Installation / Operation / Maintenance Manual

VaporGuard®

Absolute Control System

Manual Part Number: 163315

Edition: Rev-3

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Revision Control Summary

Chapter	Revision	File Name
Introduction	Rev-0	MNL000418.doc
• Initial Release		
Chapter 1 – Delivery, Unpacking, and Inspection	Rev-0	MNL000419.doc
• Initial Release		
Chapter 2 – System Components and Specifications	Rev-1	MNL000420.doc
• Added note on maximum temperature specification in table 2-1		
Chapter 3 – VaporGuard® Absolute Control System For Use With Trans-LC™	Rev-0	MNL000421.doc
• Initial Release		
Chapter 4 – System Safety	Rev-1	MNL000422.doc
• Added T4 Labels		
Chapter 5 – System Operation	Rev-1	MNL000423.doc
• Update Table 5.3		
Chapter 6 – System Installation	Rev-0	MNL000424.doc
• Initial Release		
Chapter 7 – Calibration	Rev-0	MNL000425.doc
• Initial Release		
Chapter 8 – VaporGuard® Stainless Steel Source Configuration	Rev-0	MNL000426.doc
• Initial Release		
Chapter 9 – $POCl_3$ Safe Handling and PPE Matrix	Rev-0	MNL000427.doc
• Initial Release		

TABLE OF CONTENTS

Introduction

I.1 *Introduction to the Manual*

This manual covers the Versum Materials, Inc. VaporGuard® Absolute Control System. The VaporGuard® is a microprocessor-based temperature control system designed for CVD and diffusion source chemical delivery.

READ THIS MANUAL IN ITS ENTIRITY PRIOR TO INSTALLING OR OPERATING THE VAPORGUARD® SYSTEM.

It contains information pertinent to setup and operation of the VaporGuard®. Inspect all shipping containers that are delivered with your shipment to verify that all parts are available and to acquaint yourself with the system components.

The Chapters and Appendices are organized as follows:

Introduction	Introduction to the Manual and Equipment
Chapter 1	Delivery, Unpacking, and Inspection
Chapter 2	System Components and Specifications
Chapter 3	VaporGuard® Absolute Control System for use with Trans-LC™
Chapter 4	System Safety and Interlocks
Chapter 5	System Operation
Chapter 6	System Installation
Chapter 7	Calibration
Chapter 8	VaporGuard® Stainless Steel Source Configuration
Chapter 9	POCL3 Safe Handling and PPE Matrix
Appendix A	VaporGuard® Troubleshooting Guide

I.2 Emergency Response - 24 Hour Service

If an emergency occurs that cannot be alleviated by the trained operator or his/her supervisor, call Versum Materials, Inc. on one of these telephone numbers.

- From anywhere in the continental United States, Canada and Puerto Rico – 800 523-9374 (toll free).
- From all other locations - 610-481-7711.
- VERSUM MATERIALS, INC. Operator - 610-481-4911.
- European Community/Middle East Gases - +44 500 02 02 02.
- Equipment Technical Support – 866-624-7677.

I.3 Definition of Terms

I.3.1 Definitions

There is no industry-standard term for the source container used within each type of process tool to provide chemical directly to the process. The terms ampoule, bubbler, source container, and others are all used interchangeably in industry. To reduce confusion, in this manual the term Bubbler is used to identify the Versum Materials, Inc. (Schumacher) quartz container (Teflon systems) or the Stainless Steel Source container (stainless steel systems).

There are three (3) types of notes used in this manual. They are CAUTION, WARNING, and NOTE. For purposes of this manual, they are defined as:

CAUTION: This is an example of a CAUTION. A CAUTION

notifies the reader that a procedure must be performed as prescribed, or that a specific set of conditions must be maintained or avoided, in order to avert damage to equipment or the operating environment.

VORSICHT: Dieses VORSICHTS-Gebot dient als Beispiel. Ein VORSICHTS-Gebot weist den Leser darauf hin, daß ein Verfahren nach den gegebenen Vorschriften durchgeführt oder bestimmte Voraussetzungen erfüllt bzw. vermieden werden müssen, um eine Schädigung der Anlage oder der Arbeitsumgebung zu verhindern.

ATTENTION: Voici un exemple d'un ATTENTION à suivre. Un ATTENTION avertit le lecteur qu'un procédé doit être accompli selon les consignes prescrites ou qu'une série de conditions spécifiques doivent être maintenues ou evitées afin d'empêcher tout dégât à l'équipement ou à la zone d'opération.

WARNING

WARNING: This is an example of a WARNING. A WARNING notifies the reader that a procedure must be performed as prescribed, or

that a specific set of conditions must be maintained or avoided, in order to avoid injury or death to personnel.

WARNUNG: Diese

WARNUNG dient als Beispiel. Eine WARNUNG weist den

Leser darauf hin, daß ein Verfahren nach den gegebenen Vorschriften durchgeführt oder bestimmte Voraussetzungen erfüllt bzw. vermieden werden müssen, um das Personal vor Körper- oder tödlichen Verletzungen zu schützen.

AVERTISSEMENT: Voici un

exemple d'une "AVERTISSEMENT" à suivre.

Une avertit le lecteur qu'un procédé doit être accompli selon les consignes prescrites ou qu'une série de conditions spécifiques doivent être maintenues ou évitées afin d' empêcher toute cause de blessure ou de décès du personnel.

NOTE

This is an example of a NOTE. A NOTE notifies the reader of an item that warrants special attention.

I.3.2 Abbreviations

A	Amperes
AC	Alternating Current
AIC	Ampere Interrupt Capacity
cfm	Cubic Feet per Minute
ERR	Error
DC	Direct Current
DDC	Direct Digital Controller (Tool IO Interface)
EMO	Emergency Manual Off
gr.	gram
He	Helium
I.D.	Inner Diameter
ID	Identification
in.	Inch(es)
kPa	kilopascal, absolute
lb.	pound
LED	Light-Emitting Diode
Lpm	Liters per Minute
mL	Milliliter
mm	Millimeter(s)
NC	Normally closed
NO	Normally open
N_2	Nitrogen
O.D.	Outer Diameter

P/N	Part Number
POCl3	Phosphorus Oxychloride
PPE	Personal Protective Equipment
Psia	pounds per square inch, absolute
Psig	pounds per square inch, gauge

PWR	Power
SEMI	Semiconductor Equipment and Materials International
SIS	Shipping Identification Sheet
S. S.	Stainless Steel
TEC	Thermo Electric Cooler
TEOS	Tetraethyl Orthosilicate
TDMAT	Tetrakis-dimethylamino Titanium
TiCl4	Titanium Tetrachloride
TOMCATS	Tetramethylcyclotetrasiloxane
Trans LC™ (TLC)	Trans-1, 2-Dichloroethylene
UPS	Uninterrupted Power Supply
US	Ultrasonic Probe
USFL	Ultrasonic Probe Failure
USIL	Ultrasonic Probe Interlock
VAC	Volts, Alternating Current
VaporGuard®	VaporGuard® Absolute Control System
VDC	Volts, Direct Current

I.4 Some of the Approved Chemicals

Chemical	Recommended Source Container	Recommended VaporGuard®
Trans LC	1.5L Quartz Bubbler	VG300N or W
BBr3	1.5L Quartz Bubbler	VG300N or W
POCL3	1.5L Quartz Bubbler	VG300N or W
TDMAT	1.2L S.S. Container	VG600N or W
TEOS	1.2L S.S. Container	VG600N or W
TICL4	1.2L S.S. Container	VG600N or W

Note: For additional chemical use please consult with your local Versum Materials, Inc. representative.

Chapter 1

Delivery, Unpacking, and Inspection

1.1 DELIVERY

The VaporGuard® is shipped in one packing box. The packing slip on the outside of the carton indicates the number of items in the order. A separate packing checklist, included with the manual, identifies all components in the shipment.

The content of the package is detailed below:

- Packing checklist
- VaporGuard®
- Start-up kit (See Packing Checklist included with shipment)
- Installation and Operation Manual on CD, P/N 163315

1.2 UNPACKING

Save all cartons (along with foam supports and padding) for reuse in case the VaporGuard® must be returned to Versum Materials, Inc..

1.3 *INSPECTION*

1. Insure each item on the packing checklist is included in the shipment. Notify Versum Materials, Inc. if any item is not include or damaged. Check the VaporGuard® for loose connections.

2. There is a 30 day limit upon receipt of order for reporting missing or damaged items for warrantee replacement.

3. Verify the part numbers on the items are the same as specified on the packing checklist.

4. Keep the packing checklist for use in any future communication with Customer Service with the following contact information:

Versum Materials, Inc. 1919 Vultee Street
Allentown, PA 18103
1-866-624-7677

Chapter 2

System Components and Specifications

This chapter describes the module specifications for the VaporGuard®. All models that are described in this manual are for Versum Materials, Inc. (Schumacher) containers. When using a non Versum Materials, Inc. container, the customer should consult with Versum Materials, Inc. prior to use.

2.1 Equipment and Features

2.1.1 Physical Description

Table 2-1 ATCS15/VaporGuard® Comparisons

The VaporGuard® is available in the following models:

Existing ATCS		VaporGuard®	
Models	**Temperature Range**	**Equivalent Model**	**Temperature range***
ATCS 15	+10 °C to 60 °C	VG600 N/W	+10 °C to +60 °C
ATCS 15-HT	+40 °C to 90 °C	VG600 NHT/WHT	+10 °C to +115 °C
ATCS 15-SS	+10 °C to 60 °C	VG600 N/W	+10 °C to +60 °C
ATCS 15-HT SS	+40 °C to 90 °C	VG600 NHT/WHT	+10 °C to +115 °C
ATCS 15-TLC ATCS 15 TLCHF ATCS 15-TLCHFC	+10 °C to 22 °C	VG300 N/W factory configured for Trans-LC™	+10 °C to 22 °C
ATCS 15-TLCHFCK	+10 °C to 20 °C	VG300 N/W factory configured for Trans-LC™	+10 °C to 22 °C

*Maximum temperature indicated has been tested under ideal benchtop conditions. Actual maximum temperature is molecule and application dependent. In most cases, 80-90C is appropriate.

Table 2-2 VaporGuard® Models, (refer to Chapter 6)

Part Number	VaporGuard® Model	Reference Drawing
161133	VaporGuard®, 300N -300watt Power Supply Module -Narrow Source Cup Assembly	SW004868
161134	VaporGuard®, 300W -300watt Power Supply Module -Wide Source Cup Assembly	SW003889
161135	VaporGuard®, 600N -600watt Power Supply Module -Narrow Source Cup Assembly	SW004040
161136	VaporGuard®, 600W -600watt Power Supply Module -Wide Source Cup Assembly	SW004050
163545	VaporGuard®, 600N, HT -600watt Power Supply Module -Narrow Source Cup Assembly	SW005426
163546	VaporGuard®, 600W, HT -600watt Power Supply Module -Wide Source Cup Assembly	SW005428

The VaporGuard® system consists of a Source Cup Assembly, a Power Supply Module and an optional Remote Display Module. This modular design allows the Source Cup Assembly to be installed into a hazardous location (Class 1, Division 2).

The Power Supply Module will be located outside the Class1, Division 2 location and still provide the same control as it would if installed locally.

Class 1, Division 2 (hazardous) locations are established on the basis that the equipment, in its normal operating condition, is incapable of causing an ignition of a specified flammable gas, vapor in air mixture, dust or fibers.

That is, vapors may be present during abnormal conditions. See NFPA 70, article 501 and 596 for further details.

The Power Supply Module has a power input range of 100-240VAC @ 50-60Hz. Within the module, the power is converted to 24VDC and controlled for the appropriate power to the heater/cooler elements on the Source Cup Assembly. The entire Source Cup Assembly is powered with 24VDC power.

All VaporGuard® models are Direct Digital Control (DDC) compatible with existing ATCS applications and can be used as a “drop-in replacement”.

The Remote Display Module (optional), it allows for the user to install the display up to 5 feet away from the Power Supply Module. When enabled for remote controller operation, the Remote Display Module controls the VaporGuard® exactly like the display on the Source Cup Assembly, refer to figure 2-1.

2.1.2 Features

- Alpha-numeric Liquid Crystal Display with keypad interface.
- Alarm history log with time stamp.
- Real time clock.
- Single RISC processor with onboard EEPROM and Flash.
- Password protection for system configuration menus.
- User configurable alarm disable/enable.
- User configurable alarm interlock.
- Latched alarms on front display for easy troubleshooting/diagnostics.
- Audible alarm (92 dBA max.) with configurable mute time.

- Hardwired (non-microprocessor interfaced) interlocks.
- Enhanced thermodynamic performance.
- Extended range as standard product.
- Enhanced accuracy of temperature measurement throughout range.
- Remote Liquid Crystal Display (LCD) with control capability.
- Lower operating voltage requirement to heater/cooler circuit (24VDC).
- Remote AC power supply (100-240VAC @ 50/60Hertz).
- Configurable relay outputs.
- 8 discrete level sense positions. Each level position can be configured for any one of the four dedicated relay outputs from display, VG300W/N for quartz bubblers only.
- Quartz bubbler LED backlight with adjustable ON time duration.
- Ultrasonic Level detection, VG600W/N for S.S. containers only.
- On board diagnostics for preventative maintenance
- Fan failure detection.
- Illuminated start/stop switch on front panel provides flashing backlight for alarm indication.
- Power electronics for thermal electric coolers (TEC).
- A liquid level viewing window with backlight in Source Cup Assembly.

- Modular Source Cup Assembly, Power Supply Module and Remote Display Module.

- Ability to monitor temperature and adjust temperature setpoint remotely via analog interface (DDC cable).

- The Source Cup Assembly equipped with a thermal cut-out switch that will open at factory configurable temperatures of 28°C, 70°C, 100°C, 120°C depending on model ordered.

- The Source Cup Assembly equipped with a thermal cut-out switch that will open at temperature in excess of 28°C in the Trans-LC™ model.

- The Source Cup Assembly operates on 24VDC power. All hazardous voltages (>24V) are contained within the Power Supply Module. Hazardous power connections are made inside the Power Supply Module to a separate AC to DC power supply sub-assembly.

2.2 Physical Description

2.2.1 VaporGuard® Physical Specifications Table 2-3 VaporGuard® Physical Specifications

Height	
Source Cup Assembly w/o Bubbler	12.75 in. (323.9mm)
Power Supply Module	12.75 in. (323.9mm)
Width	
Source Cup Assembly	9.2 in. (233.7 mm)
Power Supply Module	9.2 in. (233.7mm)
Depth	
Source Cup Assembly	8.2 in. (208.3mm)
Power Supply Module	2.5 in. (63.5mm)
Weight	
Source Cup Assembly	12.25 lbs (5.6 Kg)
Power Supply Module	4 lbs (1.8 Kg)
Temperature Range	Set point +10 °C to 115 °C, depending upon model

NOTE: The Space Requirements are described in Chapter 6.

Figure 2-1 VaporGuard® System (Model VG600)

2.2.2 Source Cup Assembly

The Source Cup Assembly provides local control of the temperature and monitoring of level and control circuits. It also provides the interface between the high powered electronics and the heater/cooling elements. The Source Cup Assembly is equipped with coolers, heaters and a temperature-sensing probe. The heater offsets the effect of the cooler to attain the temperature within the specified range.

A multiple conductor cable connects the Source Cup Assembly to the Power Supply Module providing current paths for the cooler and heater. The green checked pushbutton located on the keypad illuminates the back light to view the liquid level through the window on the Source Cup Assembly. The bubbler containing the chemical is placed in the Source Cup Assembly, refer to figure 2-1. The Source Cup Assembly allows for easy access, installation, maintenance, and replacement of the bubblers. The front panel controls consist of a Start/Stop switch and a keypad/LCD interface. The front panel controls are further described in Chapter 5.

2.2.3 Power Supply Module

The Power Supply Module provides the electrical power and necessary current control to maintain a preset temperature and constant vapor pressure within the bubbler. The DDC interface cable is connected to the Power Supply Module as well as the Remote Display Module.

Table 2-4 Power Supply Module - Electrical Specifications

Input Power (VG300 Model)	Input Voltage Range 100-240 VAC @ 50/60 Hz, 300 Watt
Output Power (VG300 Model)	Heater: 13.6 VDC @ 4.6 A max. (Trans-LC™) Cooler: 10.5 VDC @ 6.2 A max. (Trans-LC™)
Input Power (VG600 Model)	Input Voltage Range 100-240 VAC @ 50/60 Hz, 600 Watt
Output Power (VG600 Model)	Heater: 22 VDC @ 7 A max. Cooler: 20 VDC @ 12 A max.

NOTE: VaporGuard® was evaluated to CE standard EN-61326-1 using heavy industry EMC standards (radiated and conducted susceptibility) to insure that the temperature will remain constant in all industrial installations.

Figure 2-2 VaporGuard® Power Supply Module

Power Supply Module, VG300

Power Supply Module, VG600

Chapter 3

VaporGuard® Absolute Control System for use with Trans-LC™

WARNING

Only the VG300W/N are intended for use with Trans-LC™

3.1 VaporGuard® Manufactured for Use of Trans-LC™

The default configuration for a VG300W/N VaporGuard® is for the use of Trans-LC™. The corresponding model number from the existing ATCS design are the *ATCS 15-TLC and ATCS 15-TLCHFCK* models. The main difference between this model and the others is the over-temperature protection circuit and lower heater/cooler power limits.

The over-temp interlock is a hard-wired interlock and is factory set. The software for this model will only allow the set point to be adjusted on the front display or remotely to a maximum value of 22ºC (*ATCS 15-TLCHFCK maximum set point to 20).*

The temperature alarm window is programmable from the user interface. The temperature PID control loop has been improved overall from the existing ATCS design for all models.

The LED on-time is adjustable via the user interface in increments of seconds up to

3000 seconds (50 minutes).

The smart probe incorporates the over temperature interlock and the probe proximity interlock. The proximity interlock prevents the VaporGuard® from operating if the temperature probe is installed incorrectly.

The temperature probe provides the following features:

- A fail safe, hard-wired power interlock is tripped when the smart probe is not fully inserted into the thermowell of the bubbler or the bubbler is misaligned. The display will flash, an alarm annunciation will sound and the power will be removed immediately from the heating/cooling elements if this alarm is tripped.

- If the temperature probe measurement is outside of the user adjustable min/max temperature settings (temp low 1 & 2, temp high 1 & 2) an alarm is generated. If configured to be an interlocked alarm, it will also remove the power to the heater/cooler circuit when the threshold has been exceeded. This is not a hard-wired interlock. Temp high/low 1 also has a relay output associated with it.

To remain compliant, the VaporGuard® must be installed in an exhausted enclosure per SEMI S2 app.2 and F15. Tool interlocks must be in place to remove AC power for LEL vapor detection and/or loss of exhaust until the on- board interlocks are certified completely

- The VaporGuard® Trans-LC™ model is designed to accommodate high flow applications and has been tested to maintain temperature control to within 20 minutes (or less) of start of carrier gas flow (1000sccm).

- Versum Materials, Inc. temperature control systems designed for use with Trans-LC™ require the end-user or OEM tool manufacturer to install certain safeguards to insure safe handling of Trans-LC™.

WARNING

If the VaporGuard® is used in a manner not specified by this manual, the protection provided by this equipment may be impaired.

WARNING

WARNING: EXPLOSION HAZARD. Spark or ignition sources are present in the Power Supply Module. The user must insure that the Power Supply Module is located in an area where explosive vapors are not present. Under no circumstances should electrical connectors be connected or disconnected while the equipment is energized.

WARNUNG: EXPLOSIONSGEFAHR. In der Reglereinheit befinden sich Funken- oder Zündquellen. Die Reglereinheit muß vom Betreiber an einem Ort aufgestellt werden, der frei von explosiven Gasen ist. Unter keinen Umständen sollten elektrische Stecker eingesteckt oder herausgezogen werden, wenn die Anlage unter Strom steht.

AVERTISSEMENT: RISQUE D'EXPLOSION. Des sources d'étincelle ou d'ignition sont présentes dans l'unité de contrôle. L'utilisateur doit s'assurer que l'unité de contrôle se trouve dans un endroit hors de la présence de vapeurs explosives. En aucun cas les connecteurs électriques ne doivent être raccordés ou débranchés quand l'équipement est sous tension.

3.2 Trans-LC™

Versum Materials, Inc. temperature control system is designed for use with Trans-LC™ and requires the end-user or OEM tool manufacturer to insure safe handling of Trans-LC™ by installing certain safeguards. Noncompliance with these safeguards could result in hazardous conditions including loss of containment and/or fire conditions.

Specific procedures have been developed for handling Trans-LC™.

Refer to the following documents

- Safety Data Sheet (SDS) for of Trans-LC™
- Versum Materials, Inc. **Safetygram 50** - Trans-LC™
- Bubbler Installation and Removal Procedure – **PN 9901-0044**

If you require additional assistance, please call Versum Materials, Inc. Equipment Technical Services at **1-866-624-767**

Chapter 4 System Safety

4.1 Hazardous Location Safe Operation Requirements

This chapter contains vital information pertaining to the safe operation of the VaporGuard®. The user is encouraged to read this and all chapters of the manual completely before handling chemical.

The minimum personal protective equipment required for operating and maintaining the VaporGuard® system is dependent on the hazard category of the chemical being used. Consult the chemical manufacturer's SDS document.

Only trained personnel can operate this equipment. For training information contact your local Versum Materials, Inc. sales representative.

WARNING

The Source Cup Assembly is suitable for Class 1, Division 2, Groups A, B, C, and D; Hazardous Locations and Non-Hazardous Locations only.

WARNING

Explosion Hazard

Substitution of components may impair suitability for use in Class 1, Division 2 environments.

WARNING

Explosion Hazard

The area must be known to be non-hazardous before servicing/replacing the VaporGuard® and before installing or removing I/O wiring.

WARNING

Explosion Hazard

Do not disconnect equipment unless power has been disconnected and the area is known to be non-hazardous.

WARNING

The Power Supply Module is suitable for Non-Hazardous Locations only.

4.2 Safety Labels

Insure that these labels in figure 4-1, 4-2 and 4-3 are installed on the side (opposite of fan) of the Source Cup Assembly.

The labels are categorized into groups. “Danger” defines a situation that could be life threatening.

“Warning” defines a situation that has the potential for harm to the user or damage to the equipment if adherence to the warning is not taken.

“Caution” describes a potentially hazardous situation which if not avoided could result in minor or moderate injury to personnel or equipment.

NOTE: Do not block or cover any safety labels from view.

Figure 4-1

This label in Fig. 4-1 informs the user of the hazards associated with the use of this equipment using Trans-LC™, and the consequences of not adhering to the warning. Trans-LC™ is a flammable, corrosive and toxic chemical and should only be handled by trained personnel. The user is instructed to review the manual prior to working with this equipment.

Figure 4-2

This label in figure 4-2 informs the user that the VaporGuard® is designed for use in hazardous locations. As such, efforts must be taken to eliminate all spark sources as they may ignite the vapors. **To avoid this hazard, the user should never remove cables from the VaporGuard® while it is energized.**

The figure 4-2 label also warns the user of the consequences of not adhering to the dangers associated with this chemical delivery system. **The use of site specific lockout/tagout procedures are also required to prevent inadvertent removal of connector while system is energized.**

Figure 4-3 informs the user that there are no user-serviceable parts inside the Source Cup Assembly and also, there are heated parts inside the assembly. The Source Cup Assembly contains electronic circuits that could present an electrical/burn hazard if the cover is removed and also has a heated surface that could be higher than 50ºC which is considered a burn hazard. **Do not remove the cover.** The user is made aware of the consequences of not adhering to the warning. If the unit needs repair or maintenance, the user should contact the factory for service/repair.

Figure 4-3

The label in figure 4-4 is displayed on the lid side of the Power Supply Module.

The Power Supply Module contains electronic circuits that could present a hazard of electrical shock if the cover is removed. The user is informed that there is no reason to remove the cover and should not do so and the consequences if the warning is ignored. If the VaporGuard® needs repair or maintenance, the user should contact the factory for service/repair.

Figure 4-4

The CE/ATEX Labels in Figure 4-5 and Figure 4-6 are displayed on the side panel of the Source Cup Assembly for the standard VaporGuard® models. This label indicates that the Source Cup Assembly has been approved for use in hazardous locations within Europe. Models VG300W, VG300N, VG600W, and VG600N use Figure 4-5 with the T6 rating. Models VG600NHT and VG600WHT use Figure 4-6 with the T4 rating.

Figure 4-5

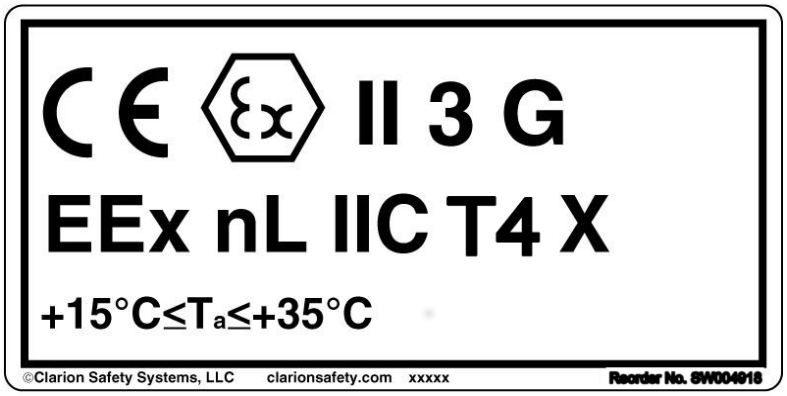


Figure 4-6

The Chassis Ground Label in figure 4-7 is displayed on the top side of the Source Cup Assembly next to the grounding lug.

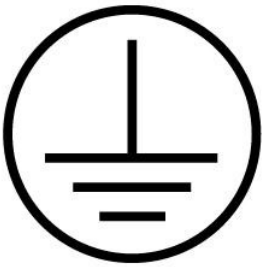


Figure 4-7

The Hot Surface Label in figure 4-8 is displayed on the top side of the Source Cup Assembly for high temp models.

Figure 4-8

The RoHS Compliant Label in figure 4-9 is displayed on the side panel of the Source Cup Assembly and on the lid side of the Power Supply Module for RoHS VaporGuard® models.

Figure 4-9

The NEC Label in Figure 4-10 and 4-11 are located on the Source Cup Assembly. These labels indicate that the Source Cup Assembly has been approved for use in the hazardous locations within the United States. Models VG300W, VG300N, VG600W, and VG600N use Figure 4-10 with the T6 rating. Models VG600NHT and VG600WHT use Figure 4-11 with the T4 rating.

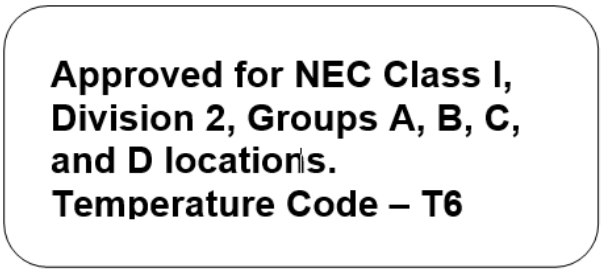


Figure 4-10

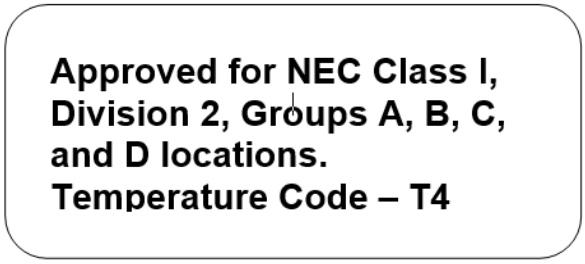


Figure 4-11

4.3 Alarm Interlocks

The safety interlocks are considered to be fail-safe and tested to be reliable under the UL991 reliability testing criteria. By definition, these alarm interlocks do not depend on the processor to generate the alarm output. The VaporGuard® was designed to be used with Versum Materials, Inc. supplied bubblers only. These bubblers are constructed with the appropriate features in order to safely operate in the VaporGuard®. Refer to Chapter 5 for system operation on the individual interlock circuits.

