GEN II ChemGuard™ CG100-325, CG400NT Chemical Delivery System
Installation and Operation Manual

Ordering information:

P/N 143936	REV. G	Standard Paper Copy

The information and data contained herein are proprietary to Versum Materials, Inc. and are not to be copied, reproduced, duplicated, or disclosed to others, in whole or in part, without prior written consent of Versum Materials, Inc. The information and data should be available only to those with a need to know. Versum Materials, Inc. makes no representation that the information and data is appropriate for the recipient, and each recipient needs to independently evaluate the appropriateness of the information and data for its use.

This Installation and Operation Manual is subject to change without notification. For current technical information please call Product Support at (800) 545-9242 from continental U.S., or write Versum Materials, Inc., 7201 Hamilton Blvd, Allentown, PA 18195, attention: Product Support.

Printed in the U.S.A.

WARRANTY

Versum Materials, Inc. (hereinafter referred to as "Versum Materials, Inc.") warrants that:

(A) Each new Versum Materials, Inc. GEN IIB ChemGuard™ Chemical Delivery System is free from defects in material and workmanship under normal use and service for a period of one year from the date of delivery by Versum Materials, Inc. to the first purchaser.

(B) Each new accessory is free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of delivery by Versum Materials, Inc. to the first purchaser.

If any product requires service during the applicable warranty period, the purchaser should communicate directly with Versum Materials, Inc. to determine appropriate repair. Repair or replacement will be carried out at Versum Materials, Inc. expense subject to the terms of this warranty. It is the responsibility of the customer to perform routine maintenance and periodic calibration.

This warranty is expressly conditioned on compliance with Versum Materials, Inc. operating instructions and the use of the equipment only for authorized chemicals. Operation of the equipment other than as set forth in Versum Materials, Inc. operating instructions or the use of the equipment for unauthorized chemicals shall void all of Versum Materials, Inc. warranties hereunder.

In no event shall Versum Materials, Inc. be liable for any incidental, indirect or consequential damages in connection with the purchase or use of any Versum Materials, Inc. equipment. This warranty shall not apply to, and Versum Materials, Inc. shall not be responsible for, any loss arising in connection with the purchase or use of any Versum Materials, Inc. equipment which has been repaired by anyone other than an authorized Versum Materials, Inc. service representative or altered in any way so as, in Versum Materials, Inc. judgment, to affect its stability or reliability, or which has been subject to misuse or negligence or accident, or which has the unit or lot number altered, effaced or removed, or which has been used otherwise than in accordance with the instructions furnished by Versum Materials, Inc..

This warranty is in lieu of all other warranties, express or implied, and all other obligations or liabilities on Versum Materials, Inc. part, and Versum Materials, Inc. neither assumes nor authorizes any representative or other person to assume for it any other liability in connection with the sale of Versum Materials, Inc. equipment.

VERSUM MATERIALS, INC. DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR APPLICATION.

Corporate address:

Versum Materials, Inc.
1919 Vultee Street
Allentown, PA 18195-1501, U.S.A.

Revision Control Summary

Chapter	Revision	Date	File Name
Introduction	Rev-1	September 2016	MNL000404.doc
Chapter 1 –Delivery and Inspection	Rev-1	September 2016	MNL000405.doc
• Updated company name and logo.			
Chapter 2 – Site Preparation	Rev-1	September 2016	MNL000406.doc
• Updated company name and logo.			
Chapter 3 – Installation	Rev-1	September 2016	MNL000407.doc
• Updated company name and logo.			
Chapter 4 – Changing Reservoir Containers	Rev-1	September 2016	MNL000408.doc
• Updated company name and logo.			
Chapter 5 – ChemGuard Features and Components	Rev-1	September 2016	MNL000409.doc
• Updated company name and logo.			
Chapter 6 – System Operation	Rev-1	September 2016	MNL000410.doc
• Updated company name and logo.			
Chapter 7 – Maintenance & Calibration Procedures	Rev-1	September 2016	MNL000411.doc
• Updated company name and logo.			

Addendum B – Gas Filter Setup

Rev-1 September 2016 MNL000108.doc

- Updated company name and logo.

Addendum Y – UVIR Detector

Rev-5 September 2016 MNL000114.doc

- Updated company name and logo.

Addendum Z – USB Barcode

Rev-2 September 2016 MNL000001.doc

- Updated company name and logo.

Appendix A – Standard Degasser Test Procedure

Rev-1 September 2016 MNL000412.doc

- Updated company name and logo.

Appendix B – Network Setup ChemGuard

Rev-1 September 2016 MNL000109.doc

- Updated company name and logo.

