

# FieroSil

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SURFACE PRETREATMENT SYSTEM

Owner's Manual

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# Introduction

FieroSil relies on vapor deposition using purified Hexamethyldisiloxane as a consumable, which has been used on industrial applications since the 1950's and is now widely used in the semiconductor industry. Systematic Automation has harnessed this technology and made it user friendly and affordable for the decorating industry.

Ultra purified consumable precursor HMDSO is first vaporized and then precisely metered into a mixture of propane and air prior to combustion in the burner flame. There, the HMDSO converts into pure fumed silica. The super-heated newly formed microscopic particles of silica (glass) are deposited onto the substrate by the force of the flame which is carrying it. As the silica particles fuse with the mating substrate, they permanently raise the surface tension and increase the dyne level of the material. In effect it makes the surface more like fine sandpaper, but at such a fine level, even clear glass remains clear looking. However, if you drag your fingernail over the treated glass or other substrate, you can feel the higher coefficient of friction.

## Definition of Terms

- Liquid Precursor: consumable for chemical dosing process
- HMDSO: Hexamethyldisiloxane, or  $C_6H_{18}OSi_2$
- SPS: Surface Pretreatment System
- Silicoating:
- PLC: Programmable Logic Controller
- SA: Systematic Automation
- MSDS: Material Safety Data Sheet

# SAFETY

## 1. VENTILATION

Systematic Automation Inc provides you with all the information needed to safely use FieroSil. When coupled with the FLSP Cylindrical Part Flame Treater your FieroSil System will be equipped with a fume hood and high temperature venting blowers.

The exhaust fumes contain crystalline silica which is harmful to breathe. Therefore, the exhaust from the Fierosil, or any HMDSO based vapor deposit system **must be vented out of your building**.

OSHA has clear guidelines for protecting operators from crystalline silica which is commonly generated in the stone, tile and granite cutting industry.

Refer to the following attached OSHA resources for guidelines. Your HVAC contractor will install a ventilation system that freely takes up the exhaust air of the FLSP flame treater.

Systematic Automation is committed to making sure you have an installation that is safe for your operators and surrounding employees. We will check in and make sure everything is working and venting as it should.

### **Relevant OSHA Standards:**

[1910.134 - Respiratory protection. | Occupational Safety and Health Administration \(osha.gov\)](#)

[1910.1053 - Respirable crystalline silica. | Occupational Safety and Health Administration \(osha.gov\)](#)

## 2. REFILL

- 2.1. Use caution when filling tank reservoir with HMDSO – the fluid is a class 3 flammable liquid and **MUST** be kept away from any sources of heat or ignition.
- 2.2. HMDSO generates a strong static charge when poured – the fluid tank must only be refilled with the provided funnel/quick connect set up described in **step 3 of Machine Operation**.
- 2.3. Reference the MSDS (link provided below) for further safety information regarding HMDSO
- 2.4. [SIH6115.1 GHS US English US SDS](#)

## 3. TANK PRESSURE

- 3.1. The tank is pressurized upon start up and factory set to 15-20 inches of H<sub>2</sub>O – it is not advisable to adjust this pressure setting without first contacting SA
  - 3.1.1. Tank pressure can be monitored via a 0-100 inches of H<sub>2</sub>O located inside the enclosure
- 3.2. Pressure relief valve set to 5 PSIG to protect the machine operator and dosing equipment

## 4. USER PASS CODE

- 4.1. A 4-digit password is required to operate or make any changes to equipment
- 4.2. Only trained personnel are authorized to operate this equipment