Table 4-1 Alarm Interlocks

Alarm Names	**Enable / Disable Selectable**	**Enable Default Setting**	**Default value**	**Interlock Selectable**	**Interlock Default**
Low Chem Level	no	enabled	11%	yes	not interlocked
Probe Not Install	no	enabled		no	interlocked
Tool Not Ready	yes	disabled		yes	not interlocked
Remote Stop	yes	disabled		Yes	not interlocked
Temp High2 Alarm	yes	enabled	5ºC	yes	not interlocked
Temp High1 Alarm	no	enabled	2ºC	yes	not interlocked
Temp Low1 Alarm	no	enabled	2ºC	yes	not interlocked
Temp Low2 Alarm	yes	enabled	5ºC	yes	not interlocked

Level No Connect	no	enabled		yes	not interlocked
Level Sensor Fail	no	enabled		yes	interlocked
Fan Failure	no	enabled		no	interlocked
No Communication	no	enabled		no	interlocked
Bad Communication	yes	enabled		yes	not interlocked
Thermal Tripped	no	enabled	selectable	no	interlocked
Cable Code I'Lck	no	enabled		no	interlocked
Ambient T Fail	yes	enabled		yes	not interlocked
RTD Shorted	no	enabled		no	interlocked
RTD Open	*yes **no	enabled		yes	interlocked
Temp Control Off	yes	disabled		no	not interlocked

Note: For RTD Open condition; *yes is with software version 1.33 or **no is with software version 1.32 or prior.

Table 4-2 Safety Interlocks

Safety Interlock	Activation Conditions	System Response	Operator Response
Temperature Probe Installation	Temperature probe not installed in thermowell of source container.	Error message “Probe not installed” flashes on LCD, audible, illuminated switch flashes and DDC alarms generated. Heater/cooler circuit is disabled.	Install Temperature Probe
Incorrect Source Container Orientation	Source container incorrectly installed.	Error message “Probe not installed” flashes on LCD, audible and DDC alarms generated. Heater/cooler circuit is disabled.	Rotate source container such that the thermowell is above the magnet installed at the bottom of the Source Cup.

High Temperature Cutout Switch	Bubbler temperature exceeds maximum allowed temperature.	Error message "Thermistor Trip" flashes on LCD, audible, illuminated switch flashes and DDC alarm generated. Heater/ cooler circuit is disabled.	Check thermowell oil level. Check configuration setup screen for "High Temp 1 or 2" alarm settings. Troubleshoot as required to correct cause of high temperature.
Front panel Start/ Stop switch	User wishes to stop the temperature controller operation	The switch will change colors. When control power is on, the switch will be green, when off, it will be red. When an alarm condition exists, the switch will flash red.	Use Start/Stop switch to remove power to the circuit or to start system in control.

4.4 Hazardous Location Installation Requirements

The requirements for equipment installed in hazardous locations are defined in the following documents. Refer to these documents for further details of the specific requirements.

1 Hazardous Locations requirements - Standard for "Electrical Equipment for Use in Class I and II, Division 2, and Class III Hazardous (Classified) Locations", UL 1604, Third Edition

2 General electrical and spacing requirements - Standard for "Industrial Control Equipment", UL 508, 17th Edition

3 Wiring methods - "The National Electrical Code", NFPA 70 2005 Edition

4 NFPA Article 501

The VaporGuard® offers an input to remotely shut off the high energy components to the Source Cup Assembly.

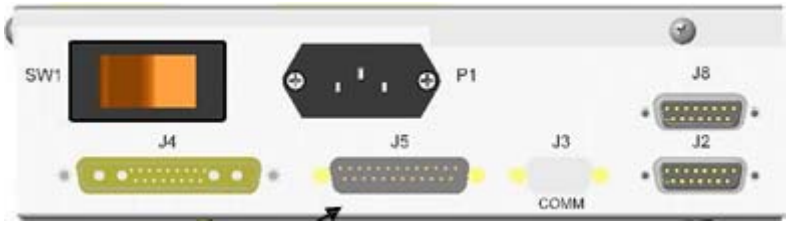


Figure 4.12 Power Supply Module, J5 DDC Cable Connector

Remote Stop signal, J5 - Pin 13 common to Pin 22 can be used as a hardware interlock to remotely remove high current energy from the Source Cup Assembly in the event that the system loses exhaust or vapors are detected greater than 25% LEL of the chemical.

The interface can be driven by a transistor (collector to Pin 13, emitter to Pin 22), opto-coupler or a dry contact. Contact closed, or transistor/optoFET ON will trip this alarm. This would remove power to high current loads.

However, the low power circuits will continue to operate for alarm logging purposes. A closed contact on J5 - Pin 13 common to Pin 22 will send a logic low signal to a redundant interlock circuit. This is a hardware interlock and will only clear when the Remote Stop signal is reset (open circuit) by the return of cabinet exhaust or the absence of chemical vapors greater than 25% LEL.

The processor monitors this input also and will generate an “ANY” alarm upon contact closure. The Start/Stop switch activation is required to allow power to return to the high current loads. The alarm must also be cleared from the LED display using the CLEAR ALARM function in the menu.

4.5 *Chemical Spill Cleanup*

In dealing with chemical spills and/or mitigating releases associated with the VaporGuard®, always use proper personal protective equipment, including gloves, face and eye protection, respirators, and protective clothing. Due to various factors in each spill incident, it has been determined unsafe to provide generic spill instructions for each type of chemical being used. For example, two spills of the same type of chemical could have two different spill procedures. Therefore, in the event of a spill, we recommend immediately contacting Versum Materials, Inc. EH&S department at **610-481-4911** (Chemical Emergency Option) for specific chemical spill instructions and environmental regulatory information.

SDS for all Versum Materials, Inc. chemicals are available from Versum Materials, Inc.

EH&S department. In addition, consult your company’s environmental hazard/safety

procedures for specific
instructions to be followed in the event of a chemical spill. Also, if a chemical spill or leakage comes in contact with the VaporGuard® proceed to section 4.7 for decontamination.

4.6 *Decontamination Procedure*

1. Don the appropriate PPE according to the chemistry. Turn OFF Power Supply Module, SW1. Insure that the incoming gas to the source container is off. (reference section 6.6.2 for quartz bubbler removal)

2. Visually inspect Source Cup Assembly for the location of any chemical spill. Determine if chemical is on cable connectors, Source Cup housing, or contained within the Cup. Verify if the container is damaged (i.e. cracked, corroded). Do not reuse a damaged container.

3. If chemical is found on any cabling, reference the chemicals manufacturers SDS for the spill cleanup and disposal procedure (reference section 4.6). Remove the contaminated cables and dispose of them by the customers' site discretion. Obtain new cables, reference parts list in section 7.5.

4. Disconnect the gas lines from each valve, and then carefully remove the container from the Source Cup Assembly. If chemical is found on the container or has entered the thermowell, reference the chemicals manufacturers SDS for the spill cleanup procedure. If the container is not damaged, it can be reused. However, if it's damaged and was purchased from Versum Materials, Inc., return the container to Versum Materials, Inc. by utilizing the proper shipping packaging. **Call Versum Materials, Inc. at 610-481-4911 for support.**

5. Visually inspect inside and around the Source Cup for chemical. If chemical is found, refer to the chemical manufacturers SDS for the spill cleanup procedure.

6. Dependent on the chemistry, if any damage (i.e. corrosion, deformity) is found, the Source Cup Assembly cannot be reused. Dispose per company protocol and replace with new Source Cup Assembly.

7. If no damaged is found, the Source Cup Assembly can be placed back in service. However, it is recommended to perform an operational check (ref. section 5.5) on the system.

Chapter 5

System Operation

5.1 *System Overview*

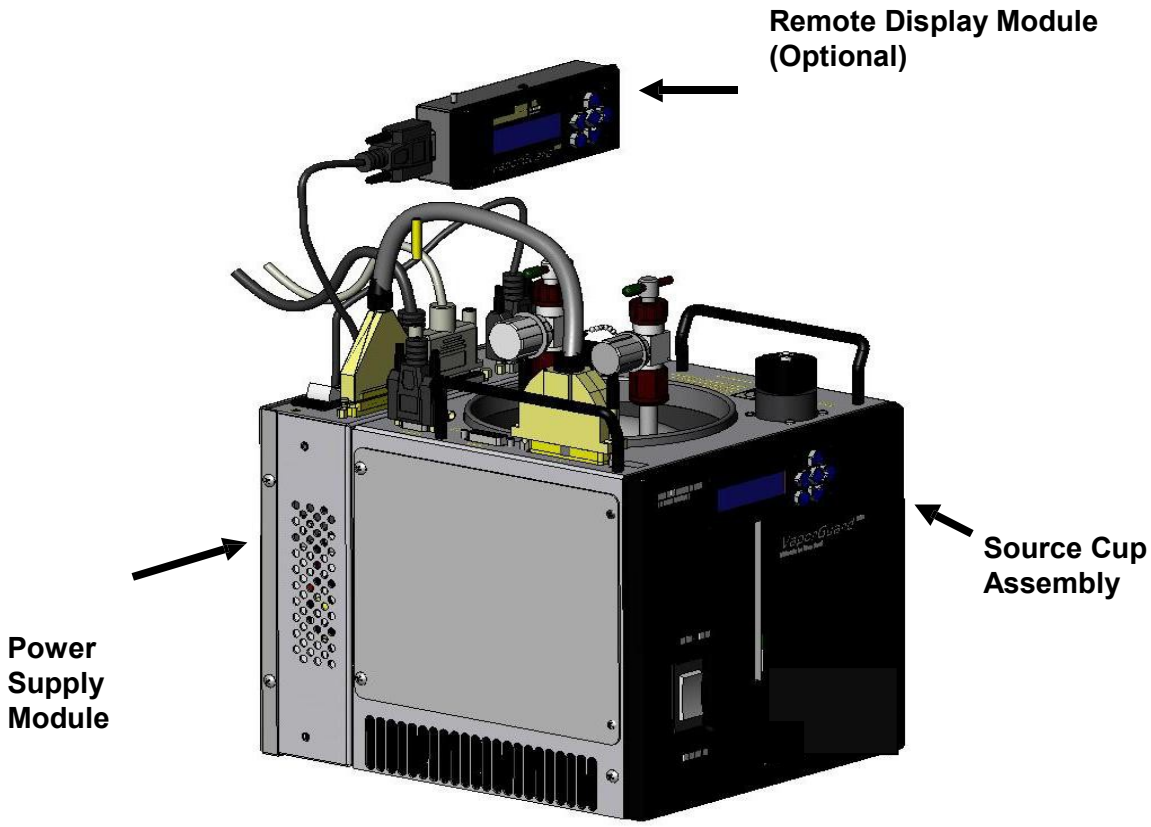
The basic function of the VaporGuard® is to provide a consistently accurate supply of source chemical with precise temperature control.

The temperature of the bubbler is maintained by a microprocessor control system. The control system incorporates thermo-electric coolers (TEC) and a heating element. Both cooling and heating modes are controlled by the microprocessor and adjusted appropriately through a factory set Proportional-Integral-Derivative (PID) loop.

VaporGuard® has been designed to minimize the destabilizing effect of evaporative cooling over a broad range of carrier flows.

The system is designed in two separate components, the Power Supply Module and the Source Cup Assembly. The heart of each module is their respective microprocessors.

Figure 5-1 VaporGuard® System



Although the Power Supply Module and Source Cup Assembly processors have separate tasks, they work together to act as one system and communicate between themselves via an RS485 link. The system architecture is implemented in a peer-to-peer configuration.

5.1.1 Power Supply Module Overview

The Power Supply Module microprocessor controls the following functions:

- Monitors the analog-to-digital converter inputs for all peripheral I/O
- Remote analog set point
- Analog level and temp voltage outputs
- Control of all digital-to-analog converter outputs
- Information processing and alarm status monitoring for the Source Cup Assembly processor
- Heater and cooler power control
- Safety interlock control circuitry for heater/cooler circuit
- Tool IO interface (DDC)
- Interface to Remote Display Module
- Monitors DC power quality
- Remote LCD/keypad interface

The analog signals monitored by the power supply include remote set point (DDC, J-5). Note the pressure transducer input (J-2) and mass flow input/output (J-8) are currently not available.

NOTE: The pressure and mass flow signals were designed in for later generations of this product. At this time, J2 has been implemented for software programming.

5.1.2 Source Cup Assembly Overview

The Source Cup Assembly microprocessor controls the following functions:

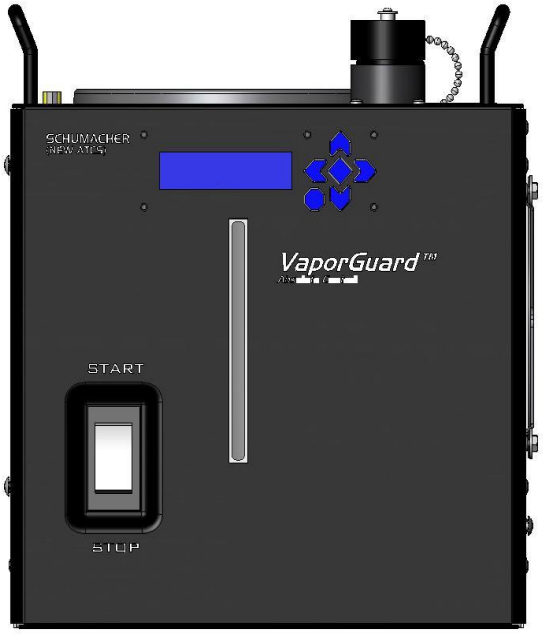
- Bubbler temperature feedback
- Interface to local LCD/keypad
- Backlight control
- Audible annunciation
- Fan speed monitoring
- Communication and alarm status monitoring from the power supply processor
- Heater/cooler power safety interlock for over-temperature and correct bubbler orientation/probe installation
- Start/Stop switch interlock
- 8 position level sensors for quartz bubbler applications
- 4 level Ultrasonic detector for Stainless Steel applications
- Level sense configuration parameters
- PID loop control parameters
- Alarm enable/disable features
- Password protected screens
- Enabling of Remote Display Module
- Enabling remote analog set point control

5.2 Source Cup Assembly, Detailed Description

5.2.1 User Interface

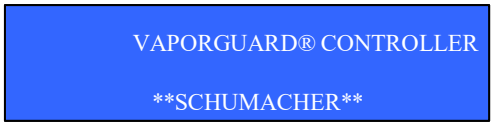
A 16 character x 2 line Liquid Crystal Display (LCD) with a keypad is used as the user interface. Display for temperature and alarm messages as well as inputting setup parameters are accessible through the user interface. An entire section “User Interface”, at the end of this chapter, has been dedicated to describing all features available in detail for this design as well as how to navigate through the menus using the keypad.

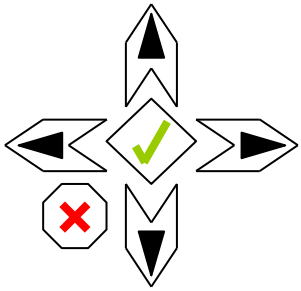
Figure 5-2 User Interface (Model VG600)



VG600W Front View

VG600N Front View





5.2.2 Backlight for Sight Glass

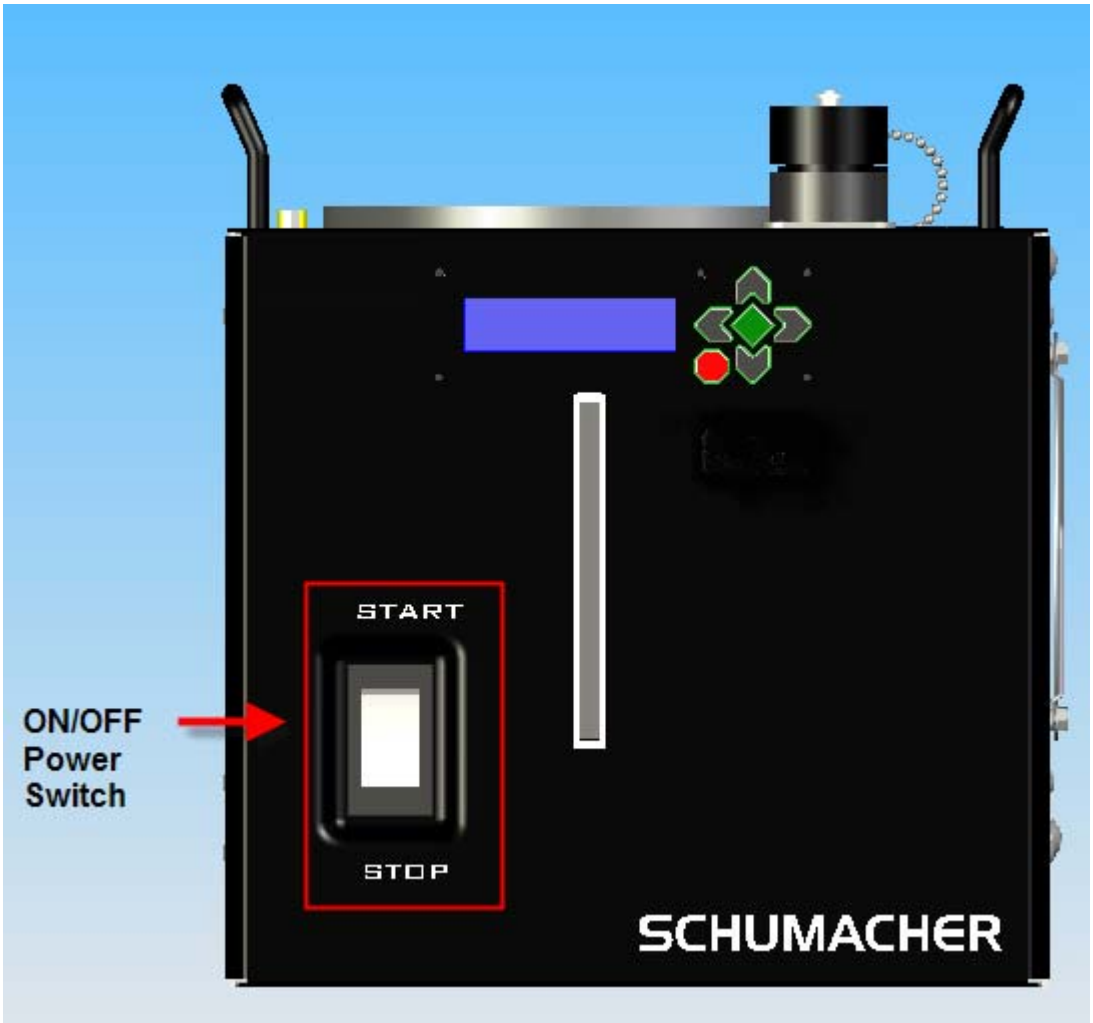
The design incorporates white LED's installed on the level sense PCA on the outside of the Source Cup. The backlight can be turned on by simply pressing the green check mark button on the keypad or by navigating to the "Backlight" menu.

From the Backlight menu, the user can also program the length of time the backlight will remain on after pressing the green check mark button. Factory default is 1 minute and can be adjusted to 50 minutes in increments of 1 minute.

5.2.3 Heater/Cooler START / STOP Power Switch

Pushing the rocker switch to the START position turns the heater/cooler power ON if all alarms are cleared. The rocker switch returns to center position when released. The green light will illuminate the top part of the switch to indicate power is ON to the heater/cooler. The STOP position on the switch turns the power to the heater/cooler circuits OFF. The red light on the bottom half of the switch will illuminate solid red.

Figure 5-3 START / STOP Power Switch (Model VG600)



The STOP position of the switch is a hardwired interlock input which the processor monitors. When an alarm condition occurs, the red light will flash. Only an alarm condition will trigger the flashing red LED. When the alarm is cleared, the red light will turn solid red.

Depending on the alarm type, the green light in the switch may or may not turn off. If the green light is not lit, push the rocker switch to the START position to return to normal operation.

There may be situations where the red light will be flashing and the green light will be on. This means that the unit is still in control, however an alarm condition exists. There are some alarms that will automatically remove the power as they are hardwired interlocks, i.e. Temp Probe NOT Installed interlock.

5.2.4 Liquid Level Alarm – Quartz Bubbler

The Source Cup Assembly has slots on opposite sides which allow for IR (infrared) light transmission for liquid level detection. Eight Infrared LEDs on a Transmit PCA and 8 Phototransistors on a Receiver PCA form a line of sight transmission and detection, refer to figure 5-4C to monitor the presence of liquid inside the bubbler.

Figure 5-4A Source Cup Assembly with Level Detect PCAs

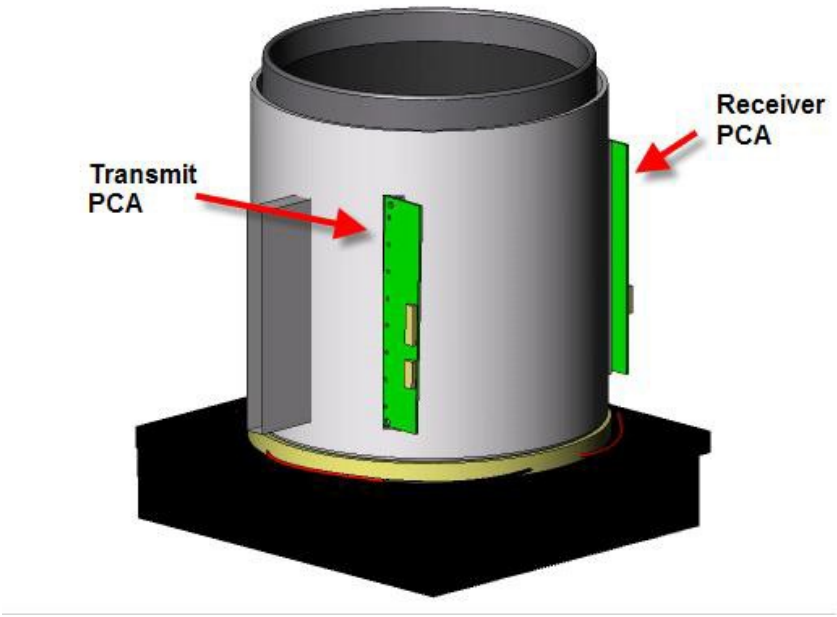


Figure 5-4B Level Detect Positions

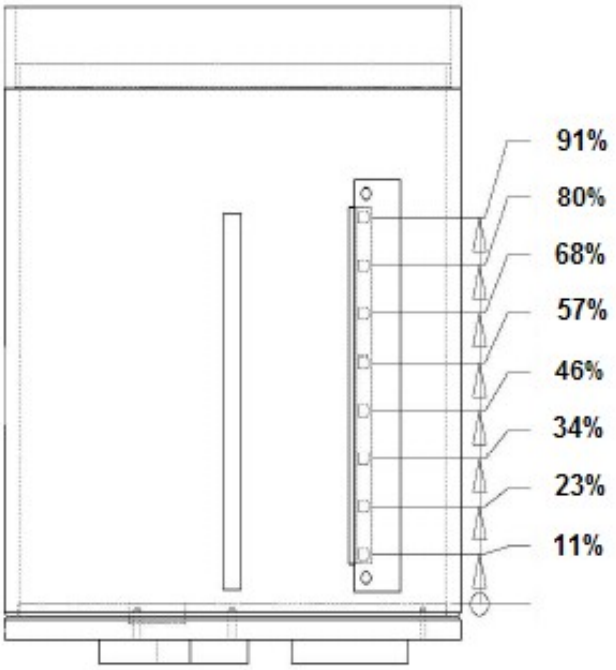
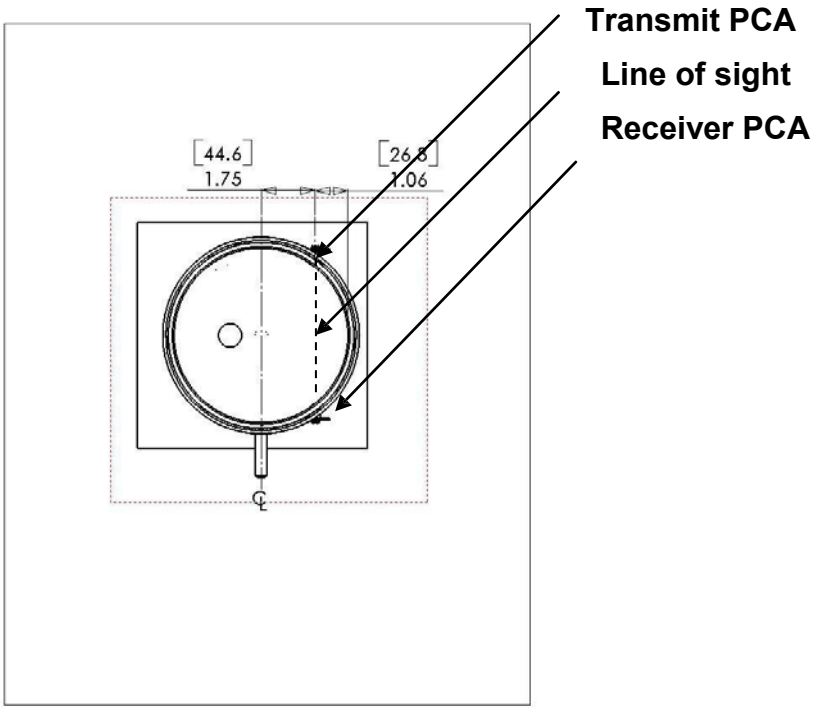


Figure 5-4C Level Line of Sight



The processor monitors all 8 levels once a second and updates the display. To prevent undesirable switching at any level while bubbling, the processor will not update the display or change relay outputs until the transition remains constant for more than 5 seconds. This is known as a software discriminator function block.

The Low Chem Level alarm will be activated when the liquid level is lower than or equal to the assigned alarm level set for the “Low Chem Level”. See Parameters & Limits menu for illustration of setting.

In this design, there are four additional level setpoints that can be assigned to dedicated relay outputs. Even though the relays can be configured to activate at the same level as the Low Chem Level alarm, these are independent of the Low Chem Level alarm output. The Low Chem Level alarm output is determined by the % level set in the configuration screen “Low Chem Level”. There is a separate configuration screen for the four other levels.

Once a Low Chem Level alarm is activated the he bubbler should be replaced as soon as possible to prevent the bubbler from going empty.

NOTE: Attaching labels on the bubbler in the level sense line of sight will render this feature useless. Figure 5.4C illustrates clearance locations for line-of-sight level sense PCA’s.

Due to manufacturing tolerances of quartz bubbler, each bubbler will have variations in diameter and curvature especially near the top and bottom. The quartz bubbler has an approximate diameter of 6 inches. The bubbler can move approximately 0.125” within the Source Cup’s diameter due to diameter tolerances of the bubblers.

This will have an effect on the actual percent of full that each discrete level sense position will represent. The percent of full values displayed on the front panel were derived from the mean average of a sample of bubblers measured at the factory.

The displayed values are height percentages. That is, the values are the percentage of the height of a full (1200cc) bubbler. Due to the lack of repeatability, the values are approximations and should be used for reference only. The percent (%) readout based on bubbler chemical levels are shown on Table 5.1 and illustrated in figure 5.4B.

Table 5.1 % Readout Based on Bubbler Chemical Level

1.2L Trans-LC™ (gm)*	% of Full Height	Liquid level definition	Physical definition
W<235	11	Level < 0.53" (1.35cm)	Chemical level below all level sensors
236<W<431	23	Level > 0.53" (1.35cm)	Chemical level below top 7 level sensors
432<W<652	34	Level > 1.03" (2.62cm)	Chemical level below top 6 level sensors
653<W<857	46	Level > 1.53" (3.89cm)	Chemical level below top 5 level sensors
858<W<1059	57	Level > 2.03" (5.16cm)	Chemical level below top 4 level sensors
1060<W<1255	68	Level > 2.53" (6.43cm)	Chemical level below top 3 level sensors
1256<W<1414	80	Level > 3.03" (7.7cm)	Chemical level below top 2 level sensors
1415<W<1443	91	Level > 3.53" (8.96cm)	Chemical level below top level sensor
W>1531	100	Level > 4.03" (10.24cm)	Chemical level above all level sensors

**The gram values are approximations and for reasons stated above, should be used for reference only. By scaling to accommodate for density differences, the user may approximately correlate these gram values to different chemical weights.*

5.2.5 Liquid Level Alarm – Stainless Steel Source Container

Refer to Chapter 8, VaporGuard® Stainless Steel Source Configuration for detailed description of this configuration.

5.2.6 No Liquid Level

There is an additional option in the “Config Sys” menu to select “NO LEVEL”, for containers that do not have level sense capabilities. Once selected the level reading states “NONE”.

