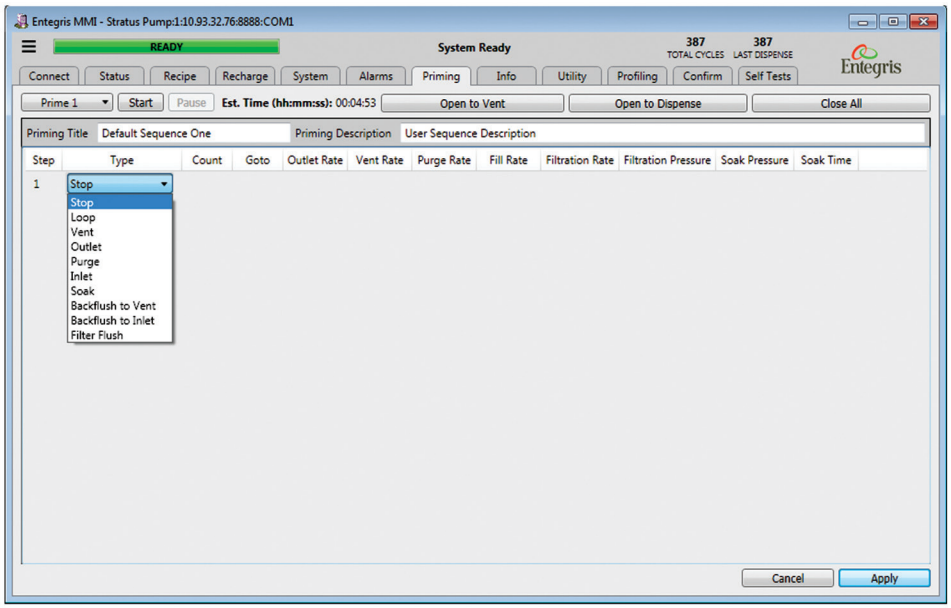
1. Click on the Menu logo.
2. Select "File".
3. Select "Import".
4. Select "Priming".
5. Select number to be assigned.
6. Select priming file to be downloaded.
7. Press "Open".
8. Press "Start" to being priming.



### Creating a Sequence

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

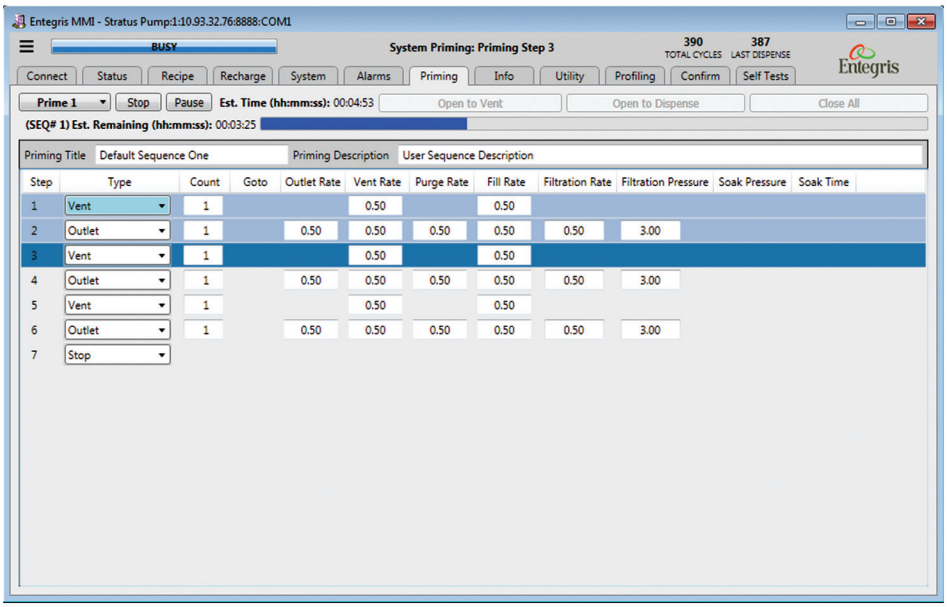
1. Under “Type” select a type of priming.
2. Under “Count” enter how many times the type of priming is to be performed.
3. For each step type, rates can be changed based on application needs.
4. Continue adding types and counts that will purge the system of air.
5. Press “Apply”.
6. Press “Start” to begin priming.
7. Priming sequence can be saved by clicking on the menu logo.
   - Select “File”.
   - Select “Save”.
   - Select “Number”.
   - Assign name of the priming sequence.
   - Press “Save”.