# Features

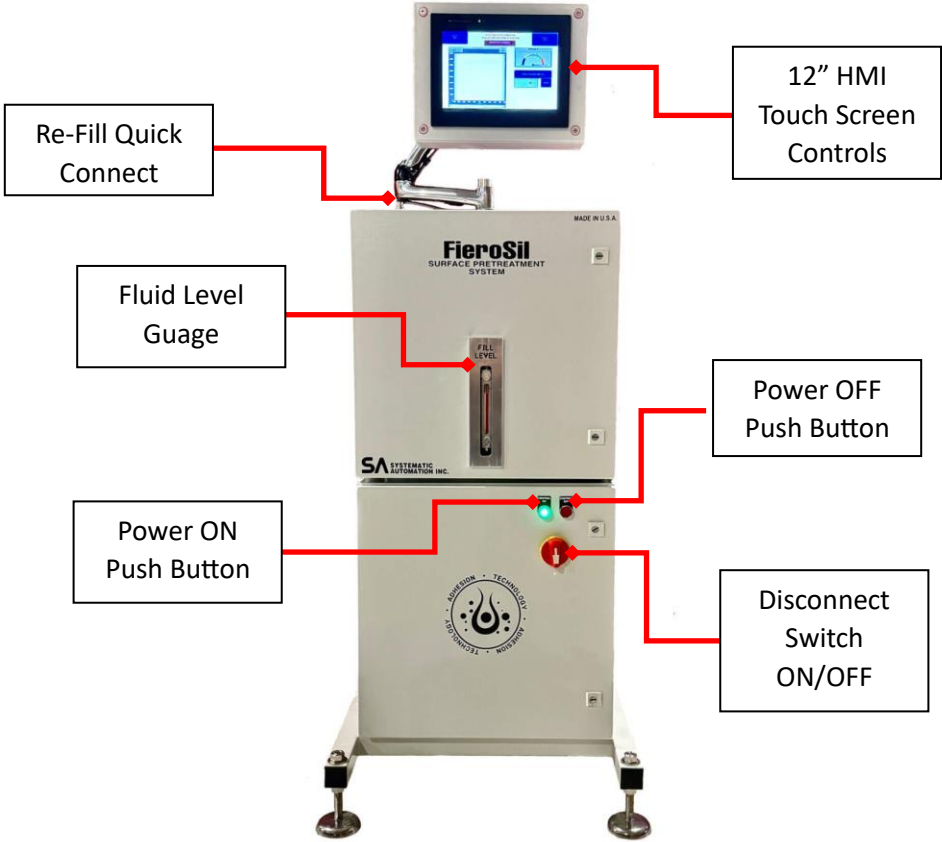


Figure 1: FieroSil Surface Pretreatment System

# Machine Operation

## Startup

1. Turning ON
  - 1.1. Plug into a standard 110VAC wall outlet. The dosing unit comes equipped with a 3-pronged 120V AC power cable
  - 1.2. Connect output hose with a compatible flame unit (compatibility determined by the manufacturer – contact Systematic Automation if dosing unit is intended for third party equipment)
  - 1.3. Turn red/yellow disconnect switch to the ON position (rotate 90°)
    - 1.3.1. Allow 30 seconds for the 12" HMI touch screen to turn on, at which point the machine operator will be prompted to confirm that they have read the manual and thoroughly understand how to safely operate the machine
    - 1.3.2. A QR code is provided to access online resources where a copy of the manual can be found if a hard copy is not readily available
    - 1.3.3. Press CONFIRM once machine operator has finished reading and understanding all relevant information provided in this user manual to safely operate the FieroSil SPS