NOTE: Required when using Versum Materials, Inc. S.S. containers with quartz optical level sensors.

5.2.7 Temperature Probe

The temperature feedback loop uses a Resistive Temperature Device (RTD) element to accurately measure the temperature of the oil inside the thermowell in the container and the corresponding temperature of the chemical.

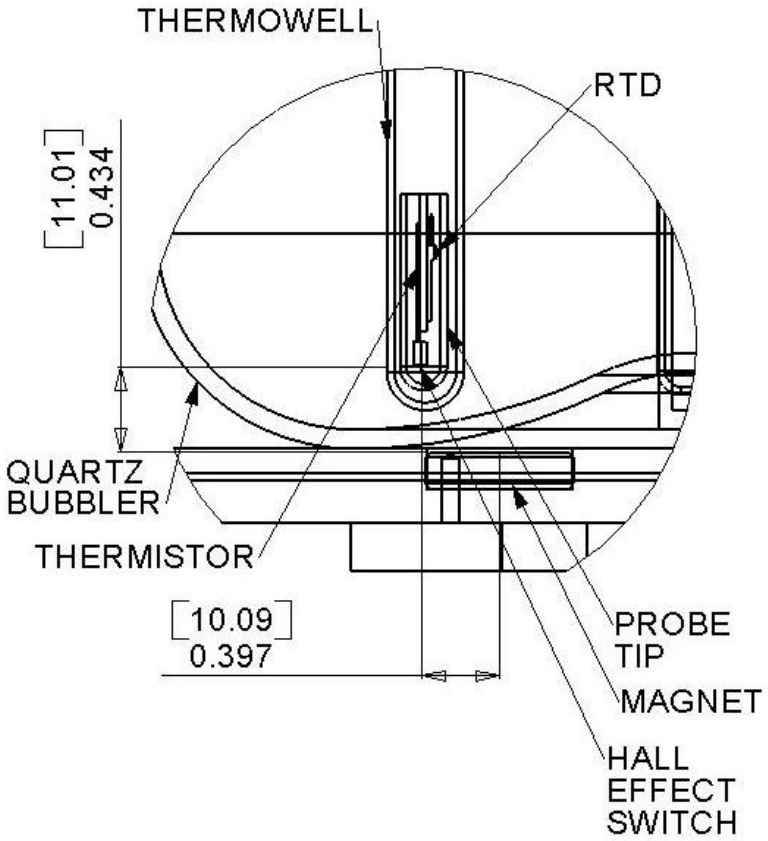
The electronics were designed to compensate for the nonlinearity of the RTD element to achieve higher accuracy. The probe has two other functions in addition to temperature measurement which are over-temp interlock and proximity sensor interlock.

The thermal cutout circuit will interlock the heater/cooler power in an over temperature condition independent of processor control. Different models will have different cutoff temperatures that are factory set.

The Trans-LC™ thermal cutoff is set to the temperature at which point the bubbler could increase the pressure beyond the specifications of the quartz bubbler. The proximity sensor will interlock the heater/cooler power when the probe is not installed at the bottom of the thermowell or if the bubbler is not oriented in the Source Cup properly.

Both over-temp and proximity sensors have been tested to reliability standards used in UL certification (UL991) for use as safety interlocks.

Figure 5-5 Temperature Probe Circuit



5.2.8 Sidewall Heater

The 198 Watt heater is wrapped around the Source Cup Assembly and is controlled by the Power Supply Modules microprocessor.

5.2.9 Thermal Electric Cooler

The thermal electric coolers (Peltier) are used to maintain the temperature of the chemical to the desired set point. They are controlled by the Power Supply Modules microprocessor.

5.2.10 Fan Failure Detection

The fan produces a square wave output that is monitored by the microprocessor. If the frequency of the square wave reduces by more than 40%, an alarm will occur.

5.3 Power Supply Module, Detailed Description

The integrated built-in switching power supply sub-assembly requires a single connection to a TYPE IEC plug specified for 100-240VAC @ 50-60Hz. The power supply sub-assembly was designed into a separate enclosure to allow the high-powered electronics to be remotely located outside of the hazardous area for Class 1 Division 2 applications. The hard wired interlocks in the Source Cup Assembly, if tripped, will turn off the heater/cooler power in the remote Power Supply Module located in the non-hazardous area.

The Power Supply Module communicates to the Source Cup Assembly via an RS485 link. Communication is monitored between the two units on both ends. If communication fails to or from either side, the power will be disconnected from the Source Cup Assembly and an alarm will be generated.

Figure 5-6 Power Supply Module (Internal View)

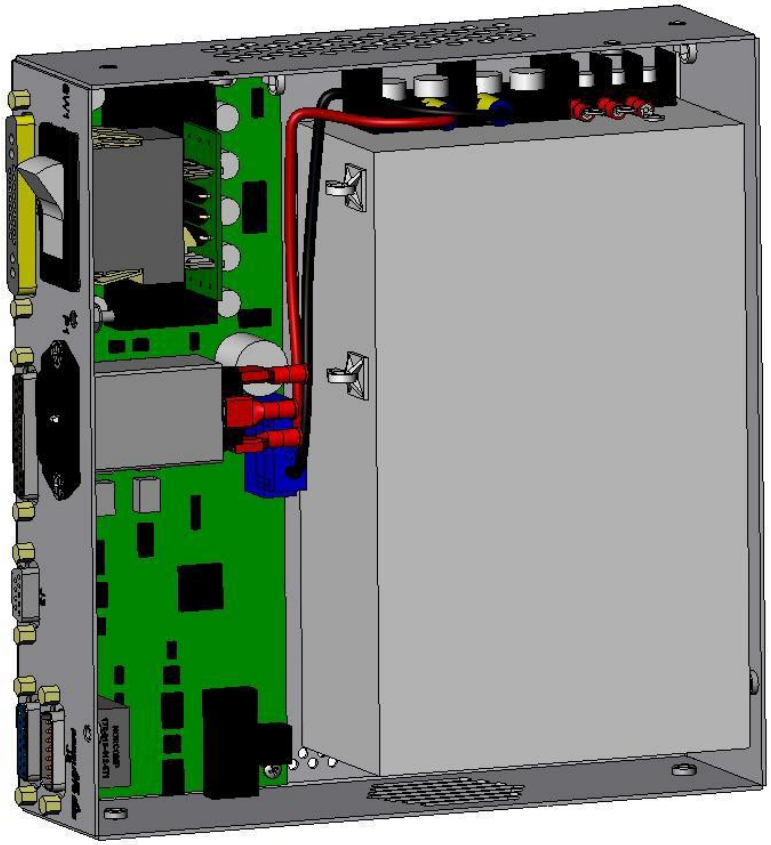
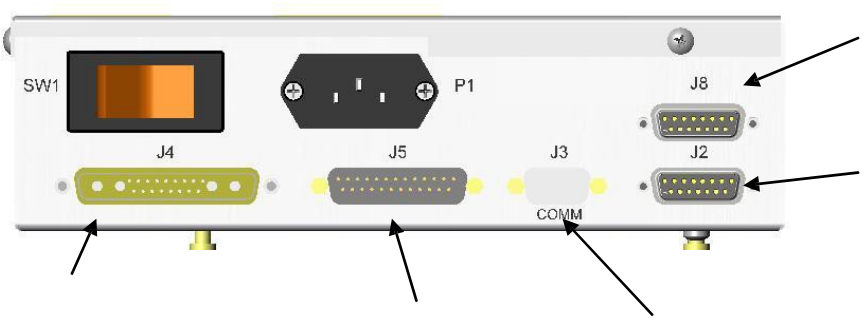


Figure 5-7a Model 600 Power Supply Module Back Panel



Not Used

Programming Port

Interconnect Cable Connector

DDC Cable Connector

Remote Display Connector

Figure 5-7b Model 300 Power Supply Module Back Panel

5.3.1 DDC Inputs/Outputs – Temperature/Level and "Any" Alarm

These three alarms can be configured for relay or voltage output from the keypad. For positive logic, output is high (+5 VDC) when no alarm condition exists, and low (<1 VDC) if an alarm condition exists. Inverted, voltage logic will result when J5- Pin 2 (25 pin DB connector) is shorted to ground.

5.3.2 Remote Temperature Set Point

This input allows a 0 to +5 VDC to be input for remote control of temperature set point with linear correspondence of 0 to 110 °C. Minimum/maximum bubbler temperature will depend on VaporGuard® model type but corresponding analog input for all models will remain the same scale.

In other words, +1 VDC input will adjust the set point to 20°C. The limits of the system will clip the set point, an analog input less than 0.5 VDC will result in a set point of 10°C. Likewise, an analog input greater than 1.1 VDC for the TransLC™ version will only result in a 22°C set point.

5.3.3 Remote Temperature Output

This output is a 0 to +5 VDC signal with linear correspondence to a bubbler temperature on a full dynamic range of 0 °C to 110 °C. Maximum bubbler temperature will vary based on VaporGuard® model type but corresponding analog output for all models will remain the same scale.

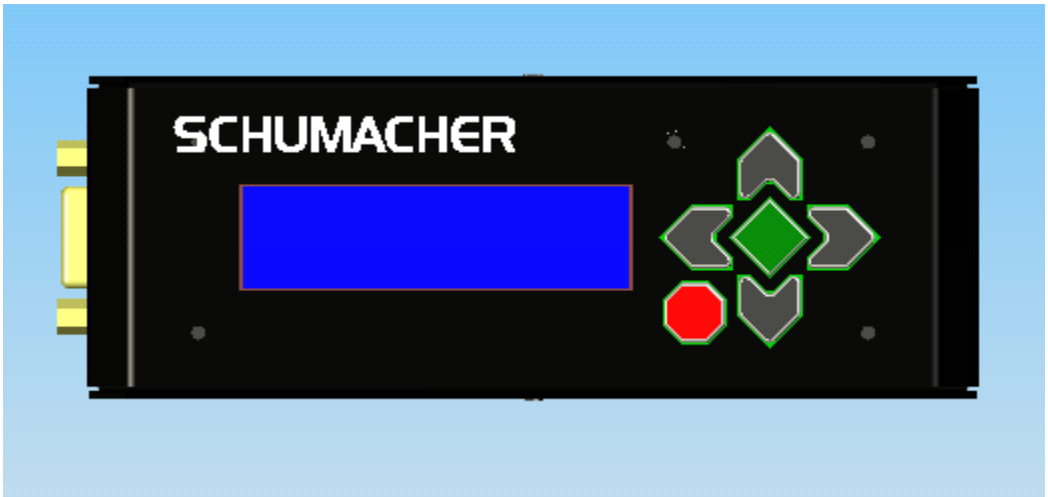
Likewise, +1 VDC output corresponds to a temperature reading of 22°C independent of the maximum control temperature of each model.

5.3.4 Remote Display Module

The Remote Display Module allows the user to control, configure and monitor the VaporGuard® from a remote location up to 7.6 meters (25 feet) away. The main display on the Source Cup Assembly will also display the same information at the same time.

However, the Remote Display Module can only be enabled to control and configure the VaporGuard® once it has been enabled from the main display. Ensure to never install temperature probe into this communications connector (J3).

Figure 5-8 Remote Display Module



5.4 Alarms

The LCD display will indicate the alarm condition on the bottom line. In addition, the Start/Stop rocker switch will change from a solid green LED (on the top half of switch) to solid red on bottom of the switch.

If the alarm is defined by the power module processor to be a safety condition, then the green LED will go out and the red light will begin to flash which indicates that the power was removed from the heater/cooler circuit.

5.4.1 Alarm Interlocks

The LCD display provides the capability to interlock the high current power to “ANY” alarm. It was implemented to cover a variety of applications where the user may

consider other conditions to be more critical than the factory configured interlocks. Allowing the user to select this feature provides more flexibility for specific applications.

For example, the VaporGuard® 600 models can be set to not monitor probe installation. Typically Stainless Steel (SS) applications are heated significantly above room temperature. If the user wants to insure the probe cannot be removed during operation, the temp low alarm can be interlocked. The user can specify at what deviation from the set point the alarm will trip.

The maximum value for low temperature is 10°C below the set point. The reading drops towards room temperature if the probe is removed. When the temperature drops below the set point that is entered for the low temperature alarm, the power is removed to the heater circuit to prevent the potential overheating condition.

5.4.2 Alarm Enable

The LCD display provides the capability to have the system ignore any non-hardwired interlock alarm. When an alarm is disabled and it occurs, the alarm will not show on the display nor will the “ANY ALARM” relay output change state.

5.4.3 Temperature Alarm

The alarm is activated when the monitored temperature is not within the tolerance of the temperature set point (factory default is ±2°C). The tolerance parameter can be changed via the keypad from ±10.0°C to ±0.1°C from the set point.

There are two alarms to high temperature. One does not have a relay output associated with it (Temp High 2). This can be used as warning while the other (Temp High 1) has an associated relay output for tool interface.

Keeping the alarm level at a tight tolerance could result in unnecessary or nuisance alarm conditions during bubbling of chemical.

As a backup and to protect against runaway temperature condition beyond the alarm limits, the probe has an independent, hard wired interfaced, thermal cutout to automatically shut off the heater/cooler power to prevent bubbler over pressurization.

This circuit was certified to UL 991 reliability standards and can be used as a safety interlock. The temperature cutoff is factory set for a particular model type. Insure that the chemical application is appropriate for the VaporGuard® model purchased.

WARNING: The maximum activation temperature of the High Temperature Cutout Switch must be below 80% of the auto ignition temperature of the chemical being used.

WARNUNG: Die maximale Auslösetemperatur des Hochtemperatur-Sperrschalters muß unterhalb 80% der Selbstentzündungstemperatur der verwendeten Chemicalie liegen.

AVERTISSEMENT:

La température maximale d'activation de l'interrupteur pour températures élevées doit être au-dessous de 80% de la température d'allumage spontané du produit chimique utilisé.

5.5 Operating Instructions

This section provides instructions on operation of the VaporGuard®. The system will be ready to operate after the following steps are performed.

5.5.1 Power Up

The Source Cup Assembly (interconnect) cable must be connected to the Power Supply Module (J4) prior to energizing the VaporGuard®. Likewise all other cable connections must be made and secured to the Source Cup Assembly and Power Supply Module prior to applying AC power.

Once connections have been completed, the Power Supply Module "ON-OFF" switch SW1 can be turned on. SW1 will be illuminated to indicate power-on condition.

During processor boot up, signals on the connector port pins are cycled. This causes several signals to momentarily turn on. They are the backlight, the fan, the illuminated Start/Stop switch and the buzzer. They will immediately turn off once the processor has completed the normal boot routine. This is normal and will only occur during initial power up.

The Start/Stop switch red LED will be on, as well as the display. This is an indication of successful communication to the Source Cup Assembly. If no alarms exist, press the START / STOP rocker to the START position to turn on the high power. The switch will illuminate green if the system is OK to operate.

If alarms exist, correct the condition and navigate to CLEAR ALARM menu to clear the alarms.

If the bubbler is not installed, or not installed properly, there will be a "Probe Not Installed" alarm on the display. If the bubbler is installed into the Source Cup Assembly and the probe is fully inserted into the thermowell, the bubbler needs to be rotated until a short beep occurs. This is an indication that the bubbler is in the correct orientation and the probe is fully installed into the thermowell.

Insure mineral oil has been added into the thermowell. Insert the bubbler into the Source Cup Assembly and install the probe into the thermowell until it touches the bottom. Listen for a short beep to indicate that the probe is installed correctly. Rotate

bubbler as required to achieve correct orientation. If the buzzer has been turned off, this feature will not work. See ”Config Sys” to enable buzzer.

There are some quick steps from the main menu to assist the user. Press the red X button to mute the alarm for the defaulted time duration. Press the right arrow once and press the center green check button. Press the down arrow repeatedly until the screen prompts to “CLEAR ALARM”. Press the center button again and the alarm will be cleared from the display. If alarm condition is gone, press the Start/Stop switch to the “START” position. The green LED will illuminate on the rocker switch.

A “High Temp” or “Low Temp” alarm may occur if the bubbler chemical temperature is higher or lower than the default setting for set point tolerances. These alarms can be cleared by changing the set point to a temperature different from the current setting or changing the tolerance for the alarm condition.

Exit the screen *and save the setting*. With the controller on, the temperature should move towards the set point temperature. A temperature alarm will trip if the temperature continues to move out of the temporary set point limits. This may be caused by the VaporGuard® not being in the START mode or is not operating properly. Investigate as required.

If other alarms exist, take measures to correct the alarm condition, and then repeat the clear alarm steps as previously described.

5.5.2 Calibration Check

With the temperature probe connected to the Source Cup Assembly, hold the probe tip to a temperature sensing device (ex. digital thermometer). This is not a calibration, but only a check to see if the device is measuring approximately close to a reference value.

The VaporGuard® is calibrated at the factory with a precise, traceable RTD simulator and can be easily calibrated in the field (if required) with the purchase of a Temperature Calibration PCA used to simulate several different temperatures, refer to chapter 7. Contact Versum Materials, Inc. for the purchase of the Temperature Calibration PCA, **PN 146617**.

5.5.3 Temperature Set Point Adjustment

The temperature set point can be adjusted to the desired temperature while the VaporGuard® is in operation. Press the right arrow key repeatedly to get to the SETUP screen. Then press the center green button. If the cursor is on the set point, use the up or down arrows to adjust the temperature setting to the desired value.

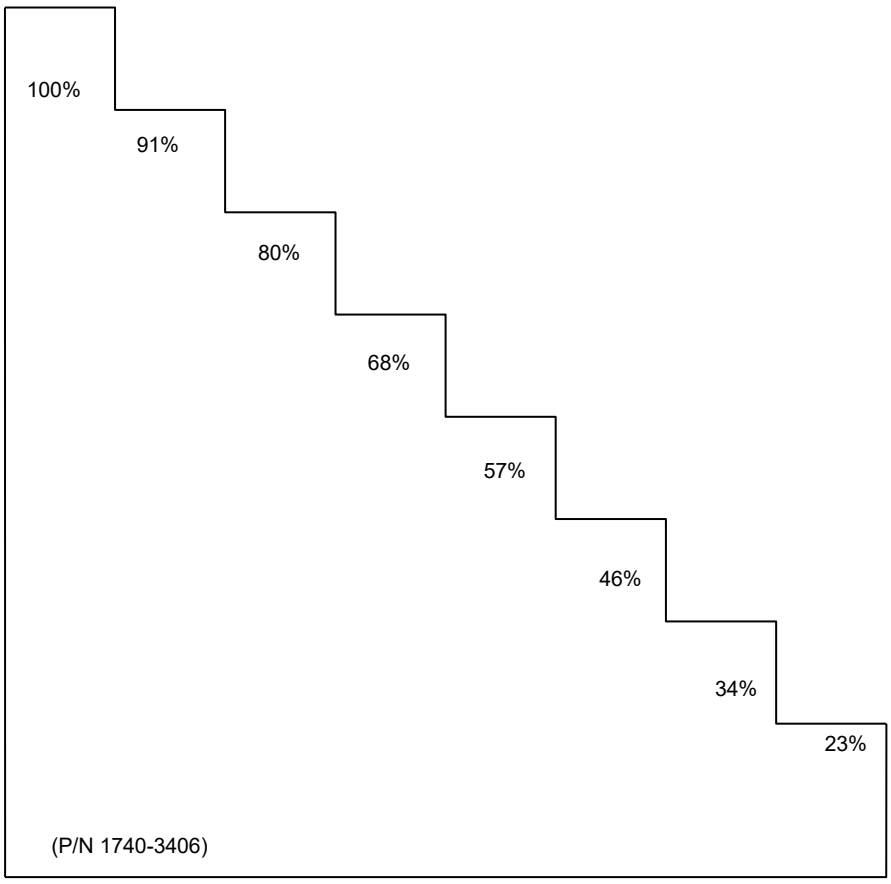
If the cursor is on the lower line, press the center button to move to the top line, then adjust as describe above. Press the red X button to exit the screen and press the center button to save the settings. Pressing the red X button on the SAVE screen will exit to the previous menu without saving the settings. Do not turn off the heater/cooler power switch on the Source Cup Assembly once the set point setting has been changed, otherwise the until will not reach the set point temperature.

5.5.4 Level Check – Quartz Bubbler

For a 1.5L quartz bubbler, the level should read 100% if it is filled to 1200cc. A template has been provided at the end of this section for testing the level sense probes with the bubbler removed. A Template must be cut out and traced over with a thicker/darker card stock material.

Inserting the card stock into the Source Cup Assembly and sliding across the receiver window will simulate level changes in the bubbler. Each level must be present for at least 5 seconds before the display will update to the new level because of the discriminator function block. For the template, reference figure 5.9.

Figure 5-9 Template for Testing Quartz Level Sense



5.6 User Interface

This section describes the keypad operation and navigation through the menus on Liquid Crystal Display (LCD).

5.6.1 Basic keypad features

- Navigate up or down by using the up/down arrow keys to either scroll through lists of alarms or increase/decrease variables.
- Press and hold the arrow up (or down) key will increase the speed of increment/decrement.
- Navigate left or right by using the left/right arrow keys to navigate through menus.
- Pressing the green "√" key in the center of the arrow keys executes that screen selection.
- To cancel a selection or return to a higher-level menu, press the red "X" key.
- Two consecutive presses on the "X" key will return the display to the main screen from any menu. Figure 5-2 illustrates the keypad and LCD.

5.6.2 Boot Screens

Source Cup Assembly Boot Screen

Each enclosure has its own processor and therefore for identification purposes, has its own boot display.

			A	T	C	S		L	O	C	A	L			
*	*	*	S	C	H	U	M	A	C	H	E	R	*	*	*

Remote Display Module Boot Screen

			A	T	C	S		R	E	M	O	T	E		
*	*	*	S	C	H	U	M	A	C	H	E	R	*	*	*

*	C	O	P	Y	R	I	G	H	T		2	0	0	8	*
0	8	/	0	6	/	0	8				V	1	.	3	2

The second row has the release date and version number for firmware validation.

5.6.3 Main Screen

Configurable for two display formats.

L	:	0	1	1	%		T	:	0	0	0	.	0	º	C
P	W	R		O	F	F		S	P	:	0	2	5	.	0

This view allows for the set point to be displayed as well as the status of the TEC/Heater power. The power on/power off will follow the green light on the rocker switch on the front panel.

- The numbers adjacent to “SP:” is the current set point of the temperature controller. The set point parameter will be replaced by any alarm text message.

- The number on the top left corner adjacent to the “L:” is the quartz or S.S. container liquid level. In this quartz design, there are 8 discrete levels. Thedisplay will update from one percentage level to the next as the chemical transitions past the next lower sensing position on the Source Cup Assembly.

- The number adjacent to “T:” is the bubbler temperature from the thermowell.

- The bottom left section is a power status indicator for the heater/cooler. When the Power Supply Module is applying power to the heater/cooler circuits, the display will read “PWR ON”.

- The status information section of the display is shared with the alarm text message. The status information will be replaced in the event of an alarm. The alarm text message will be displayed in its place.

- A second format is shown below. In the event of an alarm, the display will change to show temperature and level on the top row and the alarm condition on the bottom row. The user can decide which format is best for their monitoring purposes. See “Config Setup” section for more details on selection.

		T	E	M	P	:		2	0	.	0	º	C		
			L	E	V	E	L	:		8	0	%			

5.6.4 Alarm Screen

C	U	R	R	E	N	T		A	L	A	R	M			
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

If no alarm exists, the following screen will be displayed.

N	O		A	L	A	R	M	S	.						
E	N	T	E	R		M	U	T	E		A	L	A	R	M

If any alarm exists, the following screen will be displayed.

	2		A	L	A	R	M	S	.						
E	N	T	E	R		M	U	T	E		A	L	A	R	M

In the above screen, the “2” represents the number of alarms currently active.

A	L	A	R	M			N	A	M	E					

Pressing the arrow down key will scroll through the list of existing alarms. After the last alarm has been displayed, the CLEAR ALARM screen will prompt the user to press the red X to exit the alarm screen or the green check mark to clear all current alarms.

Clearing alarms in this screen means acknowledging them. If the individual alarms still exist, the alarm status may or may not allow the processor to start controlling temperature depending on the interlock status or alarm type. However, the alarm will be cleared from the display for approximately 5 seconds. If the alarm condition no longer exists, the system will operate normally, otherwise the alarm message will reappear.

C	L	E	A	R		A	L	A	R	M	S				
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

Press the red “X” to return to the previous screen.

5.6.5 Password Screen

From the main screen, the user may view the password screen by pressing the Up arrow for more than 5 seconds. The following screen will be displayed.

P	A	S	S	W	O	R	D		S	C	R	E	E	N	
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

Pressing the green “√” key in the center of the keypad prompts the user to enter the 4-digit password. The user must use the up or down arrow keys to select the individual digits of the password. The digits will briefly display before the * symbol returns. The right and left arrow keys are used to move to the adjacent digit.

Once the password has been entered, press the green “√” key to validate the correct password. The display will return to the main menu. The password is “1969”.

E	N	T	E	R		P	A	S	S	W	O	R	D		
L	O	G	G	I	N	G	.	.	.			1	9	6	9

If the user attempts to re-enter the password screen, and it has already been entered, the following screen will allow the user to log out. Selecting the “X” will leave the system logged in. Selecting the “√” key will log out the system and the display will return to the main menu.

E	N	T	E	R	=	L	O	G	O	U	T				
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

NOTE: If the VaporGuard® is left in the MAIN SCREEN for more than 10 minutes without a key entry, the unit will log out automatically. To prevent the auto-logout feature, do not leave the display in the MAIN SCREEN. The VaporGuard® will continue to operate normally. If the auto logout feature does occur, simply re-enter the password as described above.

5.6.6 History Alarms

H	I	S	T	O	R	Y		A	L	A	R	M	S		
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

L	O	W		C	H	E	M		L	E	V	E	L	!	
0	1	/	0	8	/	7		1	3	:	1	3	:	2	0

N	O		A	L	A	R	M	S							
E	X	I	T	=	M	A	I	N		S	C	R	E	E	N

The user has the option to clear historical alarms at the end of the alarm list.

C	L	E	A	R		H	I	S		A	L	A	R	M	?
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

5.6.7 Display Screens

D	I	S	P	L	A	Y		S	C	R	E	E	N	S	?
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

From within the Display Screen, the user has five different selections. They are the software version screen, date and time screen, raw analog readings screen, digital inputs and fan status screen.

5.6.8 Software Version Screen

S	W		V	E	R	S	I	O	N	?				
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

*	C	O	P	Y	R	I	G	H	T		2	0	0	8	*
1	1	/	1	0	/	0	8				V	1	.	3	3

5.6.9 Date and Time

This screen is a view only screen. See “Config Sys” section for details on changing the time/date fields.

D	A	T	E		&		T	I	M	E	?				
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

*	D	A	T	E	:		0	9	/	1	5	/	1	4	*
*	T	I	M	E	:		1	0	:	0	7	:	2	9	*

5.6.10 Raw Analog Input

These data points represent the analog input channels read directly into the microprocessor.

R	A	W		A	N	A	L	O	G		I	N	P	U	T
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

C	H	0	:	X	X	X	X	C	H	1	:	X	X	X	X
C	H	2	:	X	X	X	X	C	H	3	:	X	X	X	X

C	H	4	:	X	X	X	X	C	H	4	:	X	X	X	X

U	P	A	R	R	O	W	-	>	C	H	0	-	C	H	3

5.6.11 Digital Inputs

D	I	G	I	T	A	L		I	N	P	U	T	S		
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

Pressing the green "√" key will produce the following screen. Pressing the X returns to the previous menu.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
S	T	A	R	T	/	S	T	O	P						

First line: Input status. When the input is high “1”, the related text will be upper case; when the input is low “0”, the text will be lower case.

Second line: The description of the input. Move the cursor left or right, the second line will display the description of the input the cursor is pointing to.

This display is useful when troubleshooting the tool interface.

5.6.12 Fan and Ambient Temperature

The fan speed should be around 80 RPM. If the speed falls below 20%, an alarm will result.

F	A	N		A	M	B		T	E	M	P			
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

There is also an onboard temperature sensor. It is not as accurate as the one used for measuring chemical, but is appropriate for determining the ambient conditions of the installation site.

F	A	N		8	5									
A	M	B	I	E	N	T		2	3	.	8	º	C		

5.6.13 Bar Light

T	U	R	N		O	N		B	A	R	L	I	G	H	T
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

Pressing the green "√" key will turn on the bubbler light for the number of seconds shown on the top right side of the display.