### Priming

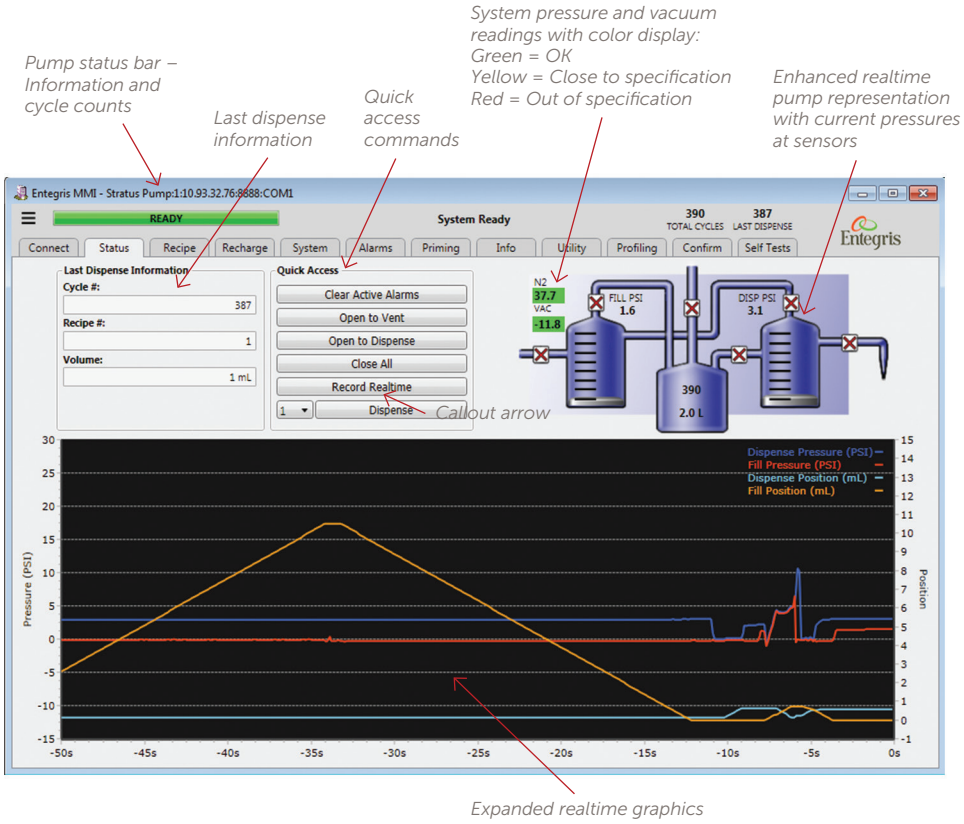
When in use, the Priming tab is divided into three sections:

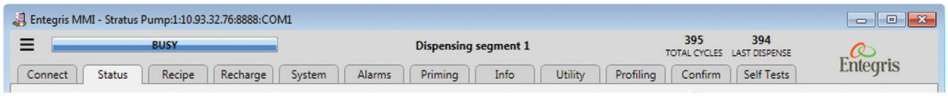
- In the top section, pump status and priming step are displayed.
- In the middle section, an estimated time of completion and count-down are displayed.
- In the priming field, finished steps are highlighted in light blue, the current step is highlighted in dark blue and unfinished steps remain in gray.



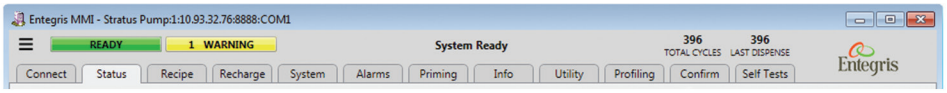
## STATUS TAB

The Status tab displays realtime data of the dispense system.

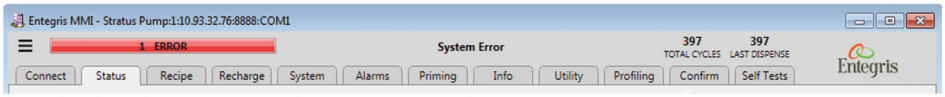



When the dispense pump is dispensing or recharging, the status will show “Busy”.



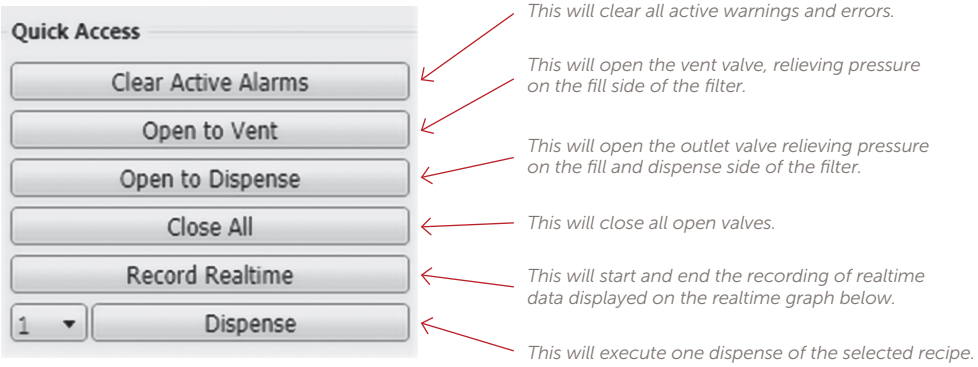

When a warning has been triggered, the status will display “Warning”.
The dispense pump will still function.




When an error has been triggered, the status will display “Error”.
The dispense pump will stop dispensing.

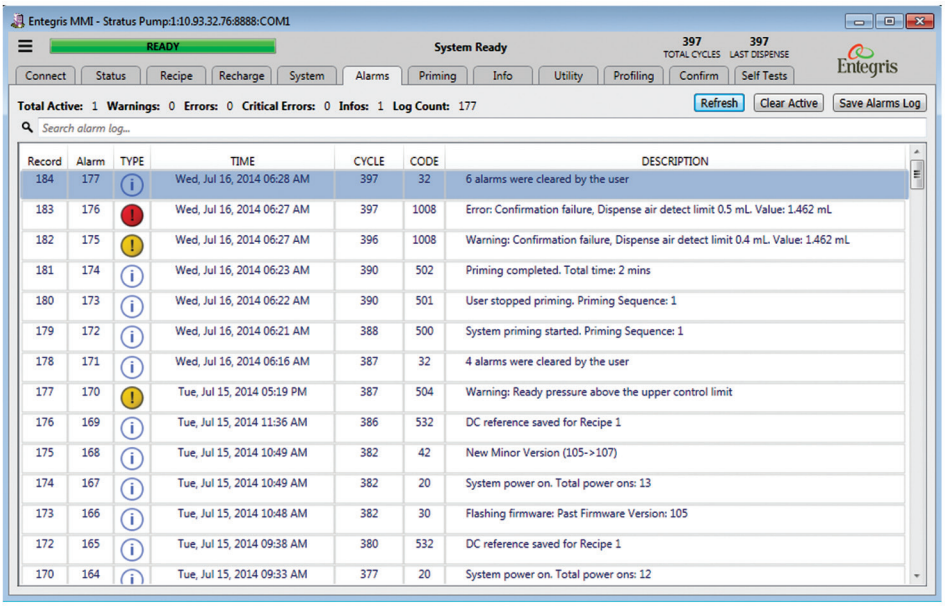
## Quick Access Menu

The Quick Access Menu allows the user to quickly perform certain functions without switching pages.