## 2. Main Screen

### 2.1. SET UP

2.1.1. DOSING: Select this menu to adjust rate of dosage (password required)

2.1.2. REFILL: Select this menu to fill fluid tank (password required)

### 2.2. RUN

2.2.1. Select this option once the setup is complete. Refer to Startup: Item #4

### 2.3. MONITER

2.3.1. Select this option for real time numerical data on dosage rate

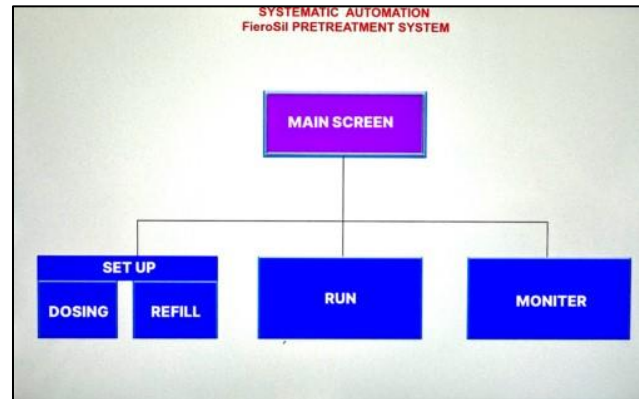


Figure 2: Main Screen Display

## 3. SET UP: REFILL

3.1. This menu can be accessed from either MAIN SCREEN or RUN

3.2. Password required to make any changes to dosing or to refill the fluid tank

### 3.3. REFILL

3.3.1. The fluid tank CANNOT be refilled during dosing

3.3.2. Refill can only be performed when the "READY FOR REFILL" circle in the center of the display screen turns GREEN

3.3.3. DO NOT OVER FILL FUNNEL – avoid any spillage when filling the tank

3.3.4. DO NOT OVER FILL TANK – the fluid tank should never be filled past the HIGH mark on the liquid level gauge

3.4. Disconnect funnel from quick connect when not in use to avoid buildup of dust/contaminants which can affect the concentration of HMDSO precursor

3.5. NOTICE: Failure to adhere to warnings 3.3.3 and 3.3.4 may result in damage to equipment

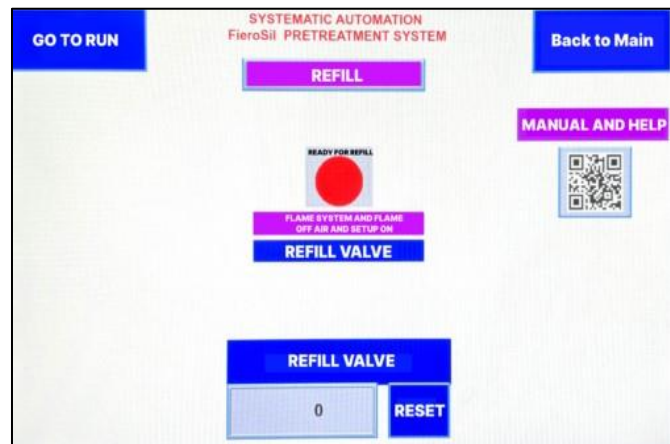


Figure 3: Refill Menu

4. SET UP: DOSING (SLIDE OPTION)

- 4.1. The dosing menu can be accessed prior to dosing, or while dosing is active via SET UP > DOSING or RUN > GO TO DOSING
- 4.2. Once the flame is on and detected by the burner control unit, allow 10-15 seconds to pass for the flame to reach sufficient temperature. Once the circle in the middle of the display is GREEN and reads "READY FOR DOSAGE", the DOSING ON button can be activated via touch screen.
- 4.3. To adjust the amount of FieroSil being added to the flame, use the slider on the left-hand side of the display to adjust the feed pressure.
  - 4.3.1. It is up to the operator to determine the optimal level of dosage % based on the substrate being pretreated. Keep a record of the flame color with relation to the slide position
  - 4.3.2. DOSAGE % can be adjusted during operation, by moving the slide up or down and selecting the bottom option to UPDATE DURING DOSING to avoid any interruption to production
  - 4.3.3. A pressure readout in PSIG can be found
- 4.4. Once the dosing setup is complete, select the red PRESS OFF button to terminate the dosing mechanism and select GO TO RUN on the top left-hand corner of the display screen to lock any changes and monitor the dosing process