B	A	R	L	I	G	H	T		O	N				6	0
E	X	I	T	=	M	A	I	N		S	C	R	E	E	N

5.6.14 Save Changes

Changes to the parameters will not be saved when exiting the menu. Therefore it is necessary to save the parameters by toggling to this screen, then select "Execute" whenever they are changed in order to store the value in memory. It is recommended to save parameters and settings every time any changes have been made.

S	A	V	E		C	H	A	N	G	E	S	?			
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

5.6.15 System Config

In the system configuration screen the following features are available:

Buzzer on/off, Local/Remote Set point control, Remote LCD on/off, quartz/SS bubbler,

Alarm output voltage/contact, Main screen views, Alarm interlocks, Alarm enable, Parameters/limits and Change clock.

Pressing the green "√" enter key will navigate down into the system configuration submenu.

S	Y	S	T	E	M		C	O	N	F	I	G			
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

B	U	Z	Z	E	R		O	N							
E	N	T	E	R		T	O		C	H	A	N	G	E	

Pressing the green "√" key will toggle between ON and OFF screens. This will disable the audible alarm feature.

B	U	Z	Z	E	R		O	F	F						
E	N	T	E	R		T	O		C	H	A	N	G	E	

Using the right (or left) arrow keypad will scroll through the other setup parameters.

S	P	-	>	L	O	C	A	L				2	5	.	0
E	N	T	E	R		T	O		C	H	A	N	G	E	

Pressing the green "√" key will toggle between local LCD set point control, remote LCD set point control and remote set point control via an analog voltage input, where 1-5VDC corresponds to 10-110ºC.

S	P	-	>	R	M	T		L	C	D			0	.	0
E	N	T	E	R		T	O		C	H	A	N	G	E	

S	P	-	>	R	M	T		A	I			2	5	.	0
E	N	T	E	R		T	O		C	H	A	N	G	E	

Local control is achieved by using the LCD keypad interface to set the temperature set point of the controller. When the controller is set in the LOCAL mode, the remote control (analog and digital) will be ignored.

Pressing the green "√" key will toggle between Local Set Point, Remote LCD Set Point and Remote Analog Input Set Point control screens.

Remote LCD Set Point control allows the user to change the temperature set point using remote LCD. Likewise, the Analog In (AI) set point control allows the user to change the set point remotely via a 1-5VDC signal to the controller corresponding to a 10°C to 110°C set point range of control.

When in remote set point mode the local LCD settings will be ignored. The main menu on the local display will indicate that the set point is in remote control.

NOTE: If the system is equipped with the Remote Display Module, the temperature set point value from the remote or local display will be overridden by the analog voltage input once the analog input has been selected for set point control. If there is no analog connection, the controller will default to the previous setpoint.

L	O	C	A	L		L	C	D		O	N			
E	N	T	E	R		T	O		C	H	A	N	G	E

Pressing the green "√" key will toggle between Local Display and Remote Display Module control screens. Local control is the factory default.

R	E	M	O	T	E		L	C	D		O	F	F	
E	N	T	E	R		T	O		C	H	A	N	G	E

The Remote Display Module allows for remote control via an additional LCD keypad interface. The remote LCD, when enabled on the local LCD, has a limited control level compared to the local display physically mounted to the Source Cup Assembly.

The Remote Display Module can be installed up to 25 feet away from the Power Supply Module. Using the right (or left) arrow keypad will scroll through the other setup parameters.

5.6.16 **Lid Heater** (Not available)

This factory default for this value is

OFF.

L	I	D		H	E	A	T	E	R		O	F	F		
E	N	T	E	R		T	O		C	H	A	N	G	E	

5.6.17 Main Screen Second Line Selection

Pressing the green "√" key will toggle between Main Screen Second Line ON and Main Screen Second Line OFF screens.

M	A	I	N		S	C	N		2	N	D		O	N	
E	N	T	E	R		T	O		C	H	A	N	G	E	

M	A	I	N		S	C	N		2	N	D		O	F	F
E	N	T	E	R		T	O		C	H	A	N	G	E	

5.6.18 Level Mode Selection

S	E	L	E	C	T	L	E	V	E	L	M	O	D	E	
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

The user may select between Quartz, SS Ultrasonic or SS No Level. For SS No Level the user must remove the hardware interlock on JP4 of the Source Cup Assembly PCA or the VaporGuard® will not function. (S.S. Optical Level is not available).

5.6.19 Product Selection

P	R	O	D	U	C	T		S	E	L	E	C	T		
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

The user may select between;

- Regular (Trans-LC™ with maximum set point = 22 ºC)
- $POCl_3$ (maximum set point = 26ºC)
- Cable Code (Trans-LC™ with maximum set point = 20ºC)

These are quartz bubbler applications and use the lowest thermal cutout setting (see Section 5.9). The interlock should be used for all Class1, Division 2 applications. When Cable Code is selected, the cable code alarm is activated.

5.6.20 Alarm Interlock

Interlocking an individual alarm will result in the removal of power to the heater/cooler circuit. When an alarm is interlocked, it will automatically be enabled in the Alarm

Enable menu. The user should decide what Alarms (if any) to interlock based on their particular site safety requirements / policies to avoid unnecessary shut-down of the VaporGuard®.

A	L	A	R	M		I	N	T	E	R	L	O	C	K	?
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

L	O	W		C	H	E	M		L	E	V	E	L	!	
N	O	T		I	N	T	E	R	L	O	C	K	E	D	

Pressing the green "√" key will toggle the alarm from "INTERLOCKED" to "NOT INTERLOCKED".

L	O	W		C	H	E	M		L	E	V	E	L		
I	N	T	E	R	L	O	C	K	E	D					

5.6.21 Alarm Enabled

When an alarm is disabled, the controller ignores the event and the condition will not be annunciated at the main menu nor will relay outputs be activated. Furthermore, the alarm will not be captured in the current or historical alarm screens. There are several alarms that cannot be disabled, as these are hardwired interlocks for safety purposes.

A	L	A	R	M		E	N	A	B	L	E	D			
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

L	O	W		C	H	E	M		L	E	V	E	L		
E	N	A	B	L	E	D									

Pressing the green "√" key will toggle the alarm from "ENABLED" to "DISABLED".

L	O	W		C	H	E	M		L	E	V	E	L		
D	I	S	A	B	L	E	D								

5.7 Parameters and Limits

Using the right (or left) arrow keypad will scroll through the next setup parameter. Within this menu the user may edit settings for the following parameters.

- Alarm Mute & Light Bar time
- Temp alarm limits (min/max)
- Level alarm limits
- Audible alarm enable
- Screen Save (minutes)
- LCD backlight and contrast control
- Change date/time

5.7.1 Alarm Mute/Light Bar time

Alarm Mute/Light Bar time

A	L	R	M		M	U	T	E		T	M			6	0
L	I	G	H	T		B	A	R		T	M			6	0

This screen is for configuring alarm mute time and backlight on time. The user can select how long the backlight will stay on. The LED backlight is controlled by the microprocessor for the specified duration. The default for both parameters is 60 seconds. The range is 1 to 999 seconds at 1-second intervals.

5.7.2 Temp Limit Alarms

T	E	M	P		H	I	G	H	1		#	.	#	º	C
T	E	M	P		H	I	G	H	2		#	.	#	º	C

The user may adjust the HIGH1 and HIGH2 temperature alarm trip points from this menu. The range for the HIGH1 and HIGH2 alarm limit value is 0.5 to 10°C in 0.1°C increments. An alarm occurs when the limit value plus the setpoint is reached or exceeded. For example, if the temperature setpoint is 20°C and the High 1 is set to 2°C, the High Alarm 1 is activated when the temperature reaches 22°C

The default setting is 2°C for HIGH1 and 5°C for HIGH2. HIGH1 parameter has an associated relay output for remote annunciation. HIGH2 does not. The HIGH 2 can be a higher, equal or lower temperature value that HIGH1.

Pressing the "√" key will move the cursor to the HIGH2 alarm limit value. Pressing it again will return the cursor back to the HIGH1 alarm limit value.

Using the right or left arrow will scroll through the other setup parameters.

T	E	M	P		L	O	W	1		#	#	.	#	°	C
T	E	M	P		L	O	W	2		#	#	.	#	°	C

The TEMP LOW1 and TEMP LOW 2 behave similarly to the HIGH1 and 2 alarms. This temperature setting adjacent to each parameter will trigger an alarm when the bubbler temperature measurement is equal to or less than this temperature limit.

TEMP LOW1 has a corresponding relay output for remote annunciation. TEMP LOW2 does not. TEMP LOW2 can be a higher, equal or lower temperature value that TEMP LOW1.

5.7.3 Level Limit Alarms

L	E	V	E	L		4						#	#	.	#
L	E	V	E	L		3						#	#	.	#

L	E	V	E	L		2						#	#	.	#
L	E	V	E	L		1						#	#	.	#

L	O	W		C	H	E	M		A	L	M			2	3
S	P	A	R	E											0

The LEVEL 1 through LEVEL 4 limit screen allows the user to define the level at which the VaporGuard® will trip a given relay. However, these outputs are not alarms and will not show up on the display nor will they be associated with the “ANY” ALARM.

The values can be set to any level percentage associated with the quartz level sense increments, including all the same value. For example, LEVEL 1 relay output could be set to any value above, below or equal to any other LEVEL relay output.

To remain backwards compatible with the existing design, the LOW CHEM LEVEL is the only signal in this screen that is an alarm. This signal has the same flexible features as the other four levels, but it is linked to the "ANY" ALARM output and will show up on the LCD.

NOTE: The lowest value that can be entered for LOW CHEM LEVEL is 23.

Using the right (or left) arrow keypad will scroll through the other setup parameters.

Pressing X will prompt the user to save the changes or leave parameters unchanged.

5.7.4 LCD Display Controls

The user has the ability to set the contrast and brightness of the LCD display. Factory setting is preset for optimal settings; however the user may adjust if required.

L	C	D		C	O	N	T	R	A	S	T		1	6
L	C	D		B	A	C	K	L	I	G	H	T	5	0

5.7.5 Buzzer

B	U	Z	Z	E	R		O	F	F		N	O	W		
E	N	T	E	R		T	O		C	H	A	N	G	E	

B	U	Z	Z	E	R		O	N		N	O	W			
E	N	T	E	R		T	O		C	H	A	N	G	E	

5.7.6 Change Clock

The system was designed with a real time clock to support the data acquisition time stamp.

C	H	A	N	G	E		C	L	O	C	K	?			
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

*	D	A	T	E	:		0	9	/	1	5	/	1	4	*
*	T	I	M	E	:		1	0	:	0	7	:	2	9	*

5.7.7 Default Setups

The default screen will return the system to factory default settings.

D	E	F	A	U	L	T		S	E	T	U	P			
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

S	U	R	E		T	O		D	E	F	A	U	L	T	
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

CAUTION

If the Default Setup is executed, all parameters must be reselected again accordingly. Contact Versum Materials, Inc. Technical Service for assistance.

5.7.8 Set up Screens

The setup menu contains the set point screens and allows the user to change the set points to within the limits of the particular model purchased.

S	E	T	U	P		S	C	R	E	E	N			
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

Press the "√" key will select the temperature set point/flow rate adjust screen. The flow rate should be chosen to allow the controller to apply the appropriate PID parameters for better temperature control response. The flow units are in standard cubic centimeters per minute (sccm) and the default is 250 sccm. For high flow, such as 1000sccm, it is important that this flow setting be set to the actual flow rate so that the temperature control may respond optimally.

Pressing "X" will prompt you to save the changes. Press the "√" key save the set point change. Pressing "X" at the save screen will return the display main menu without saving the changes.

S	E	T		P	O	I	N	T		0	2	5	.	0	C
F	L	O	W		R	A	T	E					2	5	0

Using the right (or left) arrow keypad will scroll through the other setup parameters. The user is prompted to save changes or leave settings unchanged.

5.7.9 PID Settings

This menu allows the user to change the scale factors K for the following PID equation:

Control output=$K_p * e_{pv} + K_i * \sum e_{pv} + K_d * (e_{pv} - e_{pv-1})$

Where:

K_p = scale factor for proportional and is shown in text as "Heat Proport"

K_i=scale factor for integral term and is shown in text as “Heat Intgral”

K_d =scale factor for derivative term and is shown in text as “Heat Derivat” e_{pv}

$=T_{MEASURED}- T_{SETPOINT}$

$e_{pv\ -1}$ =previous error term

INT RST TIME (IRT) is the interval reset time. This is the summation (in the integral term from the above equation) for n=0 to n=x samples. Where n is the number of samples and x is the desired sample count to be summed. A summation, if taken in small enough increments, will give rise to an integral for t=0 to t= IRT.

Aside from the IRT, the other parameter which can be changed is the gain factor. The heater PID loop is used for the Source Cup heater while in heat mode.

S	E	T		P	I	D		C	O	E	F	F		
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

Pressing the “√” key will bring up the submenu for changing the individual PID parameters. The parameters have 10 bits of resolution. Therefore the range is 0 to 1000 for all parameters.

H	E	A	T		P	R	O	P	O	R	T		1	5	0
H	E	A	T		I	N	T	G	R	A	L		1	5	0

Using the right (or left) arrow keypad will scroll through the other parameters.

H	E	A	T		D	E	R	I	V	A	T		4	0	0
I	N	T		R	S	T		T	I	M	E		1	8	0

The integral reset time is in minutes and the range is from 0 to 999.

C	O	O	L		P	R	O	P	O	R	T		1	0	0

C	O	O	L		I	N	T	G	R	A	L		1	5	0

The same parameters can be modified for the cooling circuit. However, the cooling circuit must have a different control from the heater PID for efficiency.

C	O	O	L		D	E	R	I	V	A	T		4	0	0
M	A	X	.		T	E	C						1	9	0

5.7.10 Relay Manual Control

R	E	L	A	Y		M	A	N	.		C	N	T	R	L
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
L	E	V	E	L		4		R	E	L	A	Y			

First line: Input status. When the relay output is high “1”, the related text will be upper case; when the output is low “0”, the text will be lower case.

Second line: Description of the input. Moving the cursor left or right will change the relay selection to the next input and the second line will display the description of the input.

Moving the cursor to the desired replay output, and pressing “√” key will toggle the relay.

5.8 Alarm Definitions

Table 5.2 Alarm Definitions

This table used for installation, troubleshooting and PM

Alarm	Types	Notes
Temperature alarms	HIGH1, HIGH2, LOW1 & LOW2	Programmable to any temperature within operational range of controller. HIGH1 AND LOW1 provide an independent relay contact outputs. HIGH2 and LOW2 are warnings and show on the LCD as an alarm. “ANY” ALARM will trip for all four.
Chemical Level alarms	Low Chem Alarm	All levels from the quartz level may be assigned to this relay output. Level is below or equal to for low level activation
Heater failure	Source Cup Assembly	Processor driven
TEC Heater failure	Source Cup Assembly	Processor driven
TEC Cooler failure	Source Cup Assembly	Processor driven
Temperature sensor failure	Source Cup Assembly	Processor driven
Probe not installed	Source Cup Assembly	Hardware interlock
Fan Failure	Processor derived	The nominal speed for the fan is 80Hz. This alarm will trip if the frequency is 20% lower than 80Hz
Remote stop	Digital input	Hardware interlock
Cable interlock	Digital input	Insures internal cables are connected
Tool Not Ready	Digital input	Remote enable from tool
RTD Shorted	Processor derived	Processor driven interlock. Temp. reading will read below 5°C
RTD Open	Processor derived	Processor driven. Temp. reading will be >199.9°C
Ambient T Fail	Source Cup Assembly	The alarm will trip if the internal Source

		Cup Assemblies ambient temperature reaches 40°C.
No Communication	Source Cup Assembly	An issue or lack of communication between the microprocessors of the Source Cup Assembly and Power Supply Module. This alarm always occurs before the *Bad Communication* alarm
Bad Communication	Source Cup Assembly	Faulty Interconnect Cable causes the communication issue
Ultrasonic Failure	Source Cup Assembly	Model VG600 output level occurrence with a connected faulty Ultrasonic Level Sense Probe
Ultrasonic Interlocked	Source Cup Assembly	Model VG600 communication error from a non-connected Ultrasonic Level Sense Probe
Level No Connect	Source Cup Assembly	Model VG600 alarm text, which appears on both USIL (Ultrasonic Interlocked) and USFL (Ultrasonic Failure) level alarm readings, occurs if the level sense circuitry is not sensing the Ultrasonic Level Sense Probe.

5.9 *Thermal Cutout Configuration*

The system was designed with a thermal cut out circuit that is pre-set at the factory for different types of chemicals used in the various VaporGuard® models. The PCA in the Source Cup Assembly has a 4-bit dip switch that is configured for 4 different thermal cutouts and enable/disable probe interlock feature.

WARNING

The user is strongly cautioned against changing the positions of the switches for the thermal cut out unless they have prior authorization from an Versum Materials, Inc. representative.

The temperature probe contains an independent thermal sensor that will cut the high power to the heater/TEC circuit should the controller malfunction. The following table defines the temperature cutouts and the maximum set point value for the various dip switch configurations used by the different models. The circuit is accurate to 0.5ºC and has a hysteresis of 0.1ºC.

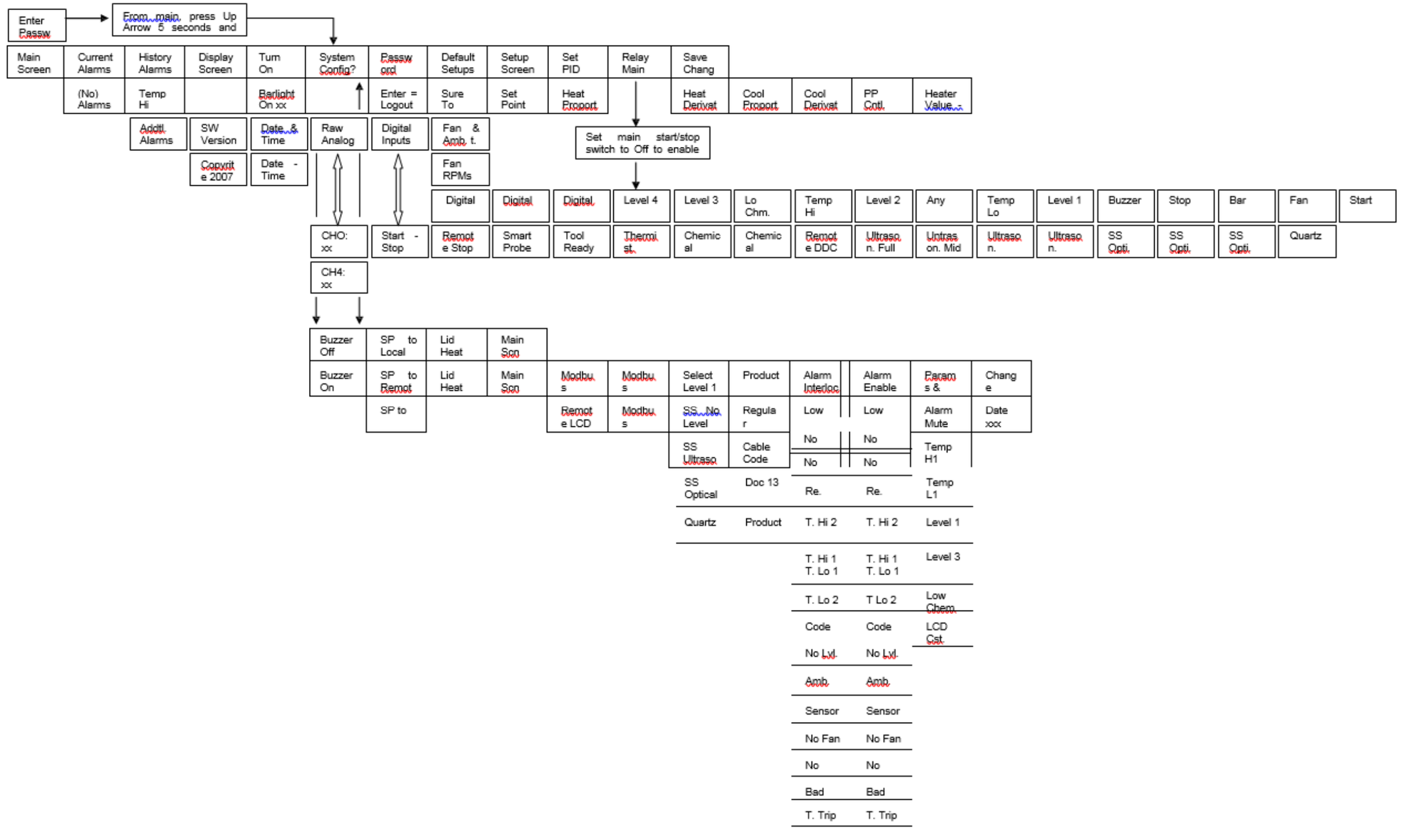
The processor monitors the dip switch settings and adjusts the maximum set point value accordingly.

Table 5.3 Thermal Cutout Switch Configuration

Dip Switch Configuration	Thermal Cutout Value	Max. Set Point Setting	Model
1	28ºC	22ºC	VG300
2	70ºC	60ºC	VG600
3	120ºC	115ºC	VG600 HT

The last bit of the switch is for the temperature probe hardware interlock. This is set to the ON position by default. This will enable the “Probe Not Installed” hardware interlock alarm circuitry.

Figure 5-10 VaporGuard® Menu Screen Architecture



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Chapter 6

System Installation

6.1 *Introduction*

This section provides instructions for installation of the VaporGuard® System. Read the entire section before proceeding with the installation.

6.2 *Placement of the System*

Figure 6-1 shows the space requirements necessary for the complete system and the integral components. Also shown are the dimensions for securing the system onto a shelf. The recommended placement height for the Source Cup Assembly is between 35” (88.9 cm) and 50” (127 cm) above the floor. This will allow for viewing of the LCD display and access to the top of the Source Cup Assembly. The placement height for the optional Remote Display Module is between 52” (132 cm) and 58” (147 cm) above the floor. The placement of the LCD displays should allow for a viewing distance that is between 18 inches (45.7 cm) and 30 inches (76.2 cm).

CAUTION

The VaporGuard® should be securely bolted to a shelf to provide protection during a seismic disturbance.

NOTE: Failure of the Bubbler's connections or breakage of the bubbler can result in chemical spillage outside the VaporGuard®. To minimize personnel exposure, recommend installing the VaporGuard® within an enclosure which provides secondary containment.

The secondary containment space should be equipped with a spill sensor and associated output that would alarm at the tool. The secondary containment should be able to hold 110% of the amount of chemical in the bubbler. Mount secondary container so it can easily be removed in the event of a spill to minimize chemical exposure to personnel.

NOTE: The user must consider appropriate ventilation for the specific application.

Figure 6-1 Source Cup Seismic Mounting Holes Dimensions, inches [mm]

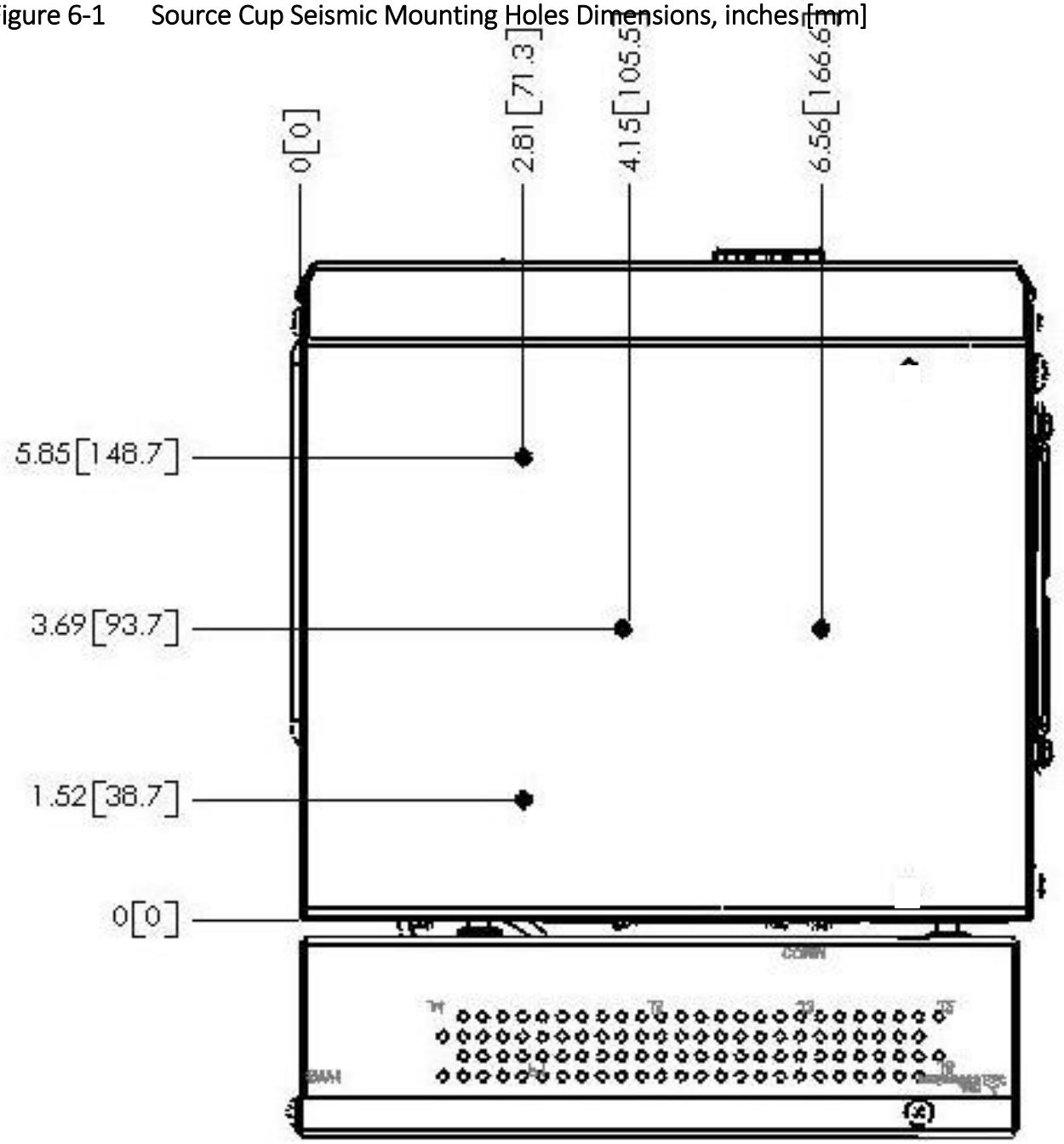
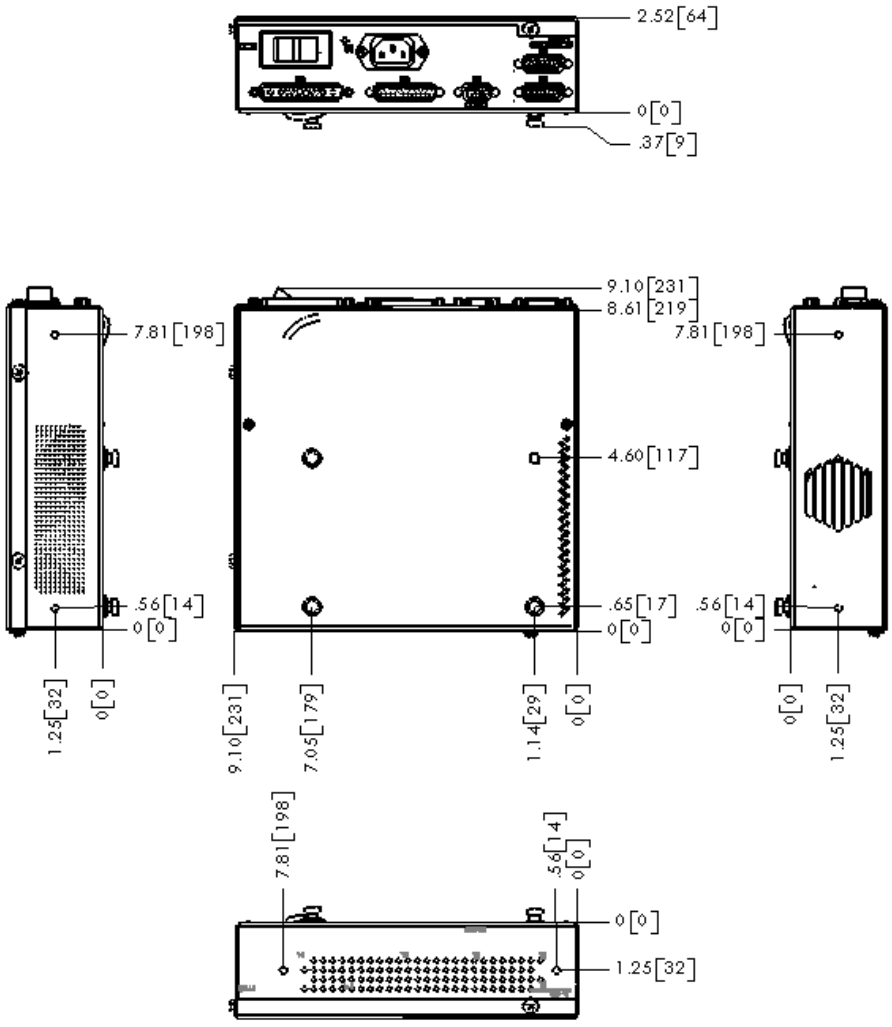


Figure 6-2 Power Supply Seismic Mounting Holes Dimensions, inches [mm]



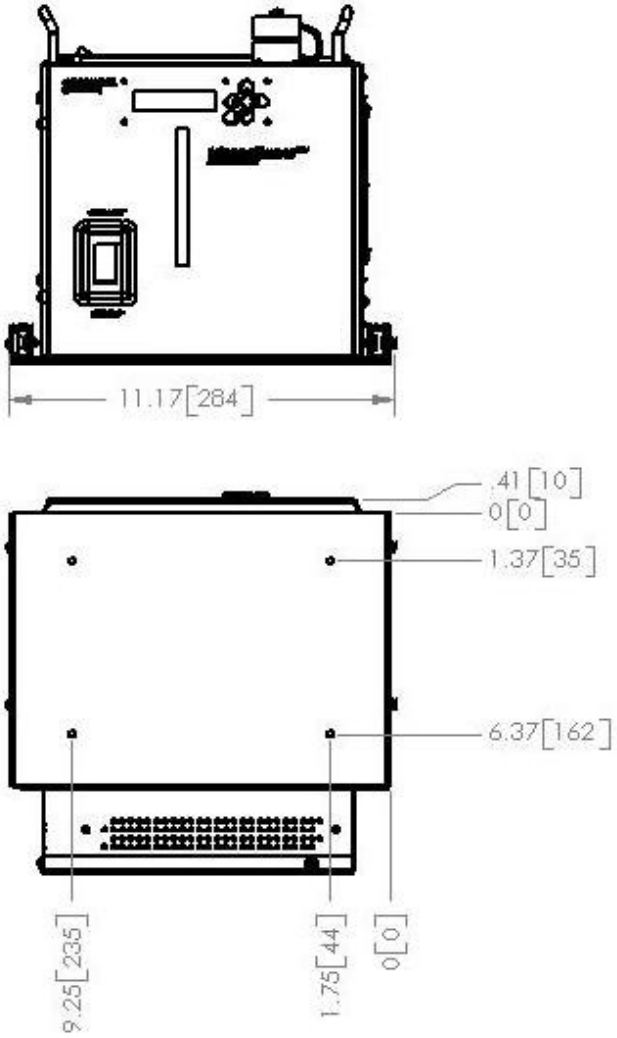
The above figures 6-1 and 6-2 provide the dimensions for seismic mounting for both the Power Supply Module and the Source Cup Assembly. The recommended installation side is the view on the right in figure 6-2 above. Mounting holes were added to two other sides (short sides) to allow for varying installation requirements, however the surface is not flush due to the lid.