Appendix C – Spare Parts Lists

Rev-1 September 2016 MNL000413.doc

- Updated company name and logo.

Appendix D – Facilities Preparation Checklist

Rev-1 September 2016 MNL000110.doc

- Updated company name and logo.

Appendix E – Versum Materials, Inc. GasGuard OPC Server

Rev-1 September 2016 MNL000111.doc

- Updated company name and logo.

Appendix F – Gas Sensor Modules

Rev-1 September 2016 MNL000112.doc

- Updated company name and logo.

Appendix G – Multi-Spectrum Digital, Electro-Optical Radiant Energy Models SS2 & SS4 Fire Detectors

Rev-2 September 2016 MNL000115.doc

- Updated company name and logo. This file needs to be completed.

TABLE OF CONTENTS

LIST OF TABLES

Chapter 1 LIST OF FIGURES

This Page Intentionally Left Blank

I.1 Introduction to the Manual

This manual explains how to install and operate Versum Materials, Inc. GEN II ChemGuard® chemical delivery system.

CAUTION

This manual is written based on revision 1.0 of the ChemGuard® PC104 software. Any future revisions to the software will be noted in the Software Release Notes addendum until the next manual release.

The ChemGuard® is a stainless steel chemical refill system. It provides a safe, clean, and efficient method of supplying chemical to process tools. The ChemGuard® continuously and automatically supplies the chemical to multiple process tools from a single large-capacity reservoir.

The ChemGuard® allows user-programmable Leak Check and Cycle Purge procedures to maintain the highest standards in safety and cleanliness required in sub-micron IC manufacturing. It automatically monitors the chemical fill level of the Reservoirs, and notifies the operator when the Reservoir Containers are low or empty.

Read this manual in its entirety prior to installing or operating the ChemGuard® cabinet. It contains information pertinent to setting up a chemical refill network, on how to program the ChemGuard®, as well as how to interface the ChemGuard® to process tools requiring chemical refill.

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.

This manual is written for personnel experienced in the analysis, troubleshooting, and maintenance of automated chemical delivery systems.

The manual contains the basic information needed to get the cabinet unpacked, installed and operating. Individual chapters contain specialized information, such as the theory of operation, additional operations available, and diagnostics.

I.2 Notes

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

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.

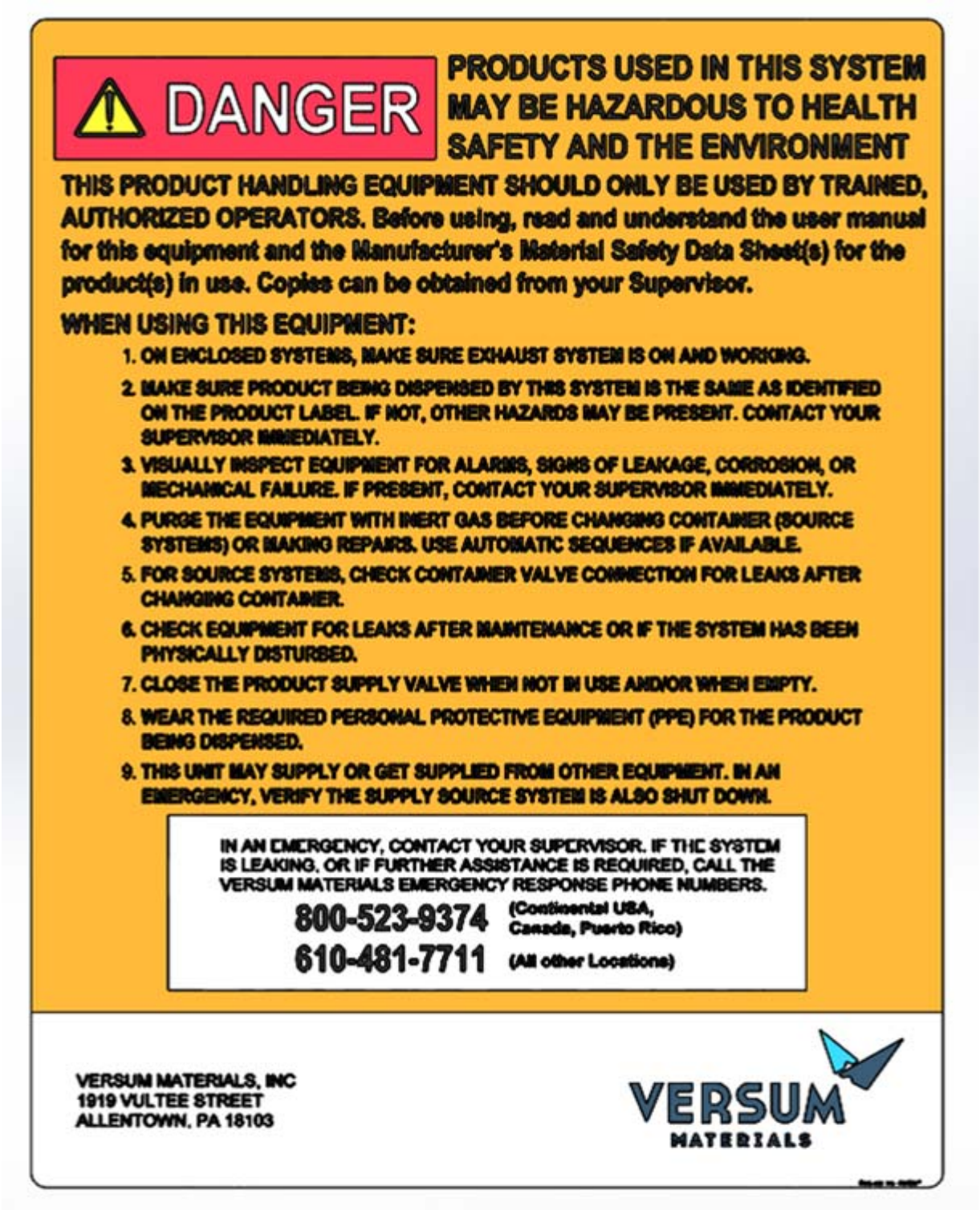
WARNUNG: Diese WARNUNG dient als Beispiel. Eine WARNUNG weist den Leser darauf hin, daß ein Verfahren nach den gegebenen Vorschriften durchgeführt oder bestimmte Voraussetzungen erfüllt bzw. vermieden werden müssen, um das Personal vor Körper- oder tödlichen Verletzungen zu schützen.