## ALARMS TAB

The Alarms tab displays information on the pump system's current state and history.




### 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. |

Each header description on the Alarms page can be sorted by double clicking on it (type, time, code, etc.).

Use the "Save Alarms Log" to save the log history to a csv file.

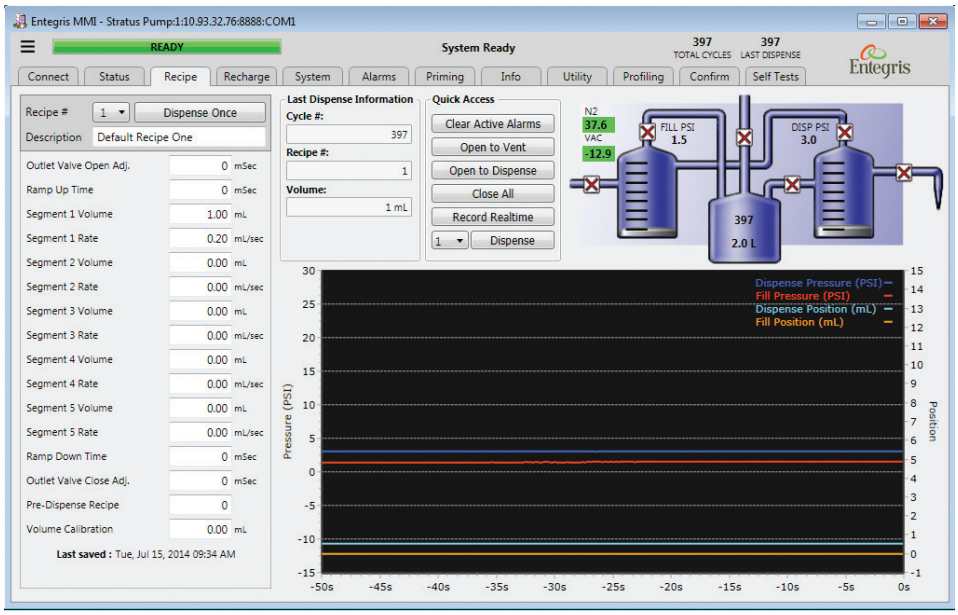
## RECIPE TAB

The Recipe tab allows access to the variables that control dispense.

To import or save all recipes or individual recipes:

1. Click on the Menu logo.
2. Select “File”.
3. Select “Import” or “Save”.
   - To Import: Assign a number to the file then press “Open”.
   - To Save: Select recipe to save, assign a name to the file, then press “Save”.

Use the mouse-over feature to obtain more information on displayed variables.




## RECHARGE TAB

The Recharge tab allows access to the variables that control the “Recharge” portion of the dispense cycle, including vent, purge, fill and filtration, and maximum dispense volume.

Use the mouse-over feature to obtain more information on displayed variables.

## UTILITY TAB

The Utility tab includes “Continuous Dispense” and “Reset Cycle Counters” functions.

## INFO TAB

The Information tab contains “read-only” items that pertain to individual pump tracking records and dispense statistical history. The screen also allows entry of information of system specifications, including location, type and fluid being used.

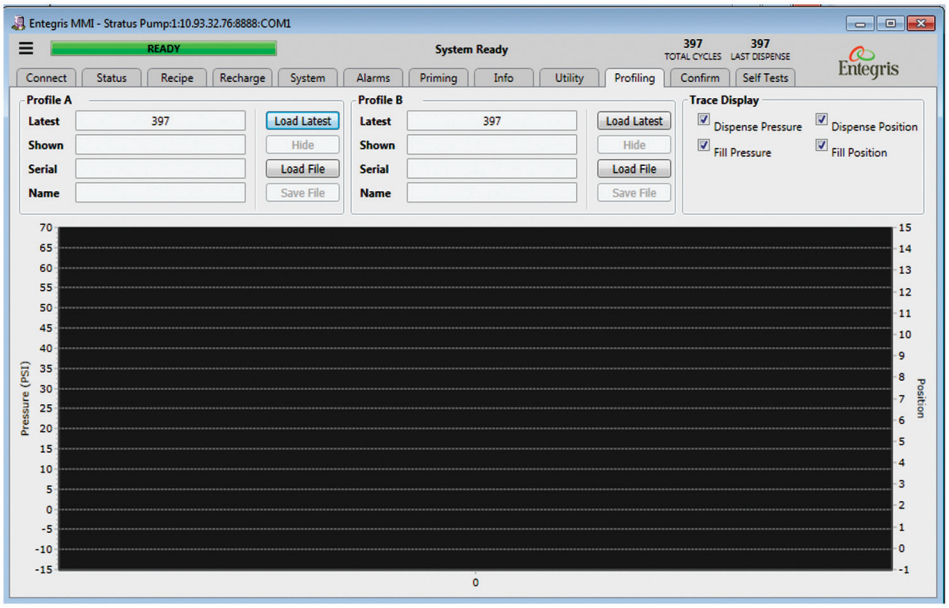
## SELF TEST TAB

The Self Test tab includes tests that evaluate motor backlash, the performance of the fill and dispense motors, and the accuracy of the pressure sensors.