There are no provisions for mounting the unit with the cover facing up or down. The

PEM® fasteners are for 6-32 screws. The screw should not penetrate more than ¼" (0.634 cm) into assembly. Increase length of screw to account for varying shelf thickness.

NOTE: If the unit is being mounted with a bracket, insure that the vent holes are not completely covered. This may cause the Power Supply Module to overheat.

Figure 6-3 Mounting Holes Dimensions, inches [mm]



Once installed, the user may pull the Source Cup Assembly by the handles on the top of the Source Cup Assembly. The PEM®'s are for 6-32 screws. The top shelf (not shown) has the same mounting pattern as figure 6.1 above. The screw should not penetrate more than ¼" (0.634 cm) into the assembly.

NOTE: The purpose of the handles are for pulling or pushing the Source Cup Assembly once its shelf mounted. They're not intended for carrying the Source Cup Assembly with a filled source container.

If the VaporGuard® is mounted in an enclosure or cabinet, allow for a minimum space requirement of 24” above the Source Cup Assembly for connection of cables, gas lines, and for replacement of the container. Also, allow spacing (approx. 6” x 6”) for hand access to the control panel side of the unit. Figures 6-4 and 6-5 show the approximate height of the inlet and outlet valves when the Versum Materials, Inc. quartz bubbler and S.S. container is used.

Figure 6-4 Space Requirements, with Quartz Bubbler, inches [mm]

Figure 6-5 Space Requirements, Stainless Steel Source Container, inches [mm]

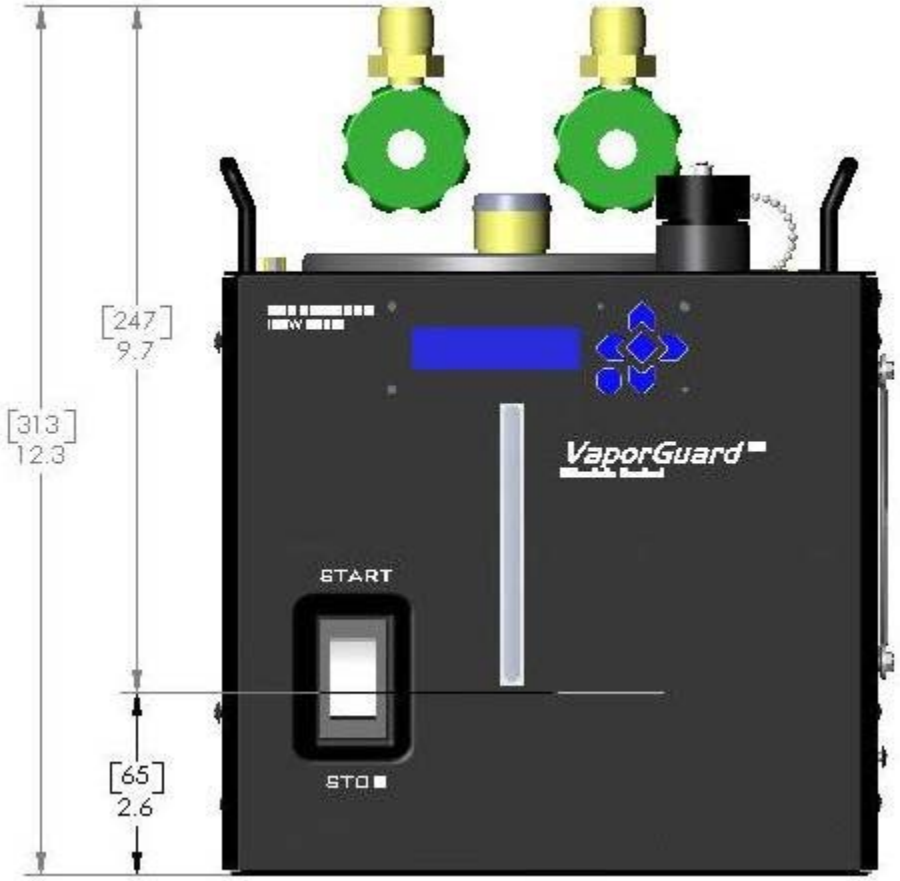


Figure 6-6 Source Cup Assembly, wide version, inches [mm]

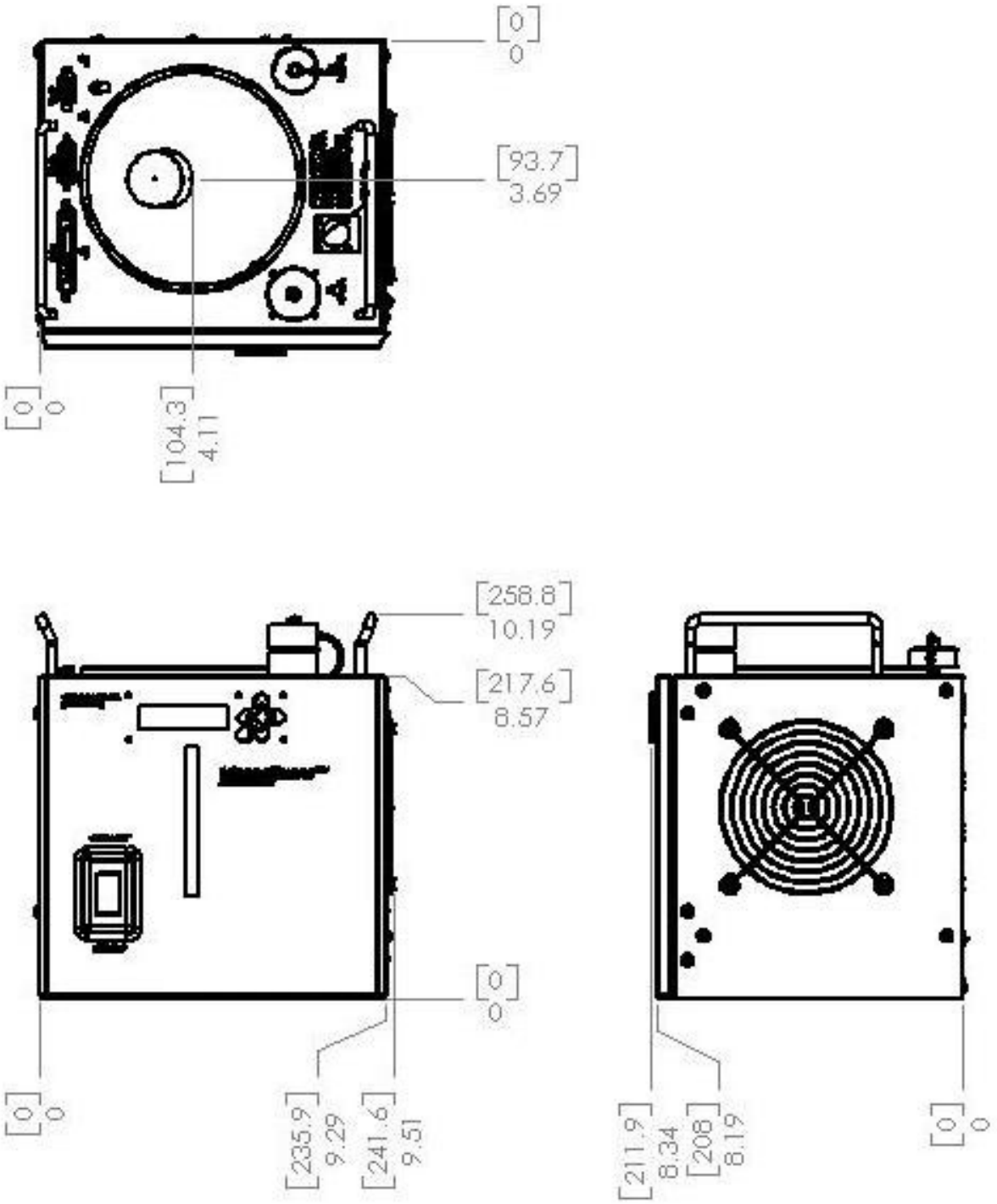


Figure 6-7 Source Cup Assembly, narrow version, inches [mm]

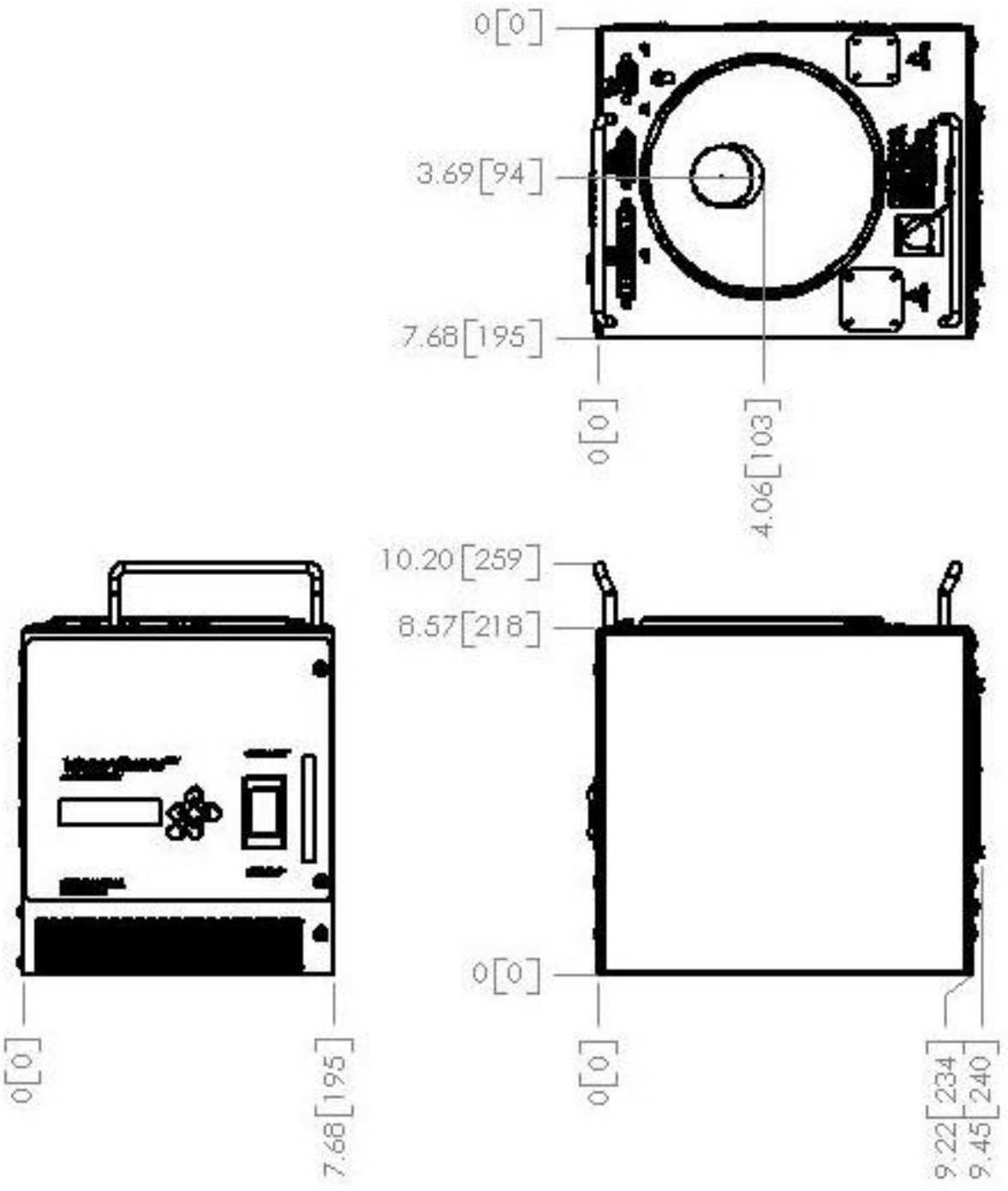


Figure 6-8 Power Supply Module, inches [mm]

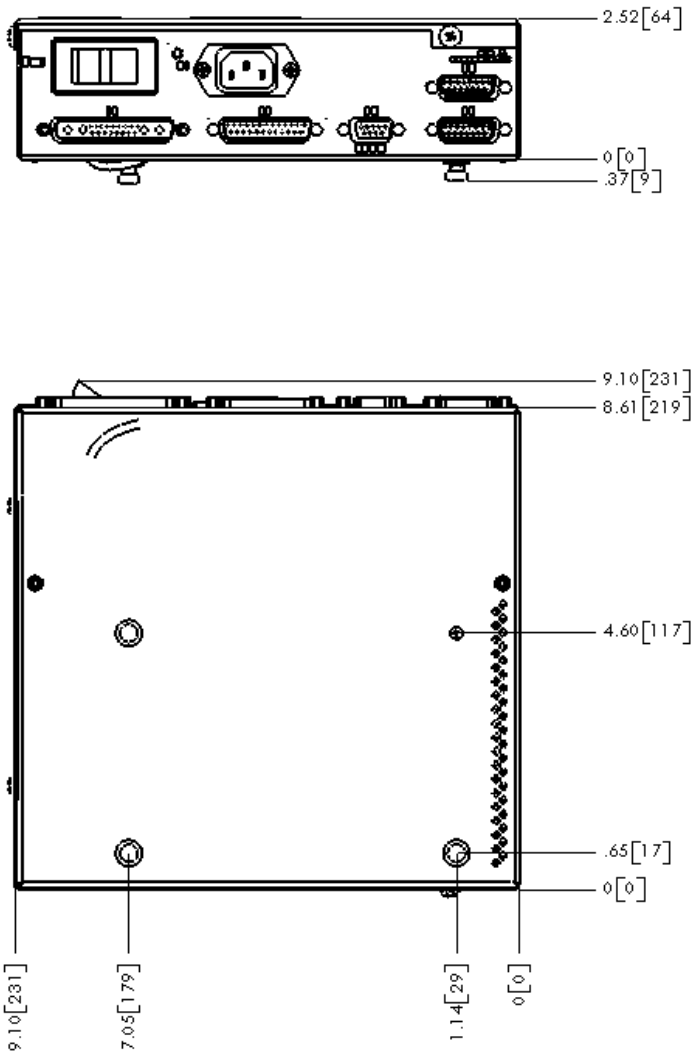
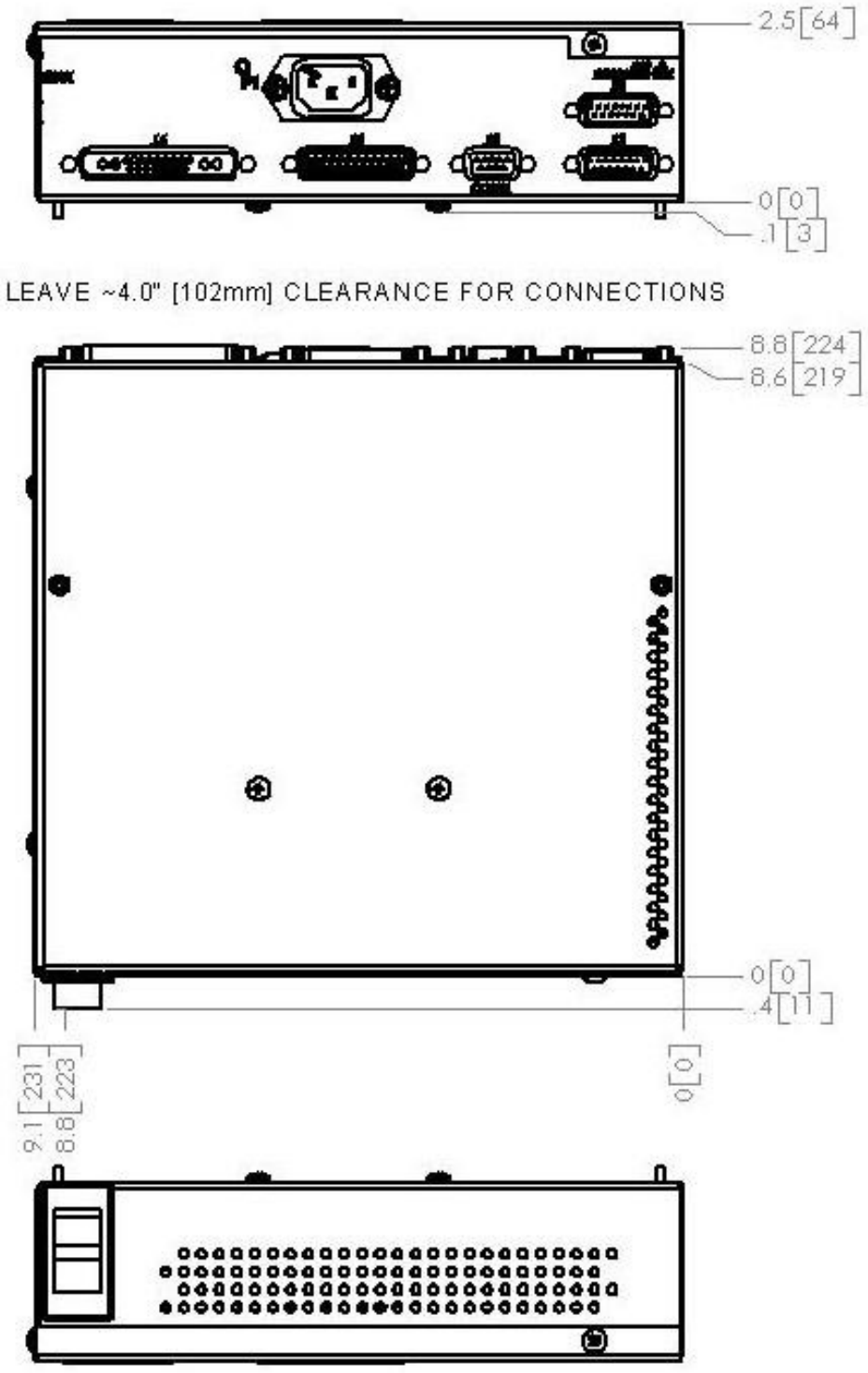
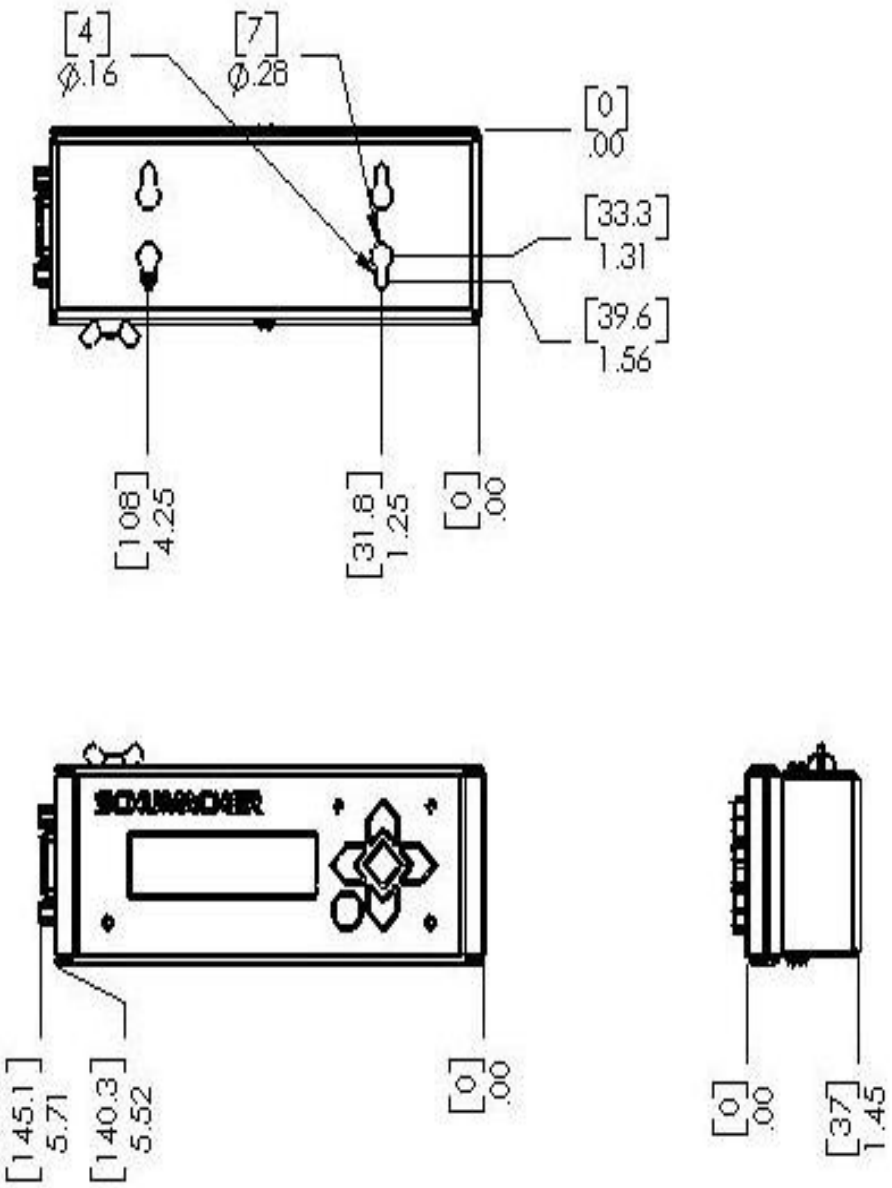


Figure 6-9 Power Supply Module, 300watt, inches [mm]



m

Figure 6-10 Remote Display Module, inches [mm]



6.3 *Installation*

6.3.1 Electrical Requirements

The VaporGuard® utilizes a built-in type switching power supply sub-assembly, which is internal to the Power Supply Module that can accept 100 to 240VAC @ 50-60Hz. The Power Supply Module is designed with a circuit breaker (5 Amp rating) and the built-in power supply sub-assembly has a crowbar output that will prevent the internal fuses from blowing. The electrical circuit into which the VaporGuard® is connected should be designed for EMO shutdown with a minimum interrupting capacity of 5000 rms symmetrical amps. The EMO device should be accessible to the operators, marked as the disconnecting device for the VaporGuard®, and must have the on/off position clearly marked for the operator.

WARNING

WARNING: AC power must be provided as required by applicable codes and standards. Where local laws allow AC LINE and AC NEUTRAL to be connected in either polarity, Versum Materials, Inc. recommends installing a GROUND FAULT CIRCUIT INTERRUPT (GFCI) protection.

WARNUNG: Die Wechselstromversorgung muß den jeweiligen Vorschriften und Normen entsprechen. Soweit lokale Vorschriften das Zusammenführen von wechselstromführenden und Neutralleitern in beiden Polaritäten zulassen, empfiehlt die Fa. Versum Materials, Inc. die Installation eines Sicherheitserdungsschalters.

6.3.2 Grounding Requirements

The VaporGuard® chassis must be grounded to protect against hazardous energies. Use ½" flat ground braid attached from the grounding stud on the Source Cup Assembly to the facility ground. Total length should not exceed 3 meters (10 feet). If a S.S. container is being used, a ½" flat ground braid should be attached from the S.S. container to the grounding stud on the Source Cup Assembly. Length should not exceed 15cm (6 inches).

6.3.3 Environmental Requirements

The VaporGuard® is designed to operate in an ambient temperature of 15°C to 35°C with humidity at 0-85% non-condensing. The temperature control specification cannot be maintained beyond this range. Furthermore, the LCD will not operate properly below 5°C and above 60°C.

6.3.4 Lighting Requirements

Install VaporGuard® in an area where the lighting allows for reading of the safety labels and to perform maintenance.

6.3.5 EMI/RFI Protection

An Amphenol brand EMI filter is included with each CE marked VaporGuard®. This filter will help eliminate RF interference when plugged into connector J3 on the Source Cup Assembly. Remove this filter when J3 is used to load new software. A ferrite core is also included with the CE marked models. The ferrite is placed on the temperature probe near the connector end for additional RFI shielding.

6.3.6 Thermowell Oil

A 1 oz. bottle of Thermowell Oil, **PN 1600-0001** (A.K.A. white mineral oil) and SDS is included with each new VaporGuard®. Prior to operating the unit, approximately 8 to 10 drops of mineral oil must be added to the source containers' thermowell. This number of drops equates to an oil level of approximately ½ inch without the temperature probe installed. This oil level must be maintained throughout the operational use of the unit.

The oil level can be checked by pulling out the temperature probe from the thermowell and then visually inspecting the probe end for the presence of oil. No oil will need to be added, if at least the first ½ inch of the probe tip is covered with oil. Oil will need to be added, if the first ½ inch of the probe tip is not covered with oil. Add 2 drops of oil to the thermowell and recheck the oil level. Continue to perform this until the first ½ inch of the

probe tip is covered with oil. Then reinstall the temperature probe into the thermowell.