AVERTISSEMENT: Voici un exemple d'une "ATTENTION" à suivre. Une 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 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 Safety Label

The following sign is located on the exterior door of the ChemGuard® cabinet.



Chapter 1: Delivery and Inspection

1.1 Delivery

The ChemGuard® Gen II may be shipped in multiple packing boxes. The packing slip on the outside of one of the cartons indicates the number of items in the order. A separate Shipping Identification Sheet (SIS), or packing checklist, included with the manuals, identifies all components in the shipment. Before unpacking, make sure your order includes the correct number of packages.

This shipment includes one empty Process reservoir container. You will need to order a container or containers containing chemical. The contents of the packing boxes are:

- The ChemGuard® Gen II Cabinet
- One (1) empty Process reservoir container
- Start-up kit (See Packing Checklist included with shipment)
- Shipping Identification Sheet (packing checklist)
- ChemGuard® Gen II Quality Inspection Records

NOTE: Save all cartons (along with foam supports and padding) for re-use in case unit must be returned to Versum Materials, Inc.

NOTE: In some versions of Versum Materials, Inc. product literature for chemical processing and delivery systems, the term “canister” is used in place of the term “container”.

1.2 Inspection

Be sure each item on the packing checklist is included in the shipment. Notify Versum Materials, Inc. within 30 days if anything is missing. After 30 days, it is the customer’s responsibility to purchase missing or damaged parts.

1. Verify that the part numbers on the items are the same as specified on the Shipping Identification Sheet (SIS).
2. Keep the packing checklist for use in any future communication with Versum Materials, Inc. Customer Service.

This page intentionally left blank.

Chapter 2: Site Preparation

This chapter describes the space and clearances required to install ChemGuard® cabinets along with specifications for power, gas, vacuum, cabinet exhaust, reservoir vent and chemical delivery line.

Before the ChemGuard® unit can be installed; the customer must prepare the location site as detailed in the following section to provide sufficient space and clearance around the unit. Ensure the AC power, vacuum and gas sources are available in close proximity to the unit. Please read the information in this chapter carefully to avoid problems later.

2.1 Facility Preparation

Determine a suitable location for ChemGuard® cabinet. Versum Materials, Inc. recommends installing the cabinet in close proximity to:

- Your AC power source
- Your vacuum supply
- Your helium push gas and nitrogen purge gas supplies

Ensure that there is ample space to allow the cabinet doors to open completely and that there is proper clearance around the unit. (See Table 2-1 for required cabinet clearances.) If an optional fire extinguisher is installed, additional clearance may be required.