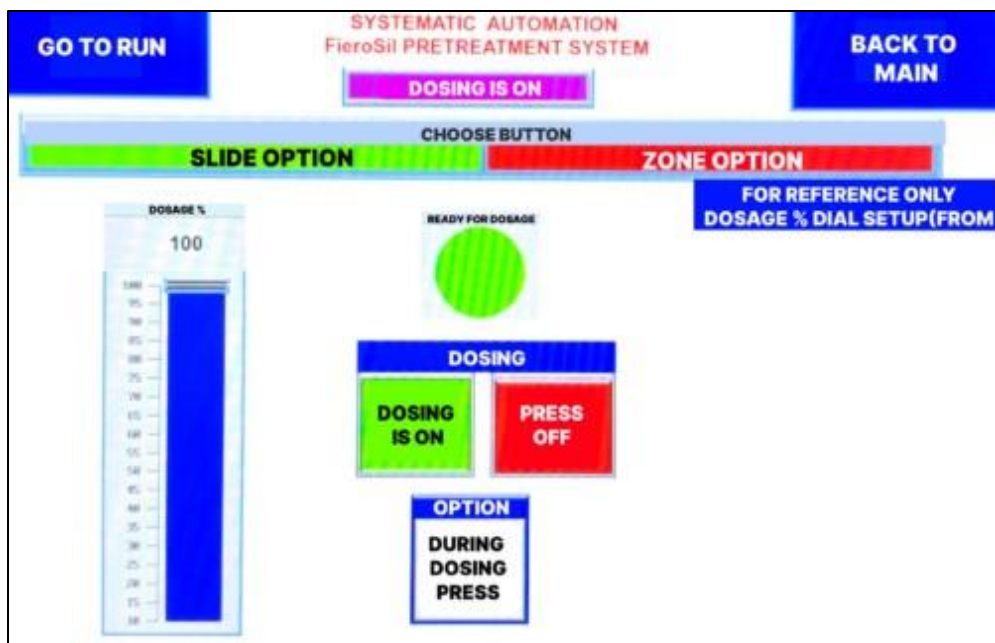


Figure 4: Dosing Screen – SLIDE OPTION

5. SET UP: DOSING (ZONE OPTION)

5.1. Use this menu if your flame unit comes equipped with burner length adjustment

**5.1.1. NOTE: Reducing the length of the burner may require adjustment to the air/gas ratio from the air & gas manifold installed on your flame unit – contact SA for assistance**

5.2. Access the menu shown in figure 5 by selecting ZONE OPTION, located directly next to SLIDE OPTION under CHOOSE BUTTON

5.3. Each zone can either be set to a specific burner size, or used as a memory bank for certain production runs

5.3.1. Changing the DOSAGE % on the ZONE OPTION screen will automatically move the slider to the number entered in the ZONE OPTION display (enter a number between 0-100)