Note: perform this check with the unit powered down. Also, the oil does not need to be replaced unless it has been contaminated with a chemical.

6.3.7 VaporGuard® Fan Clearance

It is recommended that there be at least 6 inches of clearance for the fan inlet and outlet from a wall. The system will work with a wall that is only one inch from its inlet or outlet sides, however, with reduced performance. If 6 inches is unattainable, the customer should select a location that gives the VaporGuard® the most clearance.

6.3.8 Cables

CAUTION

CAUTION: Use of a cable with an incorrect part number could create a hazardous condition.

Care must be exercised that the system is not connected to a source of power other than that indicated on the Rear Panel Label.

VORSICHT: Die Benutzung eines Kabels mit falscher Teilenummer kann zu einer Gefahrensituation führen.

Es ist zu beachten, daß das System nur an die Stromquelle angeschlossen werden darf, die auf dem Schild an der Geräterückwand angegeben ist.

ATTENTION: L'utilisation d'un câble dont le numéro de pièce est incorrect peut entraîner une condition dangereuse.

Prenez soin de vérifier que le système ne soit pas raccordé à une alimentation électrique autre que celle indiquée sur l'étiquette de panneau arrière

The VaporGuard® is designed to be placed on a level, stable surface. Versum Materials, Inc. recommends all electrical connections be made before securing system to a shelf.

Cables furnished with each system are:

- The 3 meter (10 foot) Interconnect Cable connects the Source Cup Assembly to the Power Supply Module. See Spare Part List in chapter 7.
- Optional 3 meter (10 foot) and 5 meter (16 foot) Interconnect, Split cable, sold separately. See Spare Part List in chapter 7.
- Temperature Probe assembly connects to the top of the Source Cup Assembly. There is only one probe design used for all VaporGuard® models.
- The 7.6 meter (25 foot) DDC Cable connects the output signals to the furnace data lines.
- Power Cable for 100-120 VAC provided.

6.3.9 Cable Installation Procedure

Insure SW1 is in the “OFF” position on the Power Supply Module and then connect the cables in the order given below. Note, installing the J5 connector with the Power Supply Module on, could result in a hazardous condition.

1. Attach the Temperature Probe to J7 on Source Cup Assembly.
2. Install the Interconnect Cable to J9 on Source Cup Assembly and to J4 on Power Supply Module.
3. Connect DDC Cable to J5 on Power Supply Module.

4. Connect the Power Cable to P1 on Power Supply Module and to the power source receptacle.

5. Insure that all connections are secured with the connection mounting hardware.

6.4 Tool Interface Connection

For tables 6-1 thru 6-7, reference System Schematic in Chapter 6. Reference designator A2 is identified as the PCA for the Source Cup Assembly and A1 is for the Power Supply Module PCA. Connector references without the A1 or A2 designation are not part of the PCAs. They are part of the interconnecting cables that attach from the external panel mount connector to the PCAs. The A1 and A2 reference designators are only for clarification in these tables. All references to connections elsewhere use the "J#" designator alone.

The measurements on the J4 connector, in figure 6-11, are for reference and can be used for routing the Interconnect cable for remote installations of the Power Supply Module.

The cable may require larger routing paths to allow for the large rectangular connector P4. Optional Interconnect, Split cables are available for these applications, and is sold separately, refer to figure 6-12 and the Spare Parts List in chapter 7.

Figure 6-11 Model 600 Power Supply Module Connecter Designations

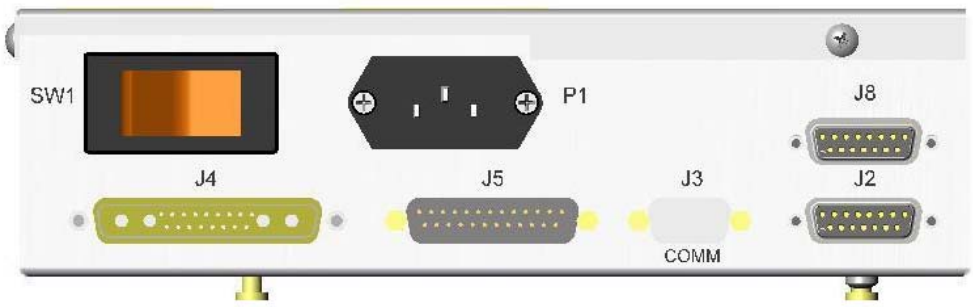


Figure 6-12 Optional Interconnect Split Cable, PN 184466

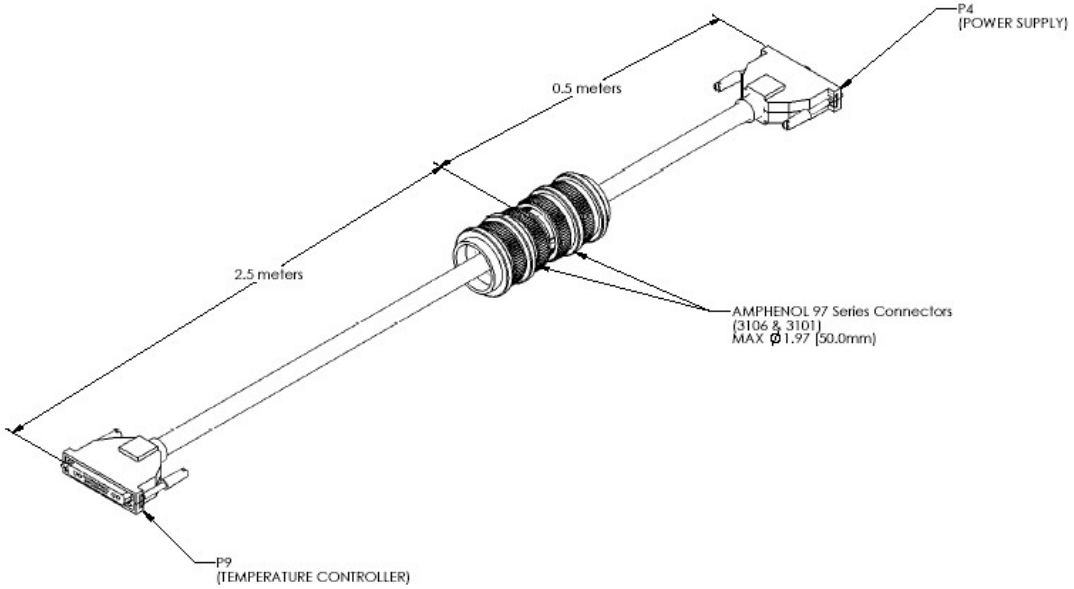


Table 6-1 Power / Signal Interconnect Interface

A1&A2 J4 Power/Signal Interconnect **Cable connector dimensions: 2.9x0.9” (7.4x2.3cm)**		
Pin #	***Signal name***	***Signal definition***
A1	TEC Power-	Cooling power-
A2	TEC Power +	Cooling power +
A3	Heater Ground	Heater power return
A4	Heater Voltage	Heater power +
1	+24V system power input	Power for electronics
10	Signal ground	24V return
2	RS485 OUT1	Comm link output
11	RS485 OUT2	Comm link output
3	+24VDC switched	Auxiliary power
12	Safety Interlock Signal	Req’d to control Temp
4	RS485 IN1	Comm link input
13	RS485 IN2	Comm link input
5	GNDD	Signal ground
14	+5VDC	Microprocessor power
6	No connection	No connection
15	Cable interlock to pin 7	Shorted to pin 15
7	Cable interlock to pin 15	Shorted to pin 7
16	JTAG PORT1	Comm port pin
8	JTAG PORT2	Comm port pin
17	JTAG PORT3	Comm port pin
9	JTAG PORT4	Comm port pin

Table 6-2 Remote Display / Communication Interface

Remote Display/Communication Port A1J3		
Pin#	***Signal name***	***Remote Display pin #***
1	+5VDC	1
2	Signal ground	2
3	No connection	3
4	Tx	4
5	Signal ground	5
6	Signal ground	6
7	+12VDC	7
8	Rx	8
9	No connection	9

Table 6-3 Software Programmable Input

Software Programmable Input A1J2		
Pin #	***Signal name***	***Signal definition***
1	Program input	Analog input 1
2	GNDA	Analog ground
3	-15VDC	- Analog power supply
4	GNDA	Analog ground
5	GNDD	Digital signal ground
6	+5VDC	Processor power
7	PDI	Downloading port pin
8	GNDD	Digital signal ground
9	GNDA	Analog ground
10	+15VDC	+Analog power supply
11	GNDA	Analog ground
12	Pneumatic low	Digital input
13	MISO_C	SPI Serial Out buffered
14	SCLK	SPI clock pin
15	RESET bar	Processor reset pin (inverted logic)

*Currently J8, (MFC feature) is not implemented into the VaporGuard® design

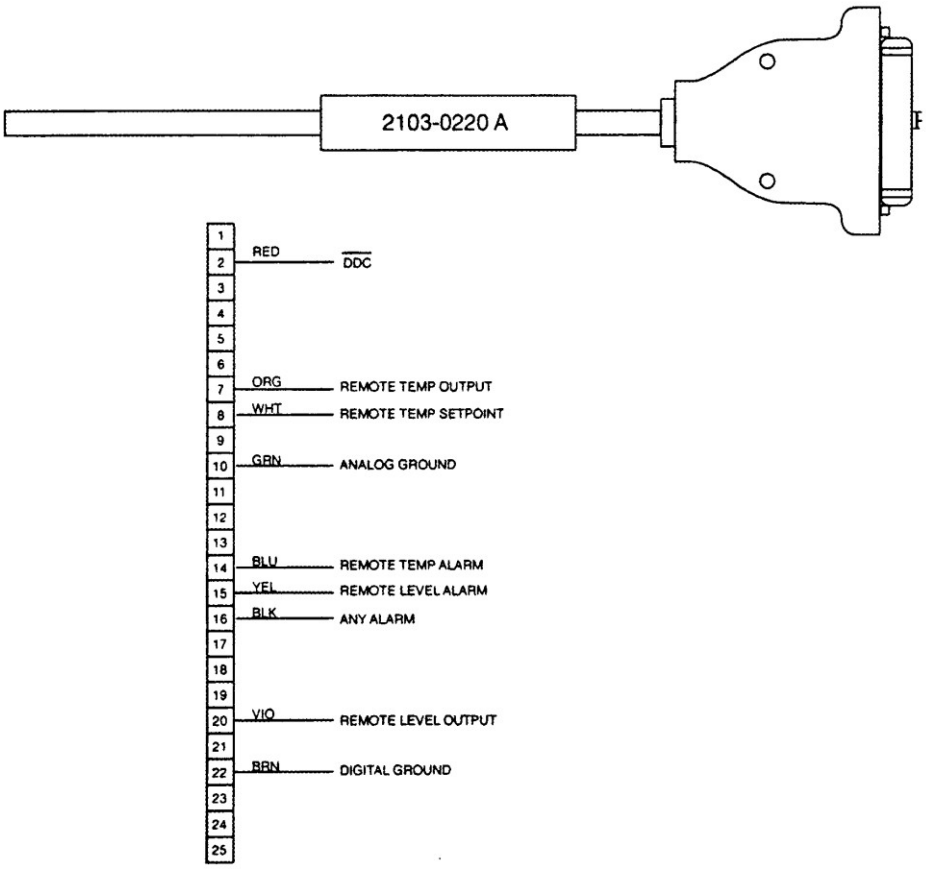
CAUTION

Not installing this cable prior to powering the unit could result in a hazardous condition as the VaporGuard® alarms the tool through this interface.

The VaporGuard® provides a jumper to remove (or add) the 5VDC output. If the application requires an open collector output, the 5V pull-up adds no value and can be eliminated. If the user requires the 5VDC output, contact the Versum Materials, Inc. representative so that this setting can be implemented as a factory setting for your application.

Refer to Table 6-8 for detailed signal descriptions of the DDC port. Signals designated with an asterisk * are downward compatible with the legacy ATCS15 temp controller.

Figure 6-13 ATCS15 DDC Interface Shielded Cable Assembly and pin out



6.4.2 Description of VaporGuard® Alarms

PIN 14: REMOTE TEMPERATURE HIGH 1/LOW 1 ALARM -This output provides a signal if the temperature exceeds the set point by the specified number in the set up screen (in °C) for Temp High 1 and Temp Low 1. This output is high (+5 VDC) when no alarm condition exists and goes low (< 1.0 VDC) when an alarm occurs.

***PIN 15: LOW CHEMICAL LEVEL ALARM -** This output provides a signal when the level of chemical in the Bubbler reaches the Low Level setpoint, selected in the set up screen. This output is high (+5 VDC) when no alarm condition exists and goes low (<1.0 VDC) when an alarm occurs.

***PIN 16: ANY ALARM -**This output provides a signal if either the temperature is exceeded from set point or the level of chemical reaches less than percent value entered in the set up screen OR ANY OTHER ALARM hence the name ANY ALARM. This output is high (+5.0 VDC) when no alarm condition exists and goes low (<1.0 VDC) when an alarm occurs.

The TEMP, LEVEL and ANY alarms can be configured to be low (<1.0 VDC) when no alarm condition exists and goes high (+5 VDC) when an alarm occurs by connecting J5-2 to ground (J5-22 is digital ground).

***PIN 7: REMOTE TEMPERATURE OUTPUT -**This 0-5 VDC output provides an analog output with linear correspondence to a Bubbler temperature displayed on the front panel of the Source Cup Assembly, (0-5 VDC equals 0°C - 110 °C).

***PIN 20: REMOTE LEVEL OUTPUT -**This 0-5 VDC output provides an analog output in decreasing steps corresponding to the front panel level indication, (0-5 VDC equals 0 -100%).

***PIN 8: REMOTE TEMPERATURE SETPOINT -**This input can be used to remotely control the temperature set point of the Source Cup Assembly from a computer or DDC, (0-5 VDC equals 0°C - 110 °C).

***PIN 2: DDC -** Grounding this input results in an inversion of the TEMP, LEVEL, and ANY alarm outputs.

***PIN 22: DIGITAL GROUND -**This is the digital ground for the alarm outputs.

***PIN 10: ANALOG GROUND -**This is the signal ground for the analog input and outputs.

PIN 23: +7VDC OUTPUT -This 7VDC output is provided as a utility output.

PIN 13: REMOTE STOP -This digital input functions like a remote emergency off (EMO) signal. When interfaced to a process tool, the tool can remotely disable the VaporGuard® and turn off the Source Cup Assemblies heating and cooling functions.

PIN 19: TOOL READY -Not used. This digital input is provided as future input for use with the Chemical Refill system.

PIN 1 & 14: ISOLATED REMOTE TEMPERATURE HIGH 1/LOW 1 ALARM -This output provides an open or closed contact if the temperature exceeds the set point by the specified number in the set up screen (in °C) for Temp High 1 and Temp Low 1. The contact is closed when no alarm condition exists and will open when Temp High 1 or Temp Low 1 alarm occurs.

PIN 3 & 15: ISOLATED LOW CHEMICAL LEVEL ALARM -This output provides an open or closed contact if the level of chemical in the Bubbler reaches the Low Level set-point, selected in the set up screen. The contact is closed when chemical in

Bubbler is above the Low Level set-point and will open when chemical reaches the Low Level set-point and Low Chemical Level alarm is activated.

PIN 4 & 16: ISOLATED ANY ALARM -This output provides an open or closed contact if any alarm is activated on the VaporGuard®. The contact is closed when no alarm condition exists and will open when any alarm occurs.

PIN 11 & 24: LEVEL #4 ALARM (Relay K7) **-**This output provides an open or closed contact if the level of chemical in the Bubbler goes below Level #4 set-point, selected in the set up screen. The contact is closed when chemical in the Bubbler is above Level #4 set-point and will open when chemical goes below Level #4 set-point.

PIN 12 & 25: LEVEL #3 ALARM (Relay K8) **-**This output provides an open or closed contact if the level of chemical in the Bubbler goes below Level #3 set-point, selected in the set up screen. The contact is closed when chemical in the Bubbler is above Level #3 set-point and will open when chemical goes below Level #3 set-point.

PIN 17 & 5: LEVEL #2 ALARM (Relay K3) **-**This output provides an open or closed contact if the level of chemical in the Bubbler goes below Level #2 set-point, selected in the set up screen. The contact is closed when chemical in the Bubbler is above Level #2 set-point and will open when chemical goes below Level #2 set-point.

PIN 18 & 6: LEVEL #1 ALARM (Relay K4) **-**This output provides an open or closed contact if the level of chemical in the Bubbler goes below Level #1 set-point, selected in the set up screen. The contact is closed when chemical in the Bubbler is above Level #1 set-point and will open when chemical goes below Level #1 set-point.

PIN 9 & 21: ISOLATED REMOTE TEMPERATURE HIGH 2/LOW 2 ALARM -This

output provides an open or closed contact if the temperature exceeds the set point by the specified number in the set up screen (in °C) for Temp High 2 and Temp Low 2. The contact is closed when no alarm condition exists and will open when Temp High 1 or Temp Low 1 alarm occurs.

6.4.3 Digital Inputs

The following display screen is accessible from the main menu. It can be used to trouble shoot the interface connections by monitoring digital inputs from the tool and by forcing relays on or off to the tool for interface verification.

D	I	G	I	T	A	L		I	N	P	U	T	S		
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

Pressing the green "√" key will produce the following screen.

Pressing the X returns to the previous menu.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
S	T	A	R	T	/	S	T	O	P						

First line: Input status. When the input is high "1", the related text will be upper case; when the input is low "0", the text will be lower case.

Second line: The description of the input. Move the cursor left or right, the second line will display the description of the input the cursor is pointing to. In the example above, pressing the Start/Stop switch will change the "A" from upper case to lower case "a".

6.4.4 Relay Manual Control

R	E	L	A	Y		M	A	N	.		C	N	T	R	L
X	=	E	X	I	T		√	=	E	X	E	C	U	T	E

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
A	N	Y		A	L	A	R	M							

First line: Input status. When the relay output is high “1”, the related text will be upper case; when the output is low “0”, the test will be lower case.

Second line: The description of the input. Move the cursor left or right, the second line will display the description of the cursor pointing input.

Moving the cursor to the desired replay output, and pressing “√” key will toggle the relay. In the example above, the highlighted letter will change from upper case “F” to lower case “f” when the “√” is pressed.

The following is a description for each alphanumeric character.

A - Level #4 Relay

B - Level #3 Relay

C - Low Chem Relay

D - Remote Temp High 1/Low 1 Alarm Relay

E - Level #2 Relay

F - Any Alarm Relay

G - Remote Temp High 2 /Low 2 Alarm Relay

H - Level #1 Relay

I - Buzzer – turns audio On/Off

J - Stop Light – Turns Red segment of Source Cup Assemblies power switch On/Off

K - Bar Light – Turns bar light in Source Cup Assembly On/Off

L - Fan – Turns Source Cup Assemblies Fan Motor On/Off

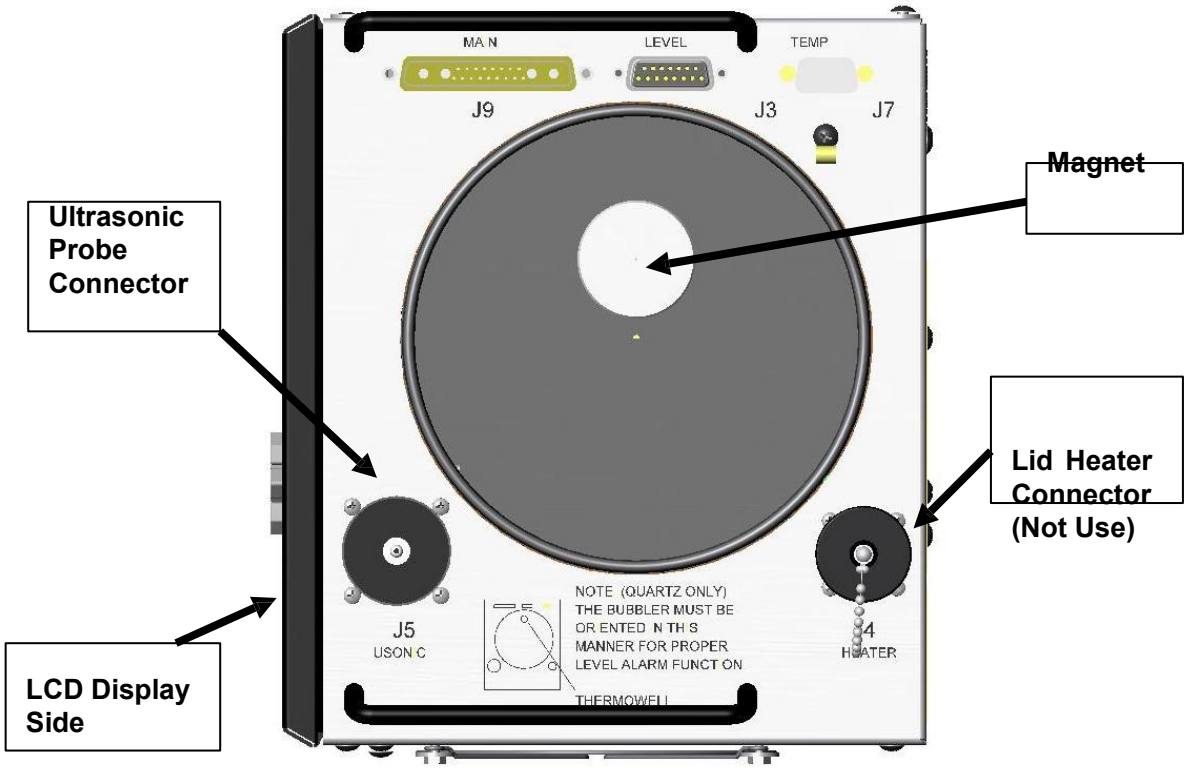
M - Start light – Turns Green segment Source Cup Assemblies power switch On/Off

N - Digital Output 1 – N/A

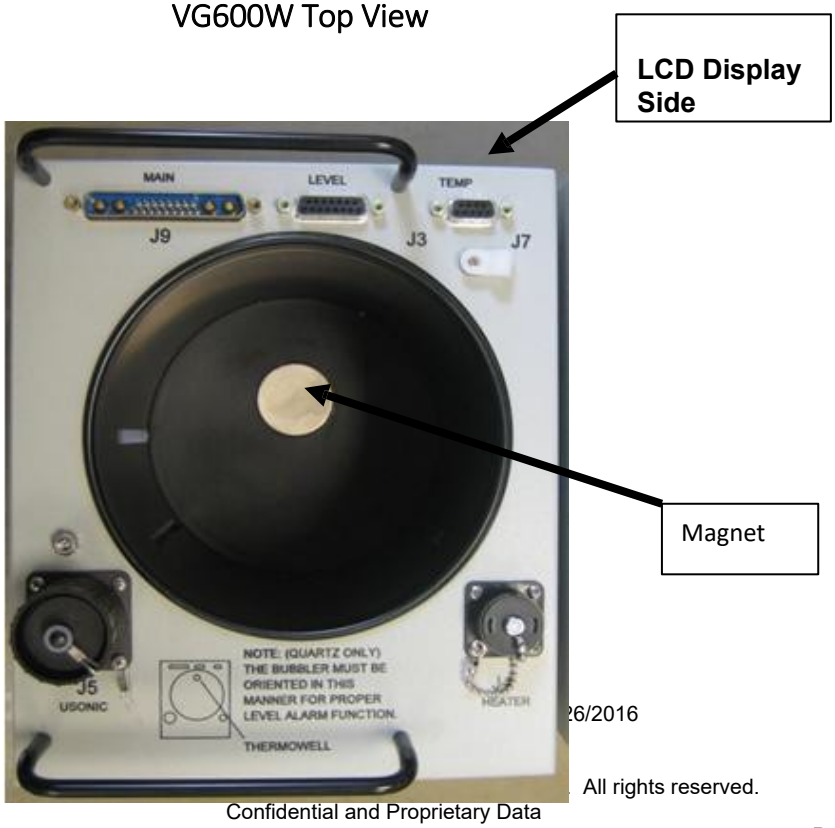
O - Digital Output 2 – N/A

P - Digital Output 3 – N/A

Figure 6-14 Source Cup Assembly Connecter Designations



VG600W Top View



Magne

VG600N Top View

Table 6-5 Temperature Probe Interface

Temperature Probe A2J7 (DB9 female)		
Pin #	***Signal name***	***Description***
1	Smart_Probe_In	Interlock for proximity sensor input
2	GNDD	Signal ground
3	+2.8V	2.8 volt power supply for proximity sensor
4	No connection	N/C
5	Cable sense	Processor port pin
6	RTD_Bub_In+	RTD Feedback input for sensing circuit
7	RTD_Bub_In-	RTD Feedback output for sensing circuit
8	GNDD	Signal ground
9	Thermistor	Overtemp interlock uses thermistor to detect temp

Table 6-6 Ultrasonic Level Interface

Ultrasonic Level J5* (CPC)		
Pin #	***Signal name***	***Description***
1	+24	Supply power for Ultrasonic Probe
2	No connection	No connection
3	GNDD	Signal ground
4	Control	Relay control logic configuration setting
5	Empty	Relay contact input for Empty level Chem level in container below sensor displays 5%, above sensor displays 15% on display.
6	Low	Relay contact input for Low level Chem level in container below sensor displays 15%, above sensor displays 65% on display,
7	Mid	Relay contact input for Mid level Chem level in container below sensor displays 65%, above sensor displays 85% on display,
8	Full	Relay contact input for Full level Chem level in container below sensor displays 85%, above sensor displays 100% on display,
9	+24	Supply power for Ultrasonic Probe
10	Empty_C	Relay contact input common for Empty level
11	Low_C	Relay contact input common for Low level
12	Mid_C	Relay contact input common for Mid level
13	Full_C	Relay contact input common for Full level
14	No connection	No connection
15	Chassis gnd	Earth ground

*Used only in VG600 for SS applications

Software Programmable Input J3* (DB15 female)		
Pin #	***Signal name***	***Description***
1	Level Low	Digital output for lowest level optical probe
2	+5V	Supply power
3	+5V	Supply power
4	Current_CNTL1	Current output drive circuit for IR LED lo level
5	Cable Conn	Interlock to insure cable is installed
6	+5V	Power supply (Programming)
7	MOSI	SPI serial input (Programming)
8	GNDD	Signal ground (Programming)
9	Level Hi	Digital output for highest level optical probe
10	+5V	Supply power
11	+5V	Supply power
12	Current_CNTL2	Current output drive circuit for IR LED hi level
13	MISO_C	Buffered SPI serial output (Programming)
14	SLK	SPI system clock (Programming)
15	RESET bar	Microprocessor reset pin (inverse logic)

Used for system programming, refer to section 6.7

NOTE: There are two female DB15 connectors in this design. The level sense cable P3 must never be installed on the Power Supply Modules J2. Likewise the cable P2 of the Power Supply Module must never be installed into the J3 of the Source Cup Assembly. Damage to the internal electronics in either condition may result.

6.5 *AC Power Connections*

Use caution, as there is live AC power present inside the Power Supply Module enclosure. There are no serviceable parts located inside the Power Supply Module enclosure. If the VaporGuard® should need repair, contact your local Versum Materials, Inc. representative for a replacement unit. Refer to your facilities safe work practices before working with live AC.

The circuit into which the VaporGuard® is connected should be designed for EMO shutdown.

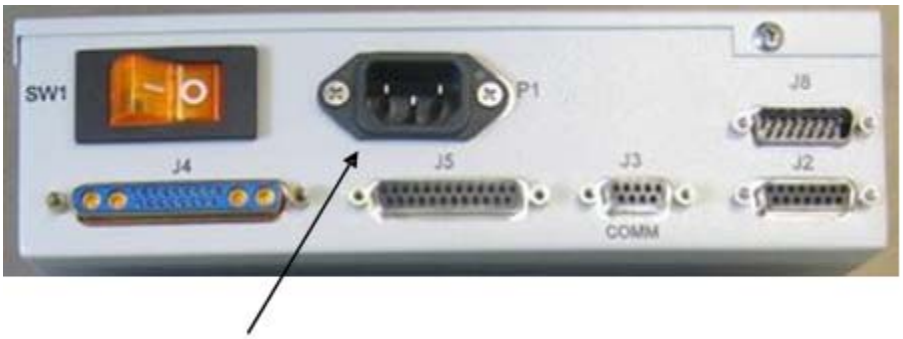
6.5.1 De-Energizing Procedure

The user should remove the power by turning off the switch SW1 on the Power Supply Module. The power cord can be removed from the Power Supply Module or the AC source at the tool must be turned off.