**NOTE: Execution of these tests is setup dependent.**
**Refer to test description to obtain setup.**

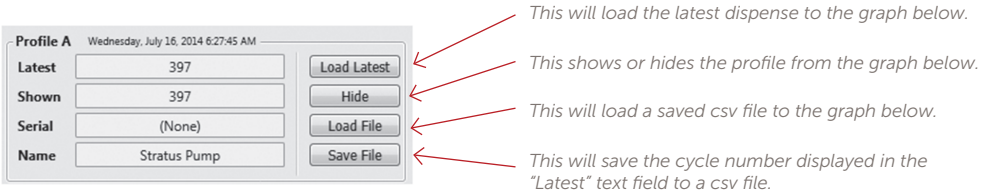
## PROFILING TAB

The Profiling tab allows dispense profiles to be plotted, saved, and imported individually or for comparison. The traces are dispense pressure, motor dispense position, fill pressure, and motor position which can be turned on or off.

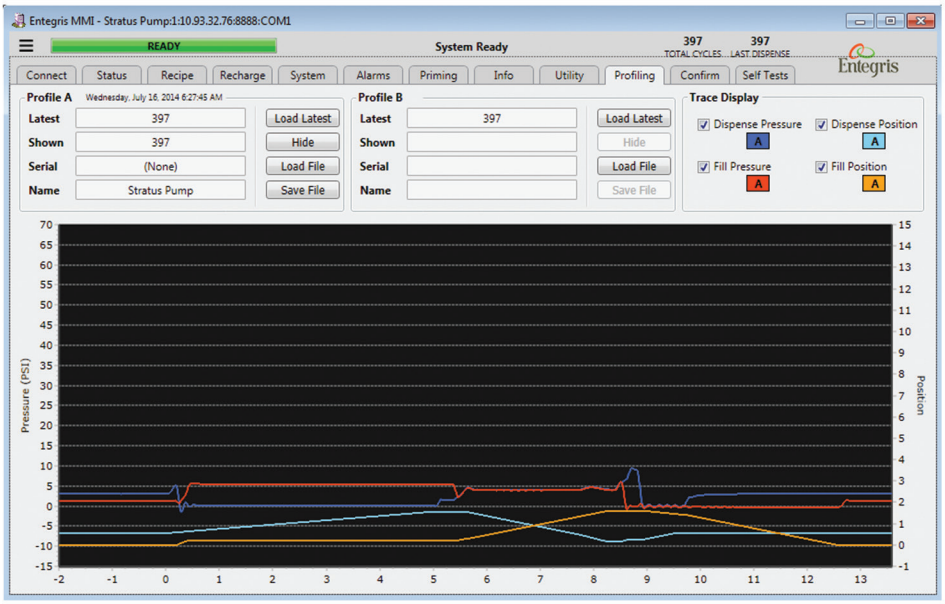


## Profile Command

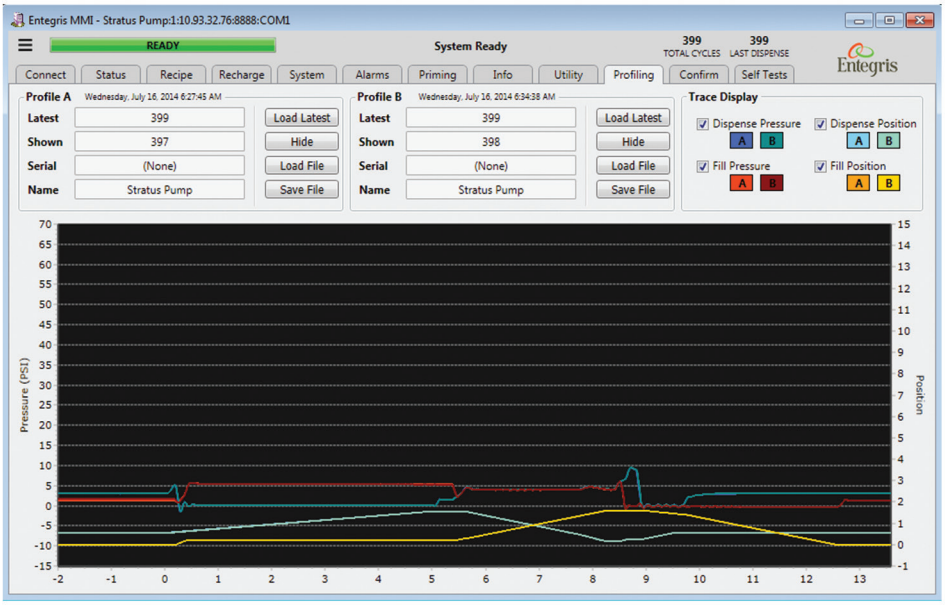
These are two profile commands: Profile A and Profile B:




Example plots are shown below:




*Single profile display*

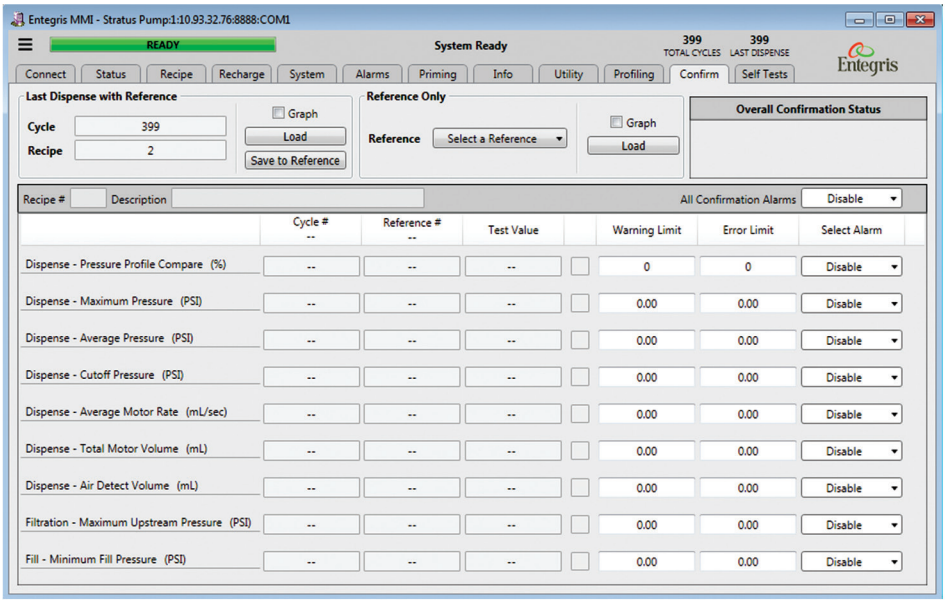


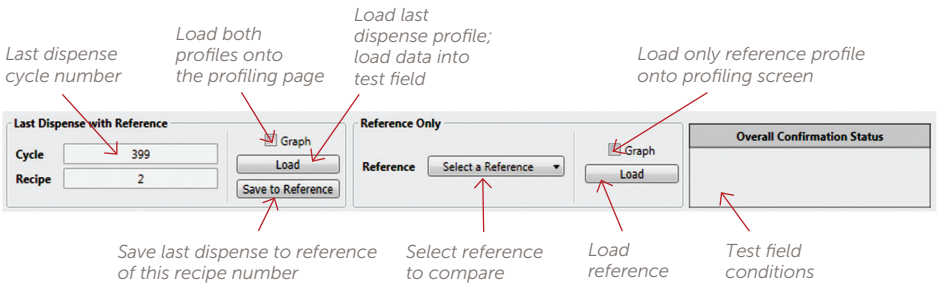

*Comparison profiles displayed*

## CONFIRMATION TAB

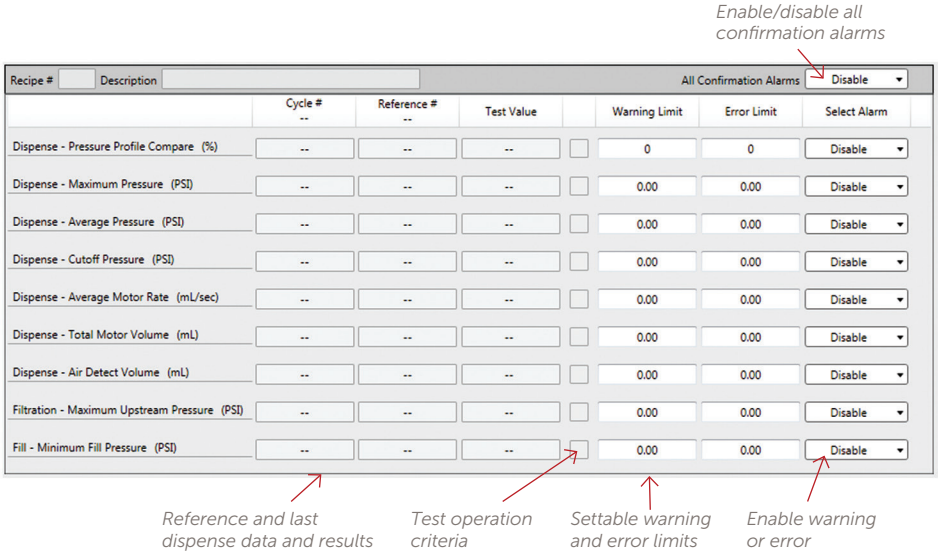
The Confirmation tab compares a dispense profile to a referenced profile by means of a criteria of "settable" confirmation tests.

- Alarms can be set to warning or error.
- Alarm limits, upper and lower, can be set by the user.
- A referenced dispense profile can be saved and viewed for each recipe.




*Control panel*




## Using Dispense Confirmation

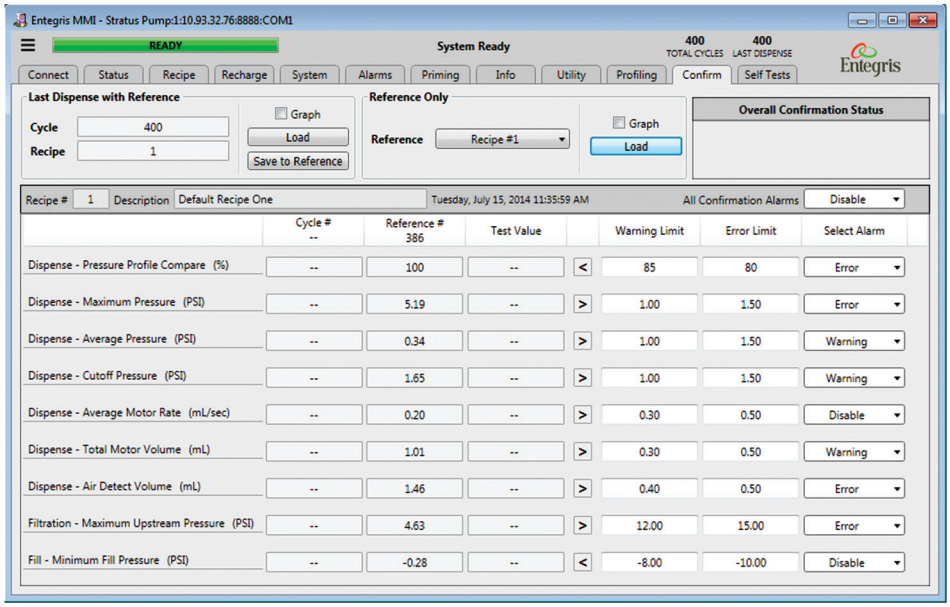
1. When the user is satisfied with the condition of dispense, press "Save to Reference". Please be patient; this may take time.
2. In the "Reference Only" section, select the recipe, then press "Load". Data should load for reference.
3. Enter values for the Error Limit and Warning Limits:
   - Error Limit: Pump will generate an error if the dispense confirmation value for the current dispense is below the user-settable limit. The error must be cleared before operation can continue.
   - Warning Limit: Pump will generate a warning if the dispense confirmation value for the current dispense is below the user-settable limit. Pump will continue to operate.