Table 2-1: Cabinet Clearances

PLACEMENT	CLEARANCES
Height	87 in. (2.209 meters)
Width	18 in. (457 mm)
Depth	Door open: 37 in. (940 mm) Door closed: 21 in. (533 mm)

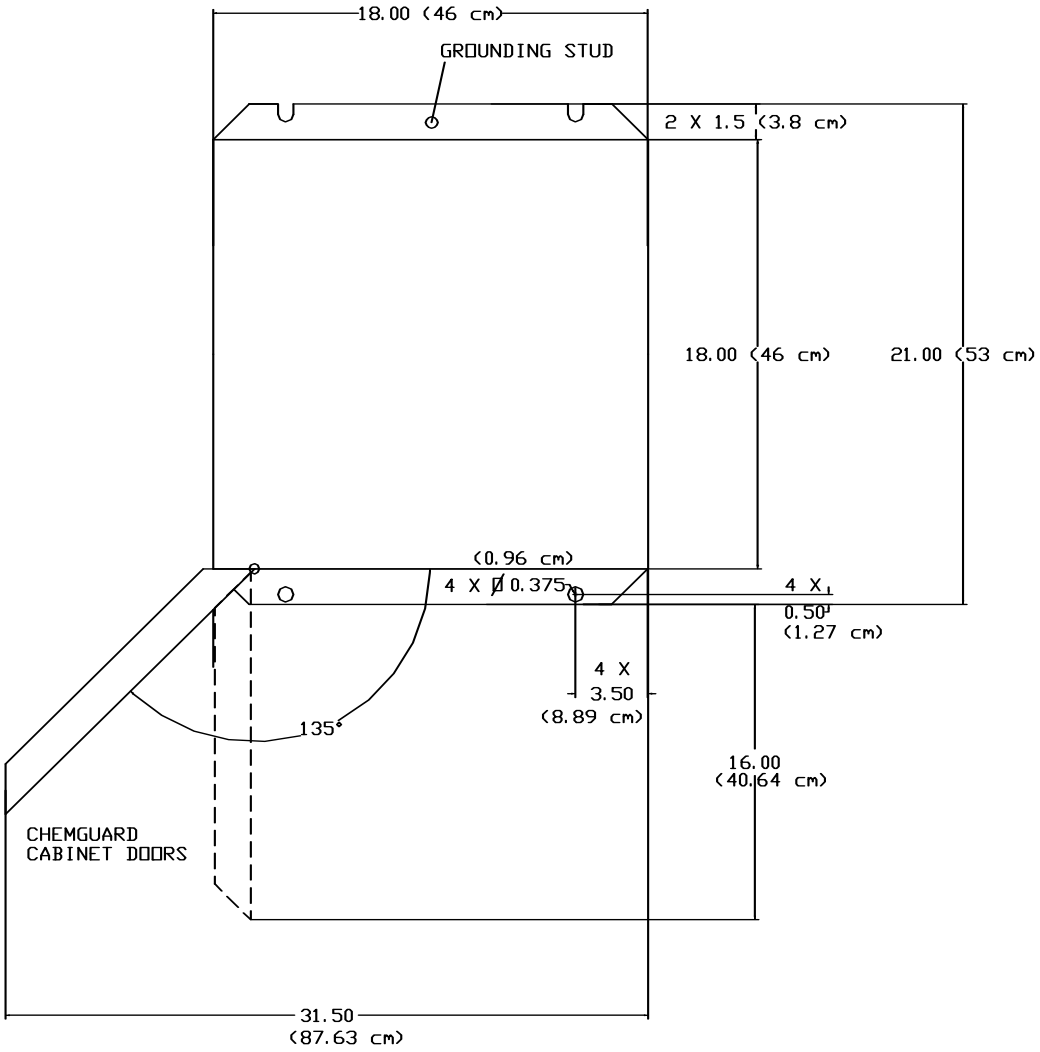
2.1.1 Bolt-Down and Ground Cabinet Requirements

Set the ChemGuard® cabinet over the bolt-down points and attach securely. Verify ChemGuard® is in a level location where it can be serviced easily, and is out of the main thoroughfare.

Per current United States UBC and SEMI S2-STANDARD requirements, floor bolts must be at least Grade 5 (metric Grade 8.8), at a recommended minimum length of 2.5 in. (6.35 cm).

1. Place the cabinet at the designated location.
2. Verify that there is enough room around the cabinet to fully open the door, or perform maintenance tasks.
3. The ChemGuard® must be grounded in accordance with Article 250 - Grounding, The National Electrical Code 2003. See reference Figure 2-1 for the location of the grounding lug. Versum Materials, Inc. recommends a ground resistance of <1.0 Ohms.