5.3.2. DIAL SETUP is used as a reference to document the distance between the burner and substrate

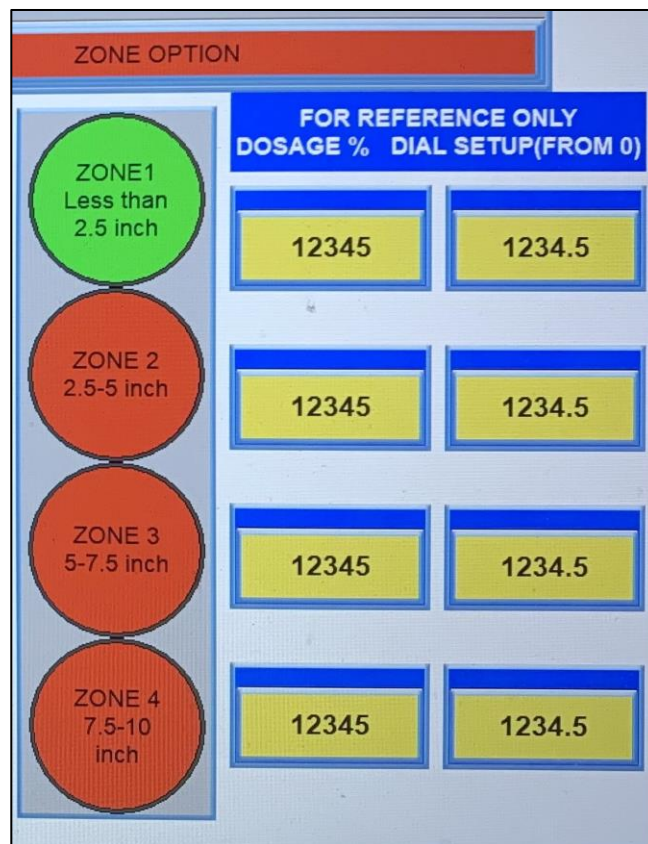


Figure 5: Dosing Screen – ZONE OPTION



6. RUN

6.1. Once SET UP is complete and calibrated for a production run, select RUN from either the MAIN MENU, or SET UP

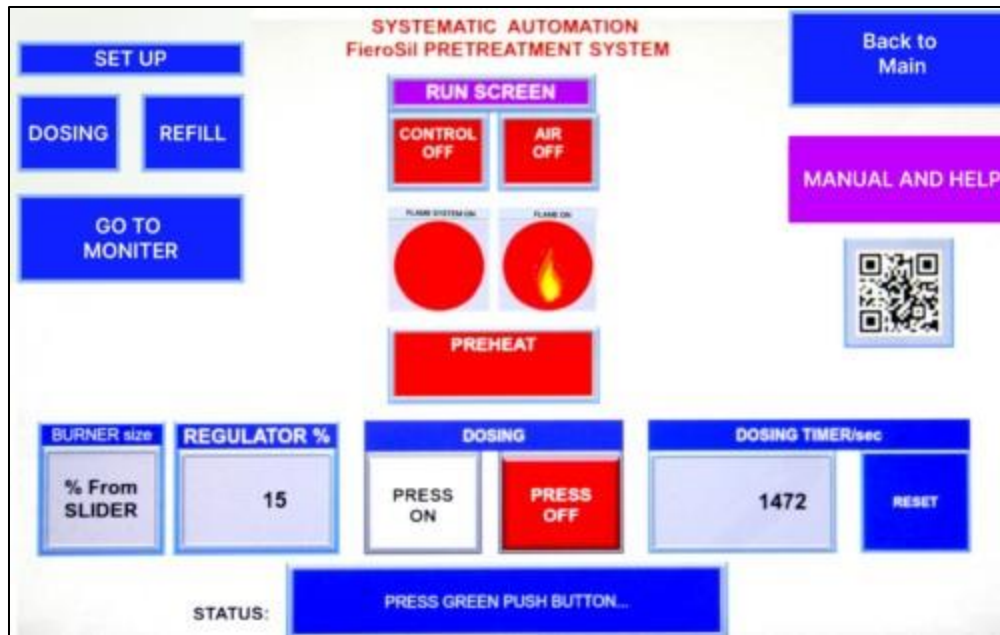


Figure 6: Run Screen - DOSING OFF

6.2. Select PRESS ON only when CONTROLL OFF, AIR OFF, FLAME SYSTEM ON, and FLAME ON are all green indicating that the machine is ready to dose

6.2.1. As stated in section 4.2, allow 10-15 seconds for the flame to reach sufficient temperature, at which point the PREHEAT box will turn green

6.3. Select PRESS ON, at which point the box will blink green and read DOSING IS ON and the dosing timer will begin to count (see **Figure 7: Run Screen - DOSING IS ON**)

6.4. Dosage rate can be adjusted by selecting DOSING in the top left-hand corner of the menu where the operator will be prompted to enter a password to make any changes