Test results should be monitored using warning limits before using error limits for fine tuning.

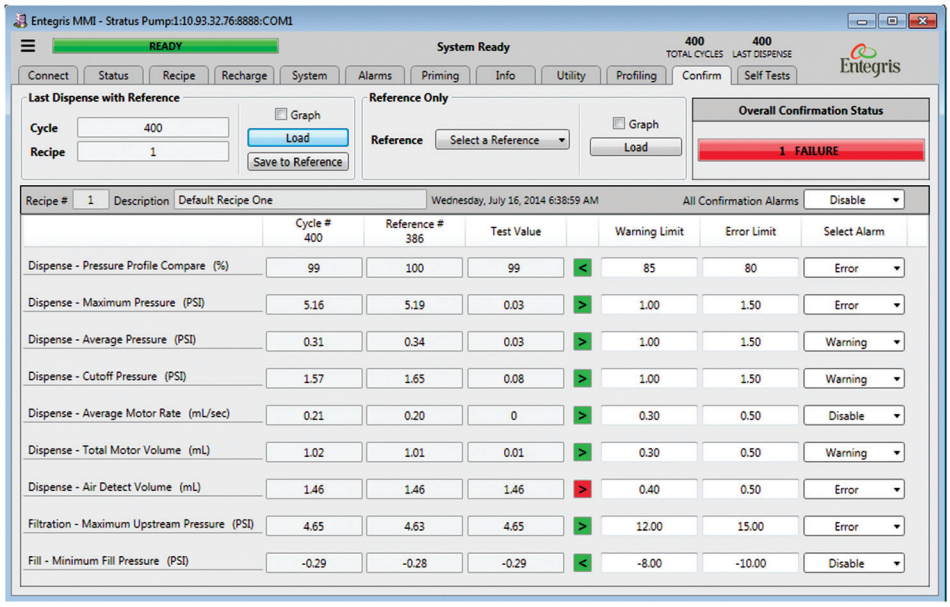
- Values can be set for "tight" control or "loose" control of the dispenses.
- Enable individual tests: set to warning or error.

4. Execute one dispense.

5. After cycle completes, in the “Last Dispense with Reference”, press “Load”. The Data field should fill in with confirmation test results.




## Confirmation Example




- Since “All Confirmation Alarms” was disabled, the data field shows what the results would have been if the confirmations test was enabled.
- The results show one test condition would have triggered an error.
- Pump shows “Ready” because alarms are disabled.

### Reading the Results

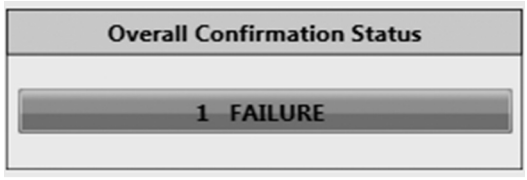
Read the results as a sentence.

IF [TESTVALUE] { < WARNING LIMIT / > ERROR LIMIT } THEN [ALARM] IF [ENABLED]

Recipe # 1 Description Default Recipe One Wednesday, July 16, 2014 6:38:59 AM All Confirmation Alarms Disable

| | Cycle # 400 | Reference # 386 | Test Value | | Warning Limit | Error Limit | Select Alarm |
|---|---|---|---|---|---|---|---|
| Dispense - Pressure Profile Compare (%) | 99 | 100 | 99 | < | 85 | 80 | Error |
| Dispense - Maximum Pressure (PSI) | 5.16 | 5.19 | 0.03 | > | 1.00 | 1.50 | Error |
| Dispense - Average Pressure (PSI) | 0.31 | 0.34 | 0.03 | > | 1.00 | 1.50 | Warning |
| Dispense - Cutoff Pressure (PSI) | 1.57 | 1.65 | 0.08 | > | 1.00 | 1.50 | Warning |
| Dispense - Average Motor Rate (mL/sec) | 0.21 | 0.20 | 0 | > | 0.30 | 0.50 | Disable |
| Dispense - Total Motor Volume (mL) | 1.02 | 1.01 | 0.01 | > | 0.30 | 0.50 | Warning |
| Dispense - Air Detect Volume (mL) | 1.46 | 1.46 | 1.46 | > | 0.40 | 0.50 | Error |
| Filtration - Maximum Upstream Pressure (PSI) | 4.65 | 4.63 | 4.65 | > | 12.00 | 15.00 | Error |
| Fill - Minimum Fill Pressure (PSI) | -0.29 | -0.28 | -0.29 | < | -8.00 | -10.00 | Disable |

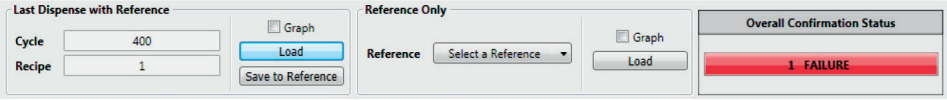
In this example, “Air Detect Volume” would have triggered an alarm, if enabled. Result shown in data field and “Overall Confirmation Status”.