The tool should provide means to perform site specific lockout/tagout procedures for AC power removal. It is a SEMI S2 requirement that the provided lockout device be lockable in the OFF position only. The lockout/tagout isolation must also be in a readily accessible location.

The removal of AC power to the internal switching power supply sub-assembly will allow both the Power Supply Module and the Source Cup Assembly circuits to deplete any power stored. There are no other requirements to relieve stored energy sources. The unit is safe to remove connections.

Figure 6-15 Model 600 Power Supply Module AC Power Connection



AC Power Supply Connection P1

WARNING: AC power must be provided as required by applicable codes and standards. Where local laws allow AC LINE and AC NEUTRAL to be connected in either polarity, Versum Materials, Inc. recommends installing a GROUND FAULT CIRCUIT INTERRUPT

(GFCI) protection.

WARNUNG: Die

Wechselstromversorgung muß den jeweiligen Vorschriften und Normen

entsprechen. Soweit lokale Vorschriften das Zusammenführen von wechselstromführenden und Neutralleitern in beiden Polaritäten zulassen, empfiehlt die Fa. Versum Materials, Inc. die Installation eines Sicherheitserdungsschalters.

AVERTISSEMENT: Le

courant alternatif doit conformer aux codes et normes électriques établis.

Au cas où les codes locaux permettent au fil à courant alternatif et au fil neutre d'être connectés dans une polarité choisie, Versum Materials, Inc. recommande l'installation d'une prise de terre de sécurité.

6.6 Bubbler Installation

Installation consists of inserting the Bubbler in the Source Cup Assembly, connecting the input and output lines and immersing the Temperature Probe into the thermowell. Versum Materials, Inc. Bubblers are highly recommended for usage.

Refer to Versum Materials, Inc. Bubbler Installation and Removal Procedures, **PN 9901-0044**, which is provided with every Versum Materials, Inc. Bubbler. This document is intended for the safe installation and removal of the quartz bubblers.

WARNING

The incoming gas pressure to the bubbler must not exceed 204.77 kPa (absolute pressure) [15 psig (gauge pressure)] at any time.

Downstream from the Mass Flow controller (MFC) there is to be a “safety,” relief valve to be activated at 204.77 kPa (absolute pressure) [15 psig (gauge pressure)].

Versum Materials, Inc. Bubblers are rated for a maximum operating pressure of 204.77 kPa (absolute pressure) [15 psig (gauge pressure)]. Installation of the appropriate pressure relief devices is required.

All specified pressure regulation and overpressure protection is the responsibility of end-user. When selecting overpressure protection it must be properly sized based on line size, regulator CV and maximum inlet pressure setting to the regulators.

1. The entire system can be kept intact and the Bubbler installed into the Source Cup Assembly.

2. Do not use adapters to defeat bubbler valve keying. Valves are sized to prevent accidental backward installation of the bubbler.

3. Inspect bubbler carefully. Do not use and contact Versum Materials, Inc. if bubbler is damaged or appears to be leaking.

NOTE: The VaporGuard® should be installed (all electrical connections made and securely bolted to a level shelf) and the main power switch (SW1) on the Power Supply Module turned off prior to installing a bubbler. Care must be taken that the Bubbler is kept in a vertical position.

WARNING: Review your corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should be familiar with the SDS and chemical being used. For precaution, all appropriate safety protection equipment should be worn including: safety goggles, protective face shield, chemical resistant gloves, and chemical resistant apron with long sleeves. Secondary containment and cleanup material should be available in the event of chemical spill or breakage of the chemical container.

WARNUNG: Vor dem Umgang mit Chemikalien die in Ihrem Unternehmen geltenden Sicherheitsbestimmungen und betriebsinternen Sicherheitsverfahren revidieren. Alle mit Chemikalien umgehenden Personen sollten mit den in den - Sicherheitsdatenblättern (SDS) aufgeführten Verfahren über die jeweils verwendete Chemikalie vertraut sein. Aus Sicherheitsgründen sollte entsprechende Schutzausrüstung getragen werden, wie zum Beispiel: Schutzbrille, Gesichtsschutz, chemikalienbeständige Handschuhe und chemikalienbeständiger langärmeliger Kittel.

Ein Zweitbehälter und Reinigungsmittel sollten bereitstehen, falls Chemikalien verschüttet werden oder der Chemikalienbehälter zerbricht.

AVERTISSEMENT: Réexaminer les règles de sécurité instituées à votre entreprise et les procédés de sécurité en force avant la manipulation de tous produits chimiques. Tout utilisateur d'un produit chimique doit être au courant des procédés prescrits dans les feuilles de normes pour matières (SDS) concernant les produits chimiques en usage. A titre de précaution, porter toutes les protections de sécurité y compris: lunettes de sécurité, masque protecteur, gants et tablier à manches longues qui résistent aux produits chimiques. Un récipient secondaire et du matériel de nettoyage doivent être disponibles en cas de renversement des produits chimiques ou du bris du récipient contenant les produits chimiques.

Before installing the Bubbler, fill the thermowell with 1/2 in. of Versum Materials, Inc. Thermowell Oil, **P/N 1600-0001**. Versum Materials, Inc. recommends and supplies thermowell oil. Failure to use proper oil may result in unstable temperature control and possible alarm conditions. A Safety Data Sheet is included with every VaporGuard®.

CAUTION

CAUTION: Use only the oil recommended above in the thermowell. Do not use water or a volatile solvent such as acetone, alcohol, etc. Irreparable damage to the Temperature Probe will result from use of such liquids.

VORSICHT: Nur das oben empfohlene Öl in der Schutzhülse für den Temperaturfühler verwenden. Kein Wasser und keine leicht verdampfbaren Lösungsmittel wie Azeton, Alkohol usw benutzen. Die Verwendung solcher Flüssigkeiten führt zu nicht wieder gutzumachenden Schäden am Temperaturfühler.

ATTENTION: Utilisez uniquement l'huile recommandée ci-dessus dans le puits thermométrique. N'utilisez pas de l'eau ni des solvants volatils tels que l'acétone, l'alcool, etc. L'utilisation de tels liquides entraînera l'endommagement irréparable de la sonde de température.

6.6.1 Installing Bubbler into Source Cup Assembly

NOTE: Failure or breakage of a Bubbler can result in spillage outside the VaporGuard®. Install the VaporGuard® in an enclosure with secondary containment, and leak-detection and alarm. Use the proper PPE for handling the bubbler. Cut gloves are recommended.

WARNING

WARNING: For safe operation the Bubbler should be maintained within its rated pressure range. Due to differences between various types of bubblers the User should consider the need for application specific pressure control and over-pressure relief.

AVERTISSEMENT: Pour

assurer l'opération sans risque le «Bubbler» devrait se

maintenir dans les limites de son taux de pression. A cause des différences entre les plusieurs sortes de

«Bubblers», l'utilisateur devrait considérer le besoin de contrôle de pression spécifique à l'application et de relève de l'excès de pression

WARNUNG: Zum sicheren Betrieb des Bubblers sollte dieser innerhalb seines

Nenn-Druckbereichs gehalten werden. Aufgrund der Unterschiede zwischen den verschiedenen Bubbler-Typen sollte der Kunde die Notwendigkeit anwendungsspezifischer Drucksteur- und Überdruckregel-Einrichtungen erwägen

1. Gently grasp the Bubbler by the two valve stems (not the valves) and lower it into the Source Cup Assembly. Exercise caution when handling Bubbler.

2. The Bubbler should be positioned only one way. With the system facing forward, the thermowell should be directly on top of the magnet in the base of the Source Cup Assembly. This is important for the proper operation of the liquid level sensors. The system will alert the user with a short beep when the probe has been installed properly, refer to figure 6-16.

Figure 6-16a Bubbler Positioning in Source Cup Assembly (Model VG300)

3. Turn on power to the VaporGuard® SW1 on Power Supply Module.

4. Inspect the Temperature Probe for physical damage.

5. With the Temperature Probe at ambient temperature, verify the VaporGuard® displays correct ambient temperature within ~± 2 °C.

6. Deposit approximately 8-10 drops of the supplied mineral oil into the thermowell.

7. Install the thermal insulating material onto the bubbler and push down on the outer sides of the bubbler. Pad should be concaved down onto the bubbler.

8. Install Temperature Probe tip in the Bubbler thermowell. Gently push in the hole until you feel it bottom out on the thermowell bottom.

9. The Temperature Probe's proximity sensor will be within 1/2 inch (1.27 cm) or less from bottom of the Source Cup for proper operation. If this is not achieved correctly, the VaporGuard® will alarm with a "probe not installed" alarm. Moving the probe down or rotating the bubbler to land the probe on top of the magnet. The system will beep to let you know that you are in the correct location. Clear the alarm from the ALARM CLEAR screen. See Chapter 5.

10. Using the keypad interface, adjust the temperature setpoint to any convenient setting between 10 °C and 22 °C. Press the up (START) position on the front switch. The green LED will illuminate to indicate that control power is being applied and the system will not begin controlling the bubbler temperature. Allow the temperature to stabilize. The time required for temperature

    stabilization will vary depending on the temperature range of the system, the original temperature of the bubbler and the ambient temperature.

NOTE: If the Temperature Probe is left out of the Bubbler or not installed correctly, the green LED will not turn on and the bottom half of the switch (red LED) will be flashing. In addition, the alarm still active will display on the second row of the LCD interface.

Figure 6-16b Bubbler Positioning in Source Cup Assembly (Model VG300)

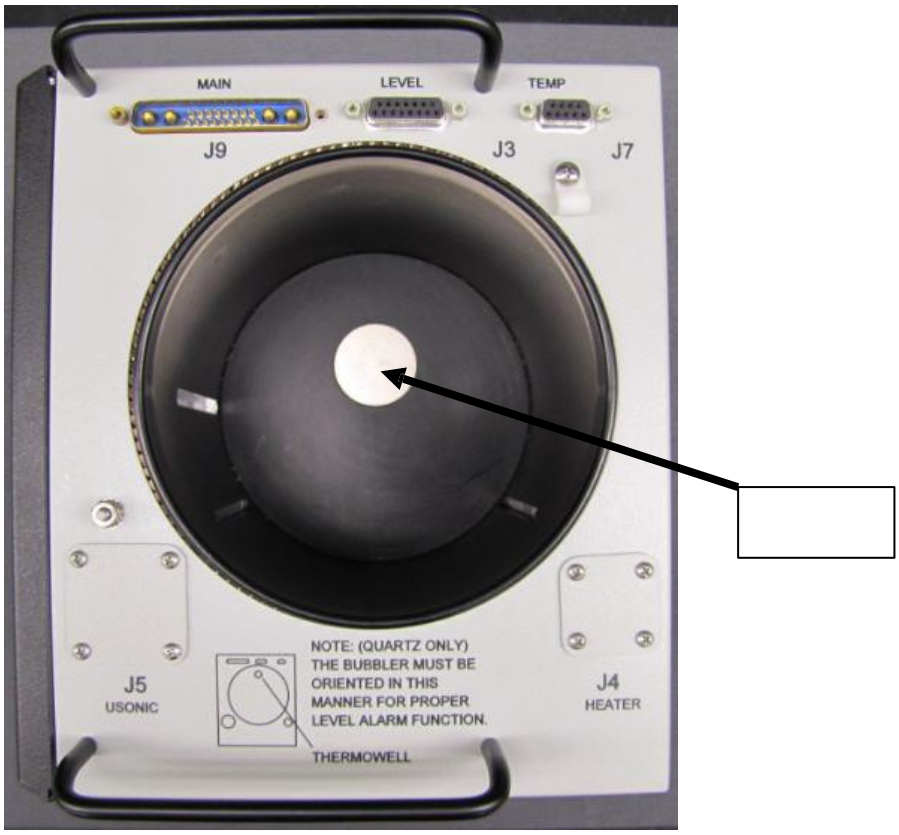
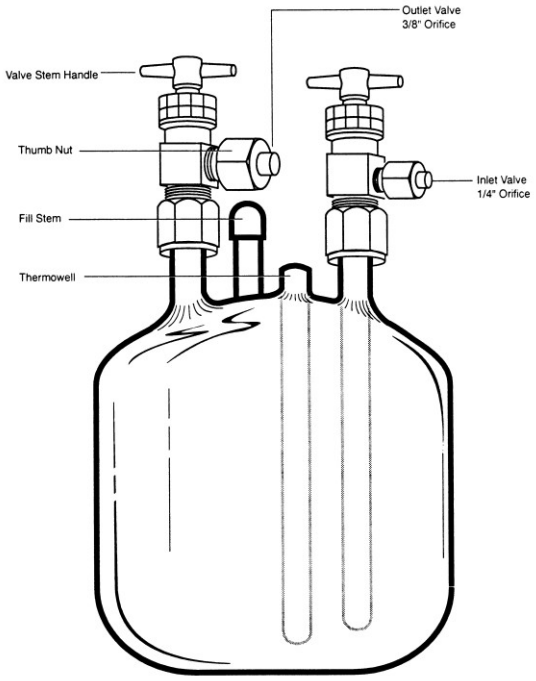


Figure 6-17 Standard Versum Materials, Inc. Quartz Bubbler



6.6.2 Removing Bubbler From Source Cup Assembly

Safety: Before proceeding, read the safety data sheet (SDS) for the specific chemical being used, and wear appropriate personal protective equipment. An SDS is included with every Versum Materials, Inc. bubbler. Cut resistant gloves **must** be worn when handling quartz bubblers**.**

- Refer to Versum Materials, Inc. Bubbler Installation and Removal Procedures, PN **9901- 0044**, which is provided with every Versum Materials, Inc. Bubbler. This document is intended for the safe installation and removal of Versum Materials, Inc. quartz bubblers

- **Do not** lift or handle bubblers by the valves.
- Follow site procedure and using Proper Protection Equipment to handle the bubbler to prevent injury or cause damage while handling bubbler.
- For installing or removing the bubbler from the temperature controller use both hands. Grasp the quartz stem close to the bubbler body while utilizing the other hand to support the side of the bubbler.
- It is critical that valve sequencing instructions be followed.
- End users should adhere to the recommended carrier gas flow rates.

If you require additional assistance, please call Versum Materials, Inc. Equipment Technical Services at **1-866-624-7677**.

6.6.3 Decommissioning Procedure

1. Don the appropriate PPE according to the chemistry. Verify that there are no chemical spills or leaks on or near the VaporGuard®. If a spill or leak is found refer to section 4.7 for the Decontamination Procedure.
2. Turn OFF the Power Supply Module. Insure that the incoming gas to the source container is turned off.
3. Remove the source container; reference section 6.6.2 for bubbler and 8.6 for SS container. If there is chemical remaining, it's the end-user/customers' responsibility to determine its reuse, displacement, or disposal. Undamaged containers can be reused. If applicable, replace with a new container.

NOTE: Under normal VaporGuard® operating conditions, the valves connection and the internal surface areas of the Quartz Bubbler or S.S. container comes in contact with the chemical.

4. After the source container has been removed, disconnect all cables from the Source Cup Assembly.
5. Disconnect all cables and AC power cord from the Power Supply Module.

6. The VaporGuard® is now decommissioned and if applicable ready for relocation. When placed back in to service, it is recommended to perform an operational check on the system, refer to section 5.5..

7. If the Source Cup Assembly was contaminated, dispose of it by the customers' site discretion. This assembly cannot be refurbished or recycled. If this Source Cup Assembly is under warranty, return it to Versum Materials, Inc. by utilizing the proper shipping methods. Call Versum Materials, Inc. Equipment Technical Services at **1-866-624- 7677** for additional information.

6.7 VaporGuard® Programming

On occasion a VaporGuard® will need to be updated with the latest software. A VaporGuard® programmer (P/N 177118) is used to download the software. The following procedure lists the steps necessary to download the software into the Source Cup assembly and Power Supply Module with a VaporGuard® programmer.

NOTE: The software for the Power Supply Module or Source Cup Assembly is already be loaded on the programmer.

1. Make sure the VaporGuard® is powered OFF.

2. To program the Power Supply Module, plug the programmer in to connector J2.

3. Turn VaporGuard® ON.

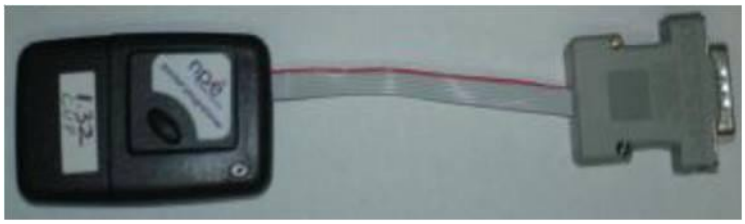
4. Press the program button momentarily on the programmer. This should cause the indicator light to shine yellow for approximately 7 seconds. This indicates that it's ready to program.

5. Press the program button again to start programming, the indicator light will flash yellow during this operation. When programming is complete, the verification operation will begin. During this time the indicator light will flash green. Upon completion of this operation, the indicator light will show a steady green, indicating the download was successful. A steady red light would indicate that the download had failed.

6. Turn OFF VaporGuard® and remove programmer.

7. Repeat for the Source Cup Assembly using a programmer that's loaded with the Source Cup software. Plug the programmer in to connector J3.

Figure 6-18 VaporGuard® Programmer, PN 177118



**Note, programmers do not come with software installed. Must specify at time of order which version of software required.

Table 6-8 Signals Designation

Signal Type	Signal pin – J5 (with ***cable wire color)	Common pin		Tool Interface Naming Convention (DDC) J5		Relay Manual Output Screen Upper Case=Closed Contact	Digital Inputs Screen Upper Case=No Alarm
		Dry contact	*Voltage/open collector*	*VaporGuard®*	*ATCS*		
+7VDC	23 Yellow/Blk			+7VDC	+7VDC		
GNDA	10 White			Analog Ground	Analog Ground		
GNDD	22 Orange/Blk			Digital Ground	Digital GND		
Backwards Compatible Digital Out	14 Blk/Wht		22 (Orange/Blk)	Temp High 1/Low 1 Alarm	Remote Temp Alarm	D –REM_TEMP_ALM_RL1	
	15 Brown/Wht		22 (Orange/Blk)	Low Chem Alarm	Remote Level Alarm	C – Low Chem Relay	
	16 Red/White		22 (Orange/Blk)	Any alarm	Any Alarm	F- Any Alarm	
Analog Out	7 Blue		10 (White)	Temp 0-5V→ 0-110ºC	Remote Temp output		
	20 Violet/Wht		10 (White)	Level Output 0-5V→0-100%	Remote Level output		
Analog In	8 Violet		10 (White)	Temp Set Point 0-5V→0 -110ºC	Remote Temp Set point		
Digital Input	2 Brown		22 (Orange/Blk)	Inverted DDC (DDC not)	Inverted DDC (DDC not)		H Remote DDC
Digital Inputs	**13 LT Green		22 (Orange/Blk)	Remote Stop (HW interlock)	Not available		B Remote Stop
	19 Blue/Wht		22 (Orange/Blk)	Tool Ready	Not available		D Tool Ready
*Isolated Existing Relay Outputs	1 Black	14 (Blk/Wht)		Isolated Temp High 1/Low 1 Alarm	Not available		
	3 Red	15 (Brown/Wht)		Isolated Low Chem Alarm	Not available		
	4 Orange	16 (Red/White)		Isolated Any Alarm	Not available		
Relay Outputs	11 Pink	24 (Green/Blk)		Level 4 relay output	Not available	A – Level 4 Relay	
	12 Pink/Black	25 (Gray/Blk)		Level 3 relay output	Not available	B – Level 3 Relay	
	17 Orange/Wht	5 (Yellow)		Level 2 relay output	Not available	E – Level 2 Relay	
	18 Green/Wht	6 (Green)		Level 1relay output	Not available	H – Level Low 1 Relay	
	9 Gray	21 (Red/Blk)		Temp High 2/Low 2 Alarm	Not available	G –REM_TEMP_ ALM_ RL2	

*Electrically isolated connections to the VaporGuard® for the same alarm outputs in previous design. If tool currently incorporates isolation block (relay or opto PCA), this module may be removed from the tool assembly as dry contacts are now available at these pins. Tool interface rewiring will be required.

To comply with **Class 1 Division 2, Pin 13 common to pin 22 can be used as a hardware interlock to remotely remove high current energy from the Source Cup Assembly in the event that the system loses exhaust or the detection of >25% LEL of the chemical is detected. The interface can be driven by a transistor (collector to 13, emitter to 22), opto-coupler or a dry contact. The result in tripping this input would allow the low power display to operate for alarm logging purposes, but the VaporGuard® will no longer control temperature. This is a hardware interlock and will only clear when the Remote Stop signal is reset by the return of exhaust flow and/or the absence of chemical vapors >25% LEL. And the Start rocker switch is depressed on the front panel.

***Note, cable wire color matches DDC cable drawing sw004673.

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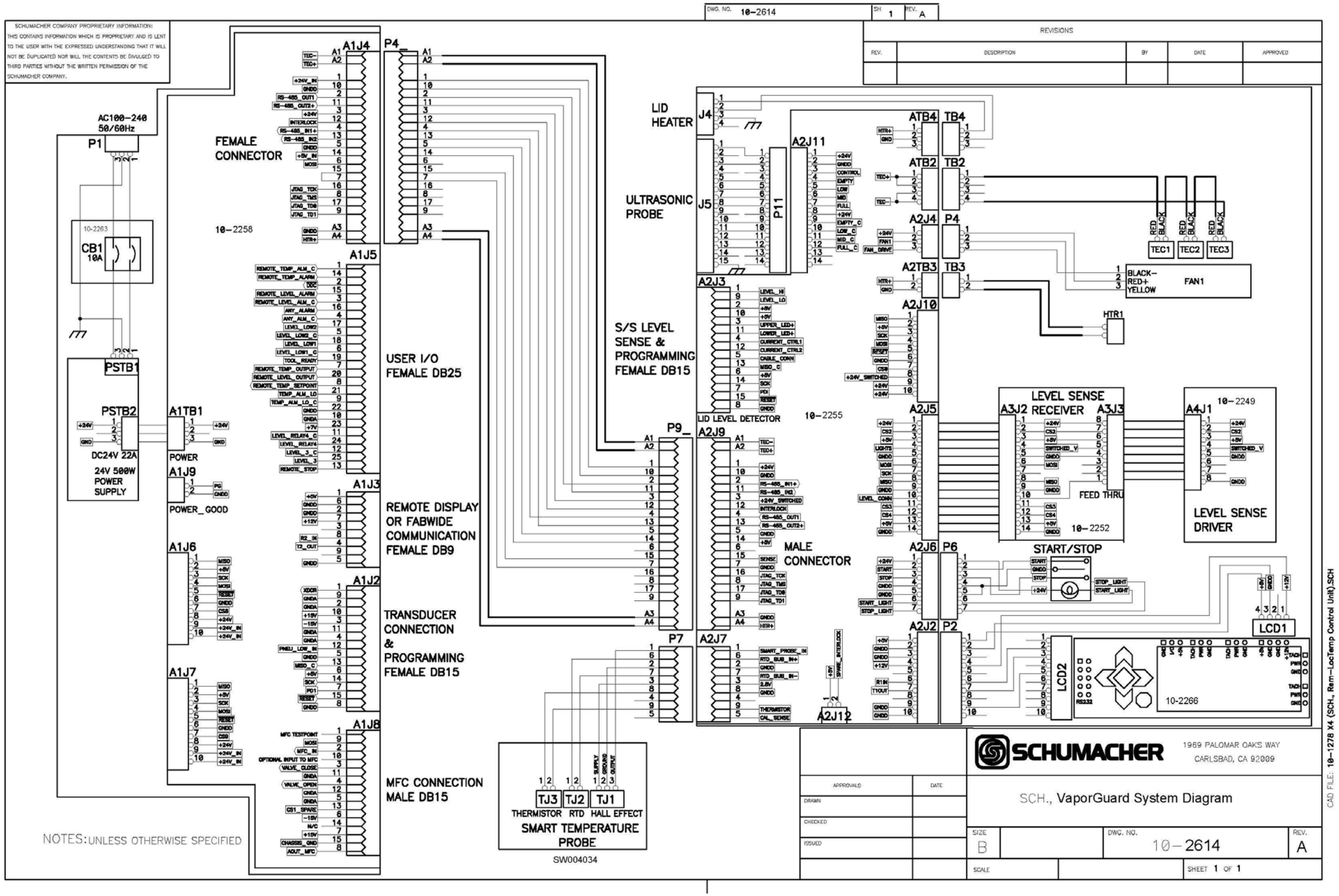
Figure 6-19 System Schematics



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Chapter 7 Calibration

1.1 Introduction

This section of the manual contains maintenance instructions for the VaporGuard® Absolute Control System in the form of Calibration procedures, Safety test, and Troubleshooting guides. The servicing technician should be familiar with Chapter 2 before attempting to troubleshoot the system.

1.2 Calibration

1.2.1 Equipment Required for Calibration of VaporGuard® Circuit

- A completely assembled VaporGuard® Absolute Control System
- Temperature Calibration PCA, P/N 146617, refer to figure 7-1
- Digital Volt Meter (accuracy = ±0.05VDC/ ±0.5mADC & ±0.05Ω)
- Remote Display Module

1.2.2 Temperature Calibration of RTD Circuit

The temperature control will retain its calibration over long periods. The calibration procedure only needs to be performed when the display of set point and probe temperatures, after stabilization, varies by more than ±0.3 °C, or when the system has been repaired and components replaced.

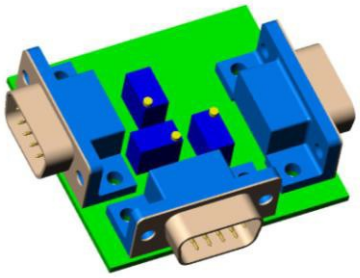
The calibration procedure requires a temperature calibration PCA, also known as a probe simulator PCA (P/N 146617). This PCA is designed to simulate the RTD. The probe will calibrate the circuit for the RTD.

Do not adjust the potentiometers on the temperature calibration PCA. The resistors are configured at the factory to a precise value against a traceable standard. Any tampering with the calibration potentiometers will void the calibration of the RTD circuit.

This VaporGuard® uses digital potentiometers to calibrate the electronics. There is no reason to open the enclosure because there are no mechanical potentiometers in this design. All circuit calibration adjustments are accomplished through the LCD keypad of the Source Cup Assembly.

The stainless steel level detection can be calibrated. The quartz level sensors can only be verified. If the quartz level sense circuit does not work, the Source Cup Assembly must be sent back to Versum Materials, Inc. for repair/replacement.

Figure 7-1 Temperature Calibration PCA, P/N 146617



1.2.3 Temperature Calibration Procedure

The calibration requires the Source Cup Assembly display to adjust the offset, gain and linearity potentiometers of the RTD circuit. The user should validate the accuracy of the RTD PCA on each connector using a calibrated ohm meter. Pins 6 & 7 on all connectors should have the following ohm values;

- P7A = 1005.07Ω +/- 0.02Ω
- P7B = 1106.19Ω +/- 0.02Ω
- P7C = 1305.91Ω. +/- 0.02Ω

Measure all connectors at pins 6 &7 to insure the PCA is within calibration. Once verified, you may begin testing the equipment.

1. Insure Power Supply Module is securely connected to the Source Cup Assembly. Turn power switch SW1 ON.

2. The main menu will default after boot up screens.

3. If the VaporGuard® is already on, insure that it is in idle mode (front switch red LED is on continuously). Alarms may be present which will result in a flashing red LED on the front switch, but the unit will still be in idle mode.

4. Remove the probe from the bubbler. Then remove the 9 pin (DB9) temperature probe connection from the Source Cup Assembly. The display will read 119.9ºC and a “RTD Open” and “Probe Not Installed” alarms will result.

5. Install the calibration PCA at connector P7A to the temperature probe connection J7. The screen will automatically update to the “POT CONFIG?” screen. Select the green check mark “√” to get to the “TEMP POT CONFIG?” screen. Select the green check mark “√” again to adjust the individual potentiometers shown in figure 7-2.

NOTE: The Stainless Steel Level Sense Calibration screen is also enabled when the Temperature Calibration PCA is installed. Do not adjust the SS POT CONFIG parameters as it is not required.