6.4.1. Reference section 4.3.2

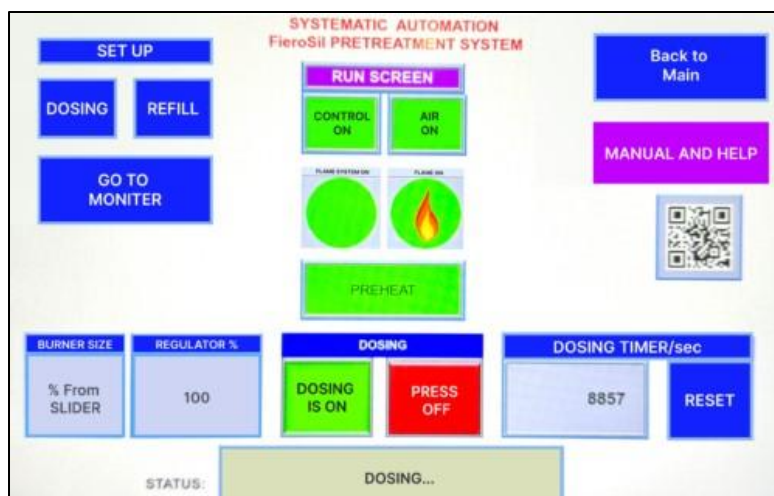


Figure 7: Run Screen - DOSING IS ON

## 7. MONITOR

7.1. The MONITOR display screen is accessed via MAIN SCREEN > MONITER, or from RUN > GO TO MONITER

7.2. Display features real time data logging for dosage rate with respect to time

7.2.1. Additional data acquisition available upon request

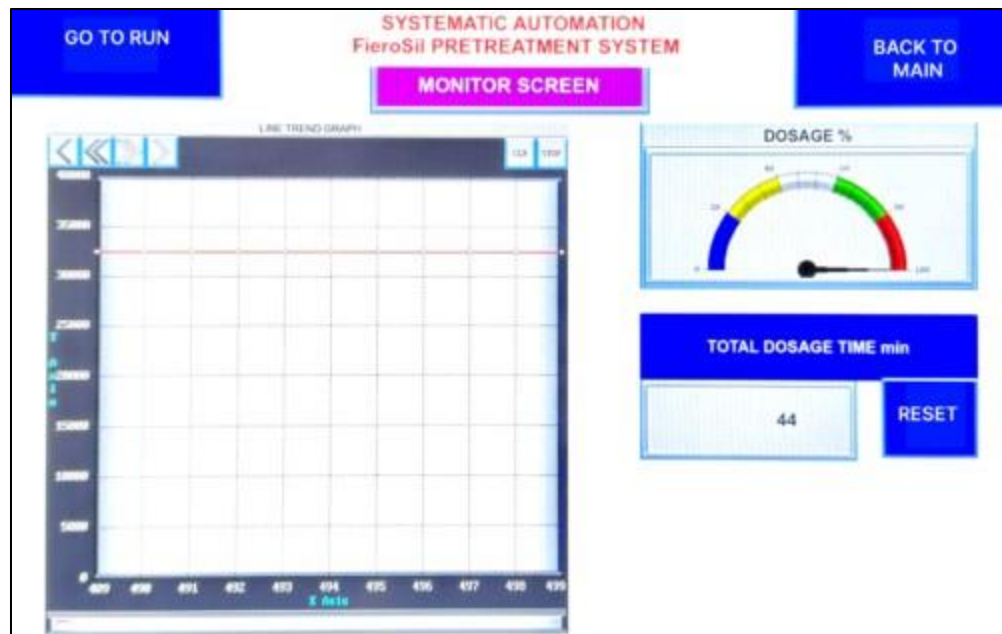


Figure 8: Monitor Screen

## Shutting Down

1. Turning OFF
  - 1.1. Select PRESS OFF from the RUN display or DOSING display
  - 1.2. Disconnect output hose from the flame unit
  - 1.3. Press CONTROL OFF