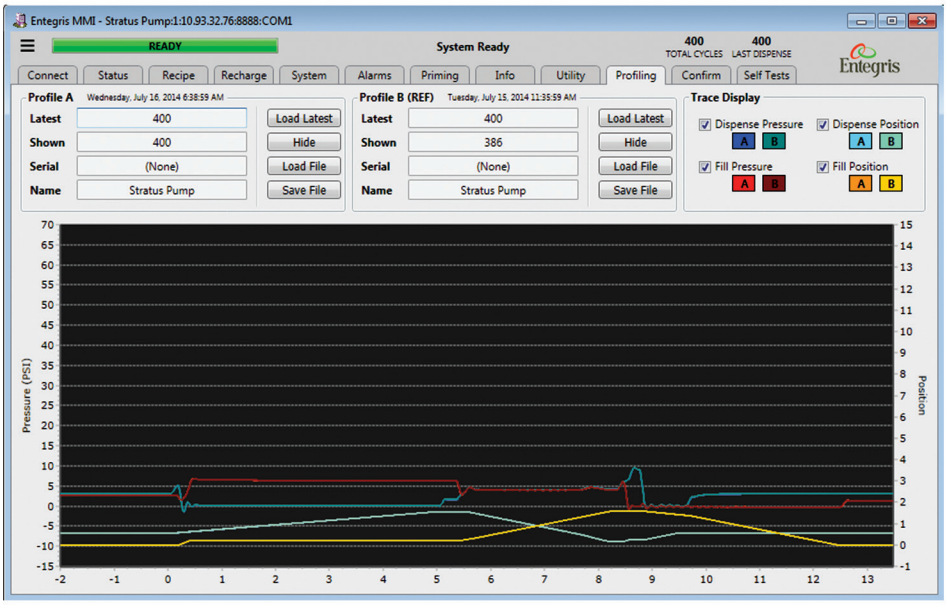

To enable tests, enable “All Confirmation Alarms”.

### Using the Profiling Page for Confirmation

1. In the Control Panel, check the graph boxes.
   - It is possible to graph reference profile separately by first selecting a reference and then pressing “Load” in the “Reference Only” section.
   - When pressing “Load” in “Last Dispense with Reference” section, the reference profile will load automatically.
   - Standard profiling commands and features apply to the confirmation profiles.




2. The reference profile is always “Profile B”




3. Press “Load Latest” to compare each subsequent dispense as “Profile A”.
4. Use the “Trace Display” function to compare specific traces.

## MAINTENANCE

The system needs no special maintenance beyond periodically changing the filter and flushing the system when necessary.

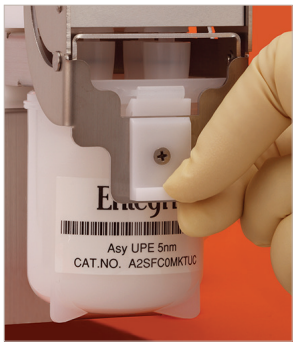
### CHANGING THE FILTER

Filter replacement can be set on the MMI by using the "Filter Cycle Alarm Limit" feature on the Systems tab.

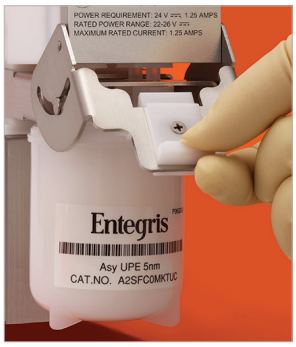
**WARNING! POTENTIAL CHEMICAL HAZARD! Obtain the chemical supplier's MSDS sheets for specific health and safety information. Wear chemical-resistant garments and eye protection while draining the system, changing the filter and during start-up. Dispose of the used filter in a manner that is consistent with approved regulations and the guidance of the chemical supplier.**

**NOTE: UPE filter membrane does not require pre-wetting for use with most photochemicals. Consult a technical support representative for additional information on filter selection and compatibility.**

1. Verify that the pump is off-line (no dispense signals will be received during the filter changeout process).
2. Pull down the tab on the lever until it clears the catch.




3. Raise the lever to open the filter manifold and remove the old filter.



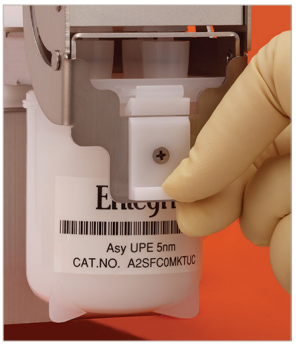

4. Verify that only **ONE** set of o-rings is used.

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

5. Slide in a new filter.


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

6. Lower the lever until the tab clicks into place on the filter.




7. Dispose of the used filter in accordance with all appropriate safety and disposal laws, regulations, and safety requirements.
8. To prime a new filter, see *Priming the Pump* on page 37.

## 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 of time, or when the dispense system and lines require flushing to remove particulates.

⚠ **WARNING! Wear chemical-resistant garments and eye protection when working with all chemicals.**

The following procedure covers most photochemical applications, but chemicals used for flushing and cleaning must be compatible with the fluid in the pump. Contact the photochemical fluid manufacturer to verify that the flushing and cleaning chemicals used will not adversely react with their product and will be effective in flushing the pump.

Isopropyl alcohol (IPA) may react with the photochemicals in the pump, so make sure that the pumps and filters flushed with IPA are first flushed with the photochemical base solvent before using photoresist in the pump.

The amount of solvent, acetone and IPA used for flushing are not fixed, but 500 – 750 mL is typical.

Depending upon the pump setup, the first 200 mL of cleaning fluid can be recycled through the pump to dissolve any residue. Remove and discard this fluid, then pass fresh flushing chemical through the pump and discard.

When changing photochemicals, the chemical manufacturer may recommend a full tubing change to avoid cross contamination. If the photochemical solvent bases are the same, the acetone and IPA flushes may not be necessary. Contact the photochemical manufacturer for their recommended procedure.

When flushing the pump to remove photoactive compound (PAC) precipitates, contact the photochemical manufacturer to determine the proper solvent for dissolving the PAC crystals. In general, the PAC crystals may not dissolve in a solvent base and a stronger solvent such as N-methyl pyrrolidinone (NMP) may be required. PAC crystals remaining in the pump may act as nucleation sites and cause particulates. Flushing of the pump is accomplished using the Priming functions described in the Priming section of this manual. In general, the rates entered when flushing the pump can be higher than when priming the system with chemical.