6. Read the display to verify a temperature of 1.3ºC. If the display reads 1.3ºC±0.2ºC, then skip to step 8.

7. If the display does not read 1.3ºC to within the specified tolerance, adjust the offset potentiometer until the display reads within tolerances. Use the up or down arrow to change the potentiometer parameter. The offset potentiometer is designated by the “O” in the top row on the left side of the screen example shown below.

8. The temperature reading is on the second row, right side. The corresponding analog signal is also displayed on the second row (units of volts DC). It is used for troubleshooting purposes only. Use the left or right arrow to move the cursor to the next potentiometer parameter.

NOTE: The Temperature Calibrator PCA may require validation once a year. This

requires a traceable (NIST) ohm meter with accuracy to 50 milliohms to measure the resistive settings on the PCA (1 resistive reading per connector).

Connect leads to meter together and null the lead impedance. Connect one lead to pin 7 and the other lead to Pin 6 of each the three connectors and verify correct resistive values to within 50mΩ. If values are within calibration, PCA can be used to calibrate VaporGuard® RTD circuit.

O	#	#	#	#	G	#	#	#	#	L	N	#	#	#	#
V	0	.	5	6	3		T		2	1	.	0	0	º	C

9. Remove the temperature calibration PCA from P7A and install at P7B. Read the display to verify a temperature of 27.3ºC. If the display reads 27.3ºC±0.2ºC, then skip to step 10.

10. If it does not read 27.3ºC within the tolerances, adjust the gain potentiometer until it does. The gain potentiometer is designated on the display by the “G”. Use the left or right arrow to move the cursor to the desired potentiometer parameter. Use the up or down arrow to change the potentiometer parameter.

11. Remove the temperature calibration PCA from P7B and install at P7C. The display should read 79.2ºC. Read the display to verify a temperature of 79.2ºC. If the display reads 79.2ºC±0.2ºC, then skip to step 12.

12. If it does not read 79.2ºC within tolerances, adjust the linearization potentiometer until it does. The linearization potentiometer is designated on the screen by the letters “LN”.

13. Return the temperature calibration PCA back to P7A and repeat steps 6 through 11 until all readings are obtainable without adjusting the digital potentiometers.

14. The temperature control circuit is now calibrated. Press the red “X” key to exit this menu. The display will prompt the user to press the green “√” to save the settings.

15. Reinstall probe.

NOTE: If the settings are not saved at this point the new calibration parameters will be lost. The settings will default back to the original settings prior to calibration.

1.2.4 Analog Output Calibration Procedure

The electronics chosen in the new design were specified for low drift due to time or temperature. The factory calibration in most cases should not to be adjusted for long periods of time. Should the output signals need calibration, the user must install the Remote Display Module, **PN 152235** connected to the Power Supply Module at J3 to complete. Contact your local Versum Materials, Inc. representative for more details on Remote Display Module, **PN 152235**.

1.2.5 Voltage Output Calibration

1. Remove the DDC connector from the Power Supply Module. Install the Remote Display Module to J3 connector of the Power Supply Module.

2. Connect the DMM positive to J5-7 and the common to J5-10 to check the temperature output. Set DMM to DC voltage mode on 20 volt range.

3. With the temperature probe uninstalled, the output should be 5.00VDC±0.05. If the measurement is within specification no calibration is required.

4. If the output requires calibration, navigate to the “CURR&VOLT CONFIG” menu and press the green “√”.

5. Press “√” at the “LEVEL & TEMP VOLT?” screen.

NOTE: Entering this menu will cause the output to float high. The real reading will return once you exit this screen.

6. The “L” on the top row designates the calibration values for the voltage level analog output. The value for percent can be adjusted to verify the output voltage measurement. Likewise, the value next to the “T” can be adjusted to verify the

voltage measurement for temperature. The entries to the right of the “OS” and “GN” represent the offset and gain parameters respectively.

L	#	#	#	%	O	S	#	#	#		G	N	#	#	#
T	#	#	#	º	O	S	#	#	#		G	N	#	#	#

7. Adjust temperature parameter to read maximum 110º. Measure the voltage output and adjust the gain parameter “GN” until the output reads 5.00VDC ±0.05.

8. Use the left arrow to move to the temperature reading and adjust the display to read 12º. Verify that the output reading is 0.5VDC ±0.05. Adjust the offset parameter “OS” as required.

9. Adjust temperature parameter back to 110º. Measure the voltage output and adjust the gain parameter “GN” until the output reads 5.00VDC ±0.05.

10. Adjust the display to read 0º. Verify that the output reading is 0.0 VDC ±0.05. Adjust the offset parameter “OS” as required.

11. Repeat steps 9 and 10 until the adjustments are no longer required.

12. The user may check any percentage value in between for the corresponding output. For example, 60ºC will produce a 2.5VDC output.

13. Move the DMM positive lead to J5-20 on the J5 connector of the Power Supply Module. The DMM setting remains the same.

14. Adjust the “L” level parameter to read maximum 100%. Measure the voltage output and adjust the gain parameter “GN” until the output reads 5.00VDC ±0.05.

15. Use the left arrow to move to the level reading and adjust the display to read 10%. Verify that the output reading is 0.5VDC ±0.05. Adjust the offset parameter “OS” as required.

16. Adjust the level parameter back to 100%. Measure the voltage output and adjust the gain parameter “GN” until the output reads 5.00VDC ±0.05.

17. Adjust the display to read 0º. Verify that the output reading is 0.0 VDC ±0.05. Adjust the offset parameter “OS” as required.

18. Repeat steps 15 and 16 until the adjustments are no longer required.

19. Press the “X” to exit the menu.

20. Press the green “√” to save the calibration settings.

NOTE: If the settings are not saved at this point the new calibration parameters will be lost. The settings will default back to the original settings prior to calibration.

High temp models will required a calibration of 5V=120ºC. Check model number for correct setting.

1.2.6 Verification without calibration

If the Remote Display Module is not available the user may use the follow verification procedure to ensure the VaporGuard® is still within calibration.

1. Remove the DDC connector from the Power Supply Module.

2. Connect the DMM positive lead to connector J5-7 and common to J5-10 of the Power Supply Module to check the temperature output. Set DMM to DC voltage mode on 20 volt range.

3. Place a piece of opaque material (card stock or paper) inside the Source Cup Assembly. Use template on last page of chapter 5 to create your own level sense fixture. The photo transistor PCA is closest to the front of the Source Cup Assembly.

4. Place the level sense fixture over all phototransistors in the Source Cup Assembly. Display will indicate 100%. The analog output should read 5VDC.

5. Slide the fixture so that the next step on the fixture uncovers another IRLED/Phototransistor pair. Continue until all levels are uncovered.

6. Check Table 7-1 for corresponding output values for each level.

NOTE: The software has a discrimination routine that keeps the level stable during

bubbling, so the sliding of the fixture must be slow and deliberate for output to change.

7. If the RTD calibration PCA is available, the user may use it to create specific temperature readings to validate against the analog output signals.

8. If the RTD calibration PCA is not available, remove the temperature probe to achieve a 100ºC reading. Then reconnect and allow measurement to settle on ambient temperature. Use these two points to verify the temperature output is within tolerances.

Table 7-1 Voltage Specifications for Percentage Values

Level %	Volts DC
11%	0.56
23%	1.11
34%	1.67
46%	2.22
57%	2.78
68%	3.34
80%	3.89
91%	4.45
100%	5.00

NOTE: Volts DC Specifications (±0.05V)

7.3 Safety Test

This test should be performed annually to verify proper function of the safety features for the VaporGuard®. The VaporGuard® should be powered up with a bubbler installed; however, the valves should be closed. You will need a digital thermometer with a thermocouple.

1. Check Probe Not Installed alarm. Remove temperature probe from bubbler. The green START lamp should turn off shortly afterwards and the alarm should be display on the LCD screen. If the green START lamp does not turn off, the VaporGuard® is not operating correctly.

2. Check Thermal Trip. From the model number, determine the thermal cutout temperature (see section 5.9).Tape the thermocouple to the Temperature Probe bulb end. For the lowest trip temperature, hold the probe ends between thumb and forefinger to slowly approach the cutout temperature. Use a hot air gun to test the higher trip temperatures. The main display will show “Thermal Trip” alarm on the LCD display. If this does not occur the VaporGuard® is not operating correctly. Place probe back in bubbler and clear alarms. Press the START switch, however dependent on the temperature reading, the unit may need to cool down.

3. Check cooling fan. Visually check that the fan is running and that air is being exhausted at the outlet side of the unit. Also, nothing should be obstructing the fan inlet and exhaust outlet.

7.4 Maintenance Schedule

The VaporGuard® is designed to have minimal maintenance activity associated with its temperature control and level detection electronics. Calibration and testing, and any resulting maintenance, should be performed at regular intervals. Refer to table 7-2 below.

Table 7-2 Recommended Maintenance Schedule

Check/Calibration	**Interval**	**Procedure**
Temperature Control Check	24 Months (or when temp setpoint is changed)	Section 7.2.2 & 7.2.3
Analog Output Calibration	24 Months	Section 7.2.4 & 7.2.5
Level Sense Control Check (Quartz Bubbler)	12 Months	Section 5.5.4
Safety Test	12 Months	Section 7.3

7.5 Spare Parts List

Table 7-3 VaporGuard® Spare Parts List

Description	Part Number
Temperature Calibration PCA	146617
Tool IO Interface Cable, 8 meters	149470
Power Supply Module-300 Watt	149471
Power Supply Module-600 Watt	149472
Source Cup Assembly-600W	149473
Source Cup Assembly-600N	149474
Source Cup Assembly-300N	149475
Source Cup Assembly-300W	149476
Remote Display Module and Interconnect Cable, 8 meter	152235
Interconnect Cable, 3 meters (Standard)	160392
Manual, Insulation and Operation, CD or E-File	163315
Temperature Probe Assembly	163547
Source Cup Assembly-600NHT	164038
Source Cup Assembly-600WHT	164039
PCA, Controller, Power Supply Module	172148
PCA, Controller, Source Cup Assembly	172149
PCA, AC Transient, Power Supply Module	172151
PCA, LCD Interface, Source Cup Assembly	172152
Power Supply, 24V-600W	172168
Power Supply, 24V-300W	172169
PCA, Receiver, Level Sense, Source Cup Assembly	172184
LCD, w/Connector, Source Cup Assembly	172185
Fan Motor Assembly	172186
PCA, LED Sender, Level Sense, Source Cup Assembly	172187
Interconnect Cable, 5 meters (optional)	177656
Interconnect Cable, 10 meters (optional)	177657
Interconnect/Split Cable, 3 meters (optional)	184466

Interconnect/Split Cable, 5 meters (optional)	410763
Thermowell Oil	1600-0001

Chapter 8

VaporGuard® Stainless Steel Source Configuration

8.1 *Introduction*

This section of the manual describes the Stainless Steel (S.S.) Source container when used with the VaporGuard® Absolute Control System.

8.2 *Description*

The VaporGuard® Source Cup Assembly, (VG600 series) has been designed to control the temperature and monitor the liquid level of the chemical within a S.S. container. Higher temperatures can be achieved with the same VaporGuard® without control degradation.

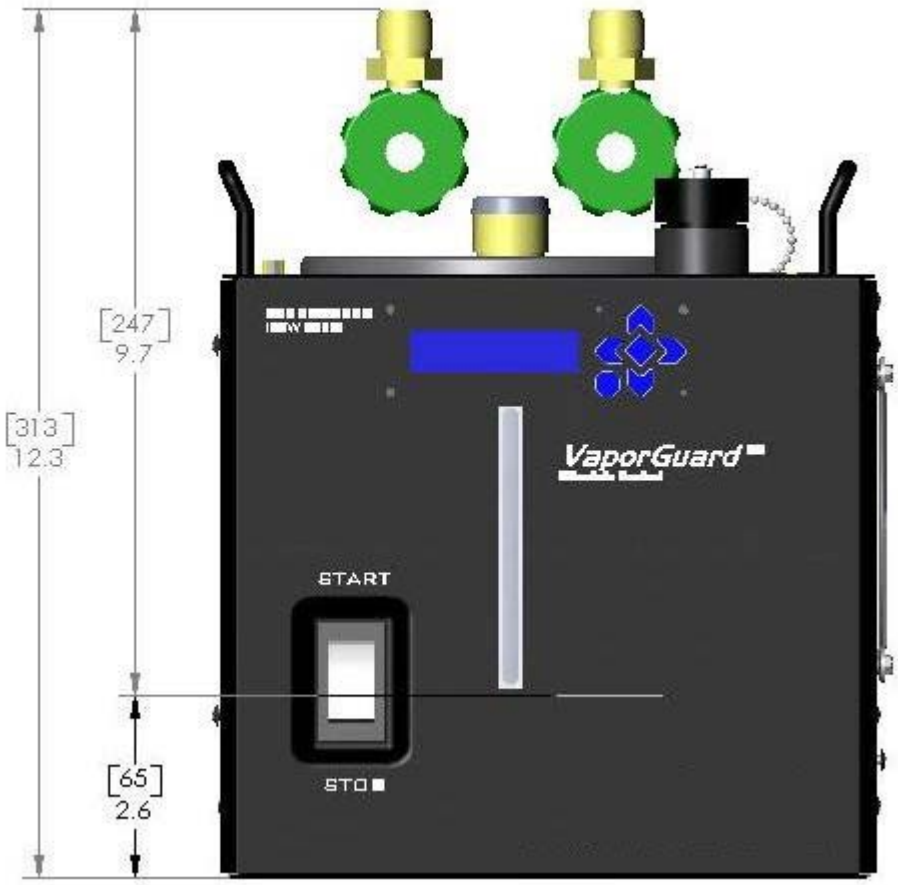
The VaporGuard® configurations are factory set by models. The difference between the two configurations is the thermal cutoff and maximum temperature setting, refer to Table 5.3 Thermal Cutout Switch Configuration.

Level monitoring by the VaporGuard® is only available with the Ultrasonic probe built into the S.S. containers, refer to figure 8-2.

NOTE: S.S. containers configure with the quartz level sense optical probes are not compatible with the VaporGuard® and level monitoring cannot be used. A stand alone Level Sense Module is required to monitor chemical level or bulk refill will need to be installed. Contact your Versum Materials, Inc. representative for additional information.

The VaporGuard® is configured to monitor the levels in the stainless steel container options, refer to table 2-1 for model types for using with S.S. containers that has the Ultrasonic Level Probe installed. The Ultrasonic Level probe is connect to the VaporGuard® level sense circuit for the S.S. container, refer to figure 8-1.

Figure 8-1 VaporGuard® with Stainless Steel Source Container Installed



(VG600W Front View)

Figure 8-2 Ultrasonic Level Probe (part of S.S. Container)

8.3 *Versum Materials, Inc. S.S. Container with Ultrasonic Level Probe*

The VaporGuard® is configured for use with an Versum Materials, Inc. S.S container with built in Ultrasonic Level probe; refer to figure 8-3.

The UltraSonic Level probe is attached to J-5 on the top of the VaporGuard® Source Cup Assembly. When the chemical level drops below one of 4 sensors within the UltraSonic Level probe, the sensor will activate a relay output and will go open or closed depending on either a wet or dry condition.

These changes are monitored by the Source Cup Assembly CPU and in turn will display a liquid level readout on the front panel. The output signal to the DDC will change accordingly. The displayed readouts corresponding to the chemical level in the S.S container are as follows:

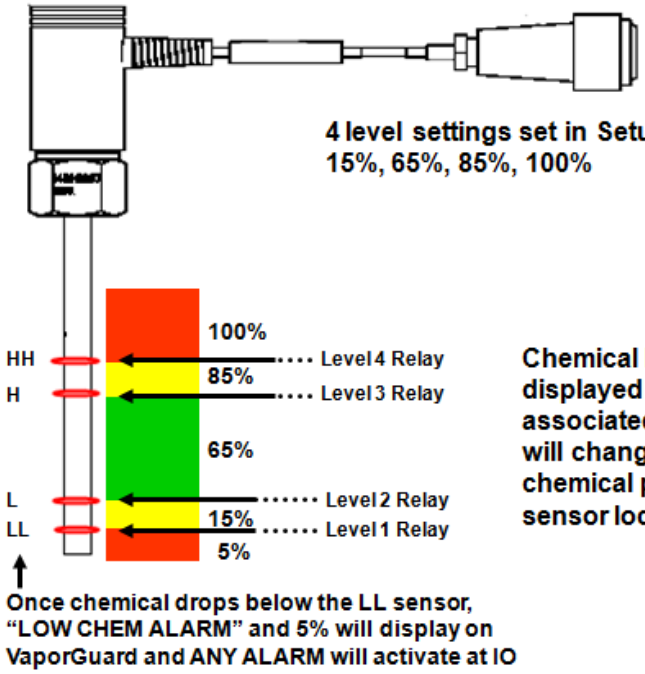
Table 8-1 Ultrasonic Level status

Empty Sensor	Relay contact input for Empty level *Chemical level in container below sensor displays 5%, above sensor displays 15% on display.
Low Sensor	Relay contact input for Low level Chemical level in container below sensor displays 15%, above sensor displays 65% on display,
Mid Sensor	Relay contact input for Mid level Chemical level in container below sensor displays 65%, above sensor displays 85% on display,
Full Sensor	Relay contact input for Full level Chemical level in container below sensor displays 85%, above sensor displays 100% on display,

NOTE: *At 5% Low Chem alarm is displayed on the front panel and the Low Chem output signal is activated to the DDC.

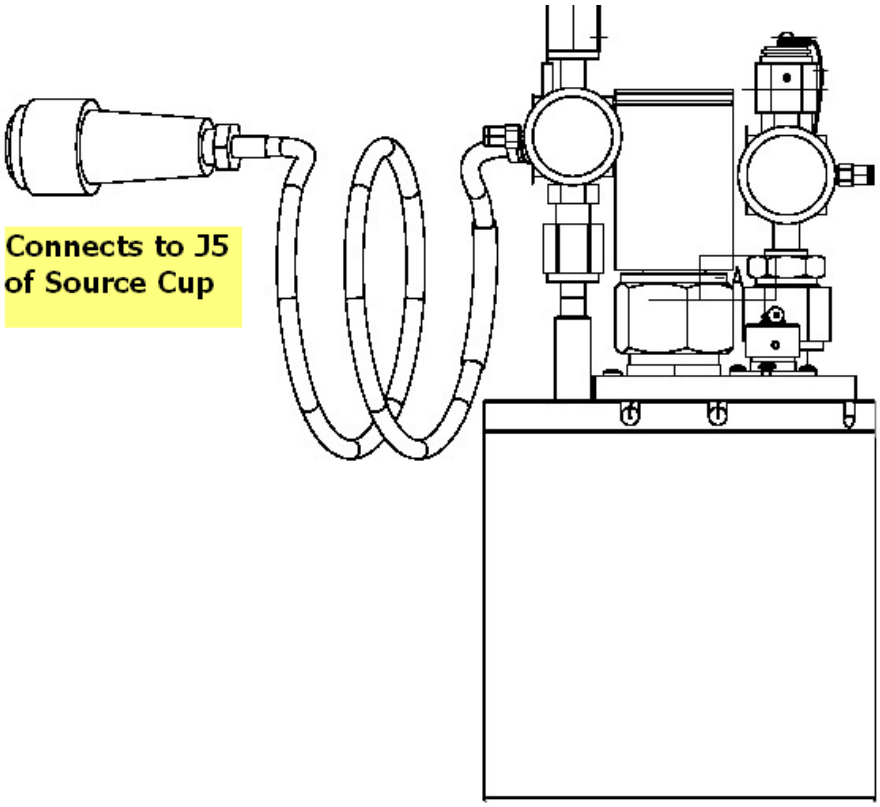
Table 8-2 Ultrasonic Level readout in percentage

This table shows the logic level of the Ultrasonic Probe

Ultrasonic Level	Function	DC Volt
	Cable Interlocked (USIL)	0 (~0.2)
	100%	5 (~5.4)
	85%	4.67
	65%	3.56
	15%	0.82
	5% (Low Chem.)	0 (~0.2)
	Probe Fail (USFL)	0 (~0.2)

The value shown are the analog output 0-5VDC signal (ref J5 Connector) from the VaporGuard® which represent the output of the Ultrasonic Probe.

Figure 8-3 S.S. Source Container with Ultrasonic Level Probe



8.4 *Stainless Steel Source Container Installation*

1. Inspect S.S. container carefully. Do not use and immediately contact Versum Materials, Inc. if the S.S. container is damaged or appears to be leaking, for Versum Materials, Inc. S.S. containers only.

2. Once the VaporGuard® is placed in the cabinet and all electrical connections have been made, insure that the S.S container is kept in a vertical position.

CAUTION

CAUTION: The weight of the

S.S. container is 17 pounds when full. Do not drop or tip the S.S. container when placing it in the VaporGuard® Source Cup Assembly.

VORSICHT: Das Gewicht des S.S. - Chemikalienbehälters beträgt 17 lbs (7,7 kg), wenn er voll ist. Den S.S.-Behälter beim Einbau in die Einsatzeinheit nicht fallen- oder umkippen lassen.

ATTENTION: Le poids de la Source S.S. est de 17 lbs (7,7 kg) quand elle est remplie. Ne pas renverser la Source S.S. lorsqu'on la place dans l'Unité de Source.

3. Prior to installing the S.S. container into the Source Cup, fill the thermowell with 1/2 in. (8 to10 drops) of Versum Materials, Inc. Thermowell Oil, **P/N 1600-0001**.

NOTE: Failure to use the proper oil may result in unstable temperature control and possible false alarm conditions.

4. Hold the S.S. container carefully by the valves and lower into the Source Cup. The S.S. container can be positioned as desired for valve hook-up.

5. Place the Temperature Probe in the thermowell and make sure that the probe is seated at the bottom of the thermowell.

6. The Temperature Probe's proximity sensor will be within 1/2 inch (1.27 cm) or less from bottom of the Source Cup Assembly for proper operation. If this is not achieved correctly, the VaporGuard® will alarm with a "Probe Not installed" alarm. Moving the probe down or rotating the S.S. container to land the probe on top of the magnet. The system will beep to let you know that you are in the correct location. Clear the alarm from the ALARM CLEAR screen. See chapter 5.

7. Using the keypad interface, adjust the temperature setpoint. Press the up (START) position on the front switch. The green LED will illuminate to indicate that control power is being applied and the system will not begin controlling the S.S. container temperature. Allow the temperature to stabilize. The time required for temperature stabilization will vary depending on the temperature range of the system, the original temperature of the S.S. container and the ambient temperature.

NOTE: If the Temperature Probe is left out of the S.S. container or not installed correctly, the green LED will not turn on and the bottom half of the switch (red LED) will be flashing. In addition, the alarm still active will display on the second row of the LCD interface.

8. Place the lid insulator properly on the S.S. container (if applicable).

9. Remove the cap or plug on the inlet and outlet valve VCR connectors. Use the proper wrench to remove.

CAUTION

CAUTION: Do not turn or loosen the inlet and output valve fittings on the lid of the S.S. container as this will break the seal and may jeopardize the integrity of the chemical.

VORSICHT: Die Verschraubungen der Einlaß- und Ausgangsventile auf dem Deckel des S.S.- Chemikalienbehälters nicht drehen oder lösen, da dadurch die Dichtung beschädigt und die Unversehrtheit der Chemikalie gefährdet wird.

ATTENTION: Ne pas tourner ni desserrer les raccords des valves d'entrée et de sortie du couvercle de la Source S.S., car ceci brisera le scellement et pourra compromettre l'intégrité du produit chimique.

NOTE: The connection of the lines to the S.S. container and the gas cabinet is beyond the scope of this manual.

10. Once the gas cabinet plumbing has been established, install new gaskets onto the inlet and outlet connector of the valves. Tighten to specification.

NOTE: If carrier gas is not used, disregard installation of the input valve and leave valve closed. Do not change the valve configuration.

11. Perform system leak check to the S.S. container per customer or S.S. container specifications.

12. To remove the S.S. container, close valves and perform steps 4 thru 9 in reverse order.

NOTE: Never open manual valves on the S.S. container, prior to verifying plumbing connections are in place.

To prevent downstream condensation, insure that downstream lines external to the S.S. container are at a higher temperature than the temperature set point on the VaporGuard®.

It is the customer's responsibility to install appropriate pressure relief devices to prevent overpressure conditions and to connect the carrier gas accordingly. Furthermore, it is dependent upon the customer's procedures whether safety shoes are required while handling S.S. containers.

Chapter 9

$POCl_3$ Safe Handling and PPE Matrix

9.1 *Chemical Handling*

Guidelines and minimum standards must be established to allow and define Personal Protective Equipment (PPE) requirements for safe handling and usage of Phosphorous Oxychloride ($POCl_3$) chemical.

The following table, 9-1 is the minimum PPE requirements recommended by Versum Materials, Inc.. These standards shall be met or exceeded but never shall they become any less restrictive than what is stated in the matrix. A site may request a local reduction in PPE. To do so, the site must use an Industrial Hygiene Health Hazard Assessment reviewed and approved by sites EH&S department.

This table was derived from Versum Materials, Inc. required Liquid Chemicals Personal Protective Equipment. This table shall not be used in lieu of proper training of personnel in the hazards of chemicals and d gases. The PPE requirements listed in the table are contingent upon:

- All equipment is installed per manufacturer's specifications.
- PPE is the last form of personal protection, and that all feasible engineering controls, administrative controls, and elimination/substitution are being used including proper ventilation, life safety systems and alarms.
- Personnel are properly trained in the hazards of the chemicals/gases.
- A procedure or work instruction exists for the task, and that it is followed.
- Personnel are properly trained in the need for and use of PPE.
- PPE is properly maintained and donned correctly.
- Emergency Contact, call Versum Materials, Inc. at 610-481-4911

9.2 Matrix Definitions:

Non- Invasive: Activities in this category do not involve direct physical contact or manual handling of products (forklift, bottle cart, pallet jacks, etc. are used). Minimal exposure is possible, provided the truck and containers are free from leaks and external contamination.

Type 1: Maintenance is non-invasive work that does not involve opening primary containment or exposure to uncontained chemical.

Type 2: Maintenance is invasive work that involves opening the primary containment and may involve controlled or manageable or exposure to small quantities (<200 ppm) of chemical (e.g. Source Change operation).

Type 3: Maintenance is invasive work that involves opening primary containment and significant risk of exposure to chemical.

Buddy System: Two people wearing the same level of PPE and trained in basic chemical/gas safe handling techniques.

Person One: Completes all steps of a Work Instruction or process (container changes, maintenance, etc.).

Person Two: Acts as Safety Observer and backup in the event of a mishap. Remains a safe distance from the work area when Person One is e.g., opening primary containment. Person Two may assist Person One during support activities (lift assists, positioning, procedure checking, etc.), but must leave the hazardous area when primary containment is opened. In the event of a safety incident, person two should activate the emergency response system and if possible, depress the emergency stop button for the equipment.

9.3 Secondary Containment

When transporting chemical containers within the site complex, secondary containment must be used. The secondary container must be fabricated from a material that is compatible with the chemical in use and does not cause a chemical reaction if exposure should occur. The qualified materials for secondary containment used for $POCl_3$ are:

Table 9-1 PPE Matrix for $POCl_3$

Product	Chemical Formula	Container Off-Load, Transport, and Inspections (Non- Invasive)	Container Receiving, Inspection Handling (Non-invasive)	Source Container Change (Type 1)	Equipment Maintenance (Type 1)	Equipment Maintenance Source Change (Type 2)	Equipment Maintenance (Type 3)
Phosphorous Oxychloride	$POCl_3$						
PPE Requirements * = SCBA or airline breathing apparatus with 5 minute escape pack ** = Tape cleanroom glove to suit or apron sleeve		Latex or Nitrile Cleanroom Gloves					
			Face Shield	Face Shield	Face Shield		
				Chemical Goggles	Chemical Goggles	Full Face Respirator	
							SCBA*
			Corrosive Gloves	Corrosive Gloves	Corrosive Gloves	Corrosive Gloves	Corrosive Gloves
			Chemical Apron with Elastic Cuffs	Chemical Apron with Elastic Cuffs	Chemical Apron with Elastic Cuffs	Chemical Apron with Elastic Cuffs	PVC Level B Chemical Suit
				Double Gloves**	Double Gloves**	Double Gloves**	Double Gloves**
							Chemical Resistant Boots or Overshoes
						Buddy System	Buddy System