Figure 2-1: Earthquake Bolt-Down Pattern with Front Door Clearances



2.2 Facility Requirements

When selecting a location for the unit, ensure that the following facilities are available to make connections on top of the cabinet.

- Environmental
- Electrical
- Supply gases
- Vacuum
- Exhaust and Vent
- Chemical Delivery Line
- Bulk Chemical Refill Line (Optional)
- Outlet Manifold

Figure 2-2: ChemGuard Gen II Cabinet Connections, Top View

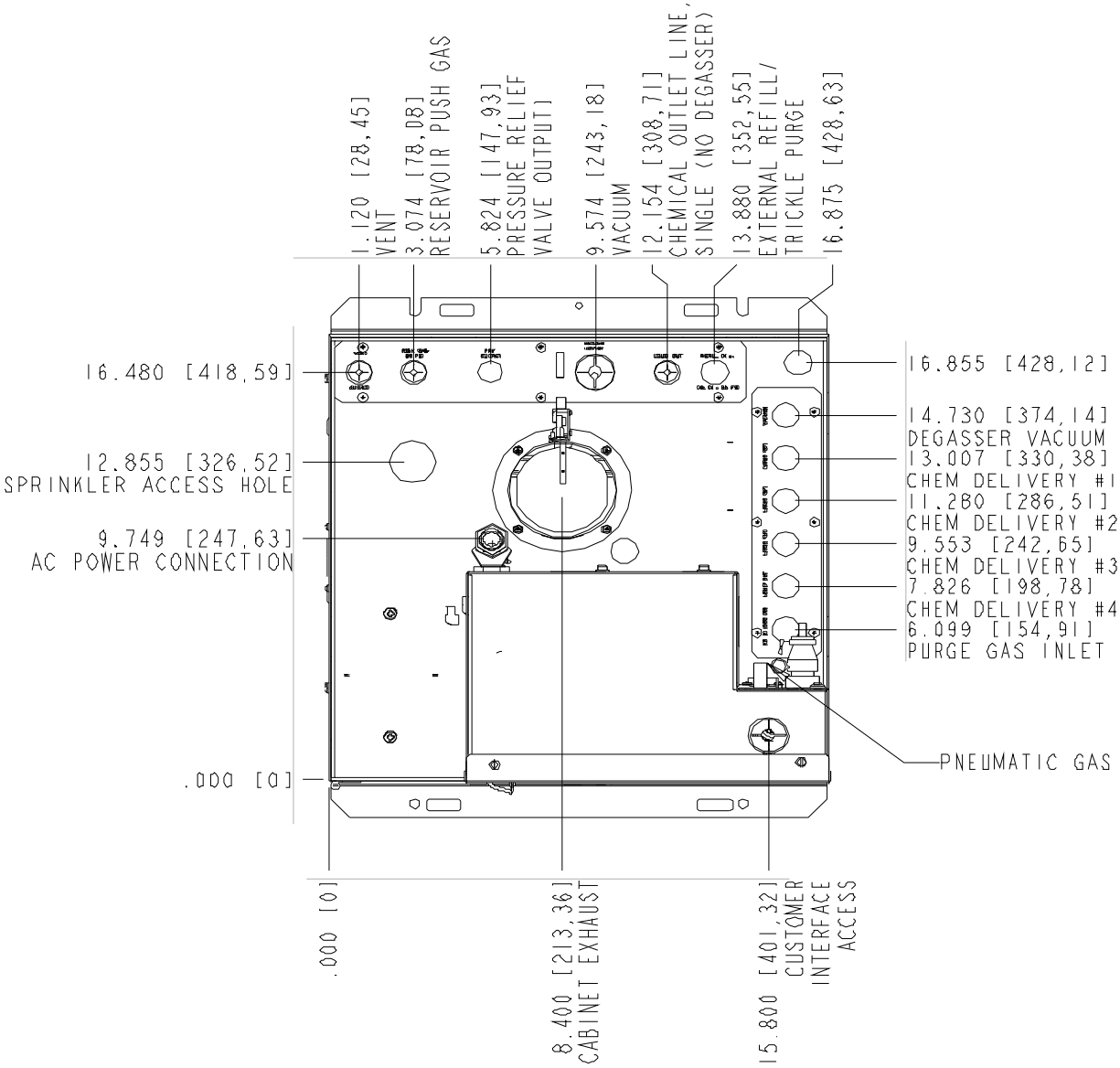