These settings will need to be adjusted for tubing diameter, length, and the viscosity of the chemicals in use.

### Flushing a Working Pump

1. Remove the filter and replace it with a flushing shell.
2. Connect the inlet line to a photoresist solvent or a manufacturer recommended stripper or thinner.
3. Follow the priming operation sequence to flush out the pump, then continue to dispense until the bulk of the original chemical is removed from the pump.
4. Connect the inlet line to a container of a manufacturer-recommended cleaning solvent.
5. Follow the priming operation sequence to flush out the pump, then continue to dispense until the bulk of the first cleaning agent is removed from the pump.
6. Connect the inlet line to a container of isopropyl alcohol (IPA) and flush the pump with this solution to remove previous cleaning agents from the pump.
7. Through the MMI, manually open all of the pump valves. Also open the outlet valve.
8. Blow dry the pump using compressed and filtered dry nitrogen. (A blow-down valve is available on the prewet system. Turn the valve clockwise to blowdown a pump.)
9. After 10 minutes, close the vent valve and continue to blow-dry the pump for 10 minutes.
10. After 10 minutes, close the purge valve and open the vent valve and continue to blow-dry the pump for 10 minutes.
11. After 10 minutes re-open the purge valve and let the dry nitrogen flow through the pump for 10 minutes.
12. Turn off the nitrogen blow-dry valve. Close all pump valves.

### Flushing a Nonworking Pump

Use this procedure to flush and dry a pump that is not properly functioning and needs to be returned to the factory for rebuild. Contact Entegris prior to returning any device 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 and drain and flush them separately.
2. Remove the filter and replace it with a flushing shell.
3. Remove the pressure source from the pump to float the valves.
4. Reattach tubing to the pump to avoid splattering the photochemicals.
5. Empty the lines as follows:
   - Pressurize the inlet line with $N_2$ or CDA to push the photochemical through the filter inlet.
   - Pressurize the purge line to push the photochemical through the dispense line.
   - Pressurize the vent line to push the photochemical through the filter vent port.
6. Discharge solvent, followed by IPA, through the pump using the inlet, purge and vent lines. Attach a pressurized source of the fluid to each of the lines or use a gravity feed to each of the lines.
7. Blow dry the pump by applying compressed $N_2$ or CDA through the inlet, purge and vent lines.

## UPDATING THE FIRMWARE

### Pump and MMI Firmware Matching

If a pump is changed out, or software has been upgraded on the controller, the system may display an MMI firmware warning. To update firmware from the controller to a pump, follow the screen prompts.

1. On the Connections tab, select and open the pump to be updated.
2. The MMI will detect that the pump has a different firmware version and ask if you want to update.
3. To update, select “Download”. The download screen will display.

**⚠ 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.**

4. When the download is complete, the download windows will close.

**NOTE: In some instances, the “Download Firmware” screen may freeze. In this case, moving the mouse will cause it to update. In all cases, the entire firmware download and flash process should be complete in less than 5 minutes.**

## TROUBLESHOOTING

This section covers some of the common problems and solutions for the dispense system. Refer to the "Serial Communications Protocol" for details on event codes, error codes, and other details, if required.

After making any adjustments, test the result with 2-3 dispenses. If the solutions in this section do not help, please contact technical support.

### Pump Does Not Dispense

| PROBLEM | SOLUTION |
|---|---|
| Pump is not responding | Check electrical connections between pump, interface module, and track.<br>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.<br>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. |
| | | For new system start-up, start with the low suckback rate and high suckback volume. For example: 0.05 cc/s and 0.5 cc respectively. This gives the chemical 10s to flow back. Optimize the parameters accordingly. |

## 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.) |

## APPENDIX: PRIMING RECIPE INFORMATION

### GUIDELINES FOR PRIMING A NEW FILTER

A filter consists of three areas that need to have air replaced with fluid: upstream of the membrane, downstream of the membrane, and in the porous area of the membrane itself. This air needs to be removed from the filter and vented out of the pump.

Begin the priming sequence with:

- Vent cycles to fill the upstream part of the filter with fluid, until a solid stream of fluid is seen in the vent line.
- Purge cycles until solid fluid is again seen in the vent line. This begins to wet the membrane and removes the bulk of the air from the filter downstream of the membrane.
- Inlet cycles will recirculate the fluid through the filter and back to the inlet, with a small amount of vent. This completes the wetting of the membrane without excessive use of chemical.

### PRIMING SETTINGS

| SETTING | DESCRIPTION | RANGE |
|---|---|---|
| **Cycle type** | Type of priming for that step | Includes: Stop |
| | | Loop |
| | | Vent |
| | | Outlet |
| | | Purge |
| | | Inlet |
| | | Soak |
| | | Backflush to vent |
| | | Backflush to Inlet |
| | | Filter flush |
| **Count** | Number of cycles | 1 – 999 |
| **Outlet rate** | Priming dispense rate | 0.1 – 3.0 mL/sec |
| **Vent rate** | Priming vent rate | 0.1 – 3.0 mL/sec |
| **Purge rate** | Priming purge rate | 0.1 – 3.0 mL/sec |
| **Fill rate** | Priming fill rate | 0.1 – 3.0 mL/sec |
| **Filtration rate** | Priming filtration rate | 0.1 – 3.0 mL/sec |
| **Filtration pressure** | Priming filtration maximum pressure | |
| **Soak pressure** | | |
| **Soak time** | | |

*Contact your local Entegris sales representative to create a customized filter priming recipe.*

## 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 (page 33).

## LIMITED WARRANTY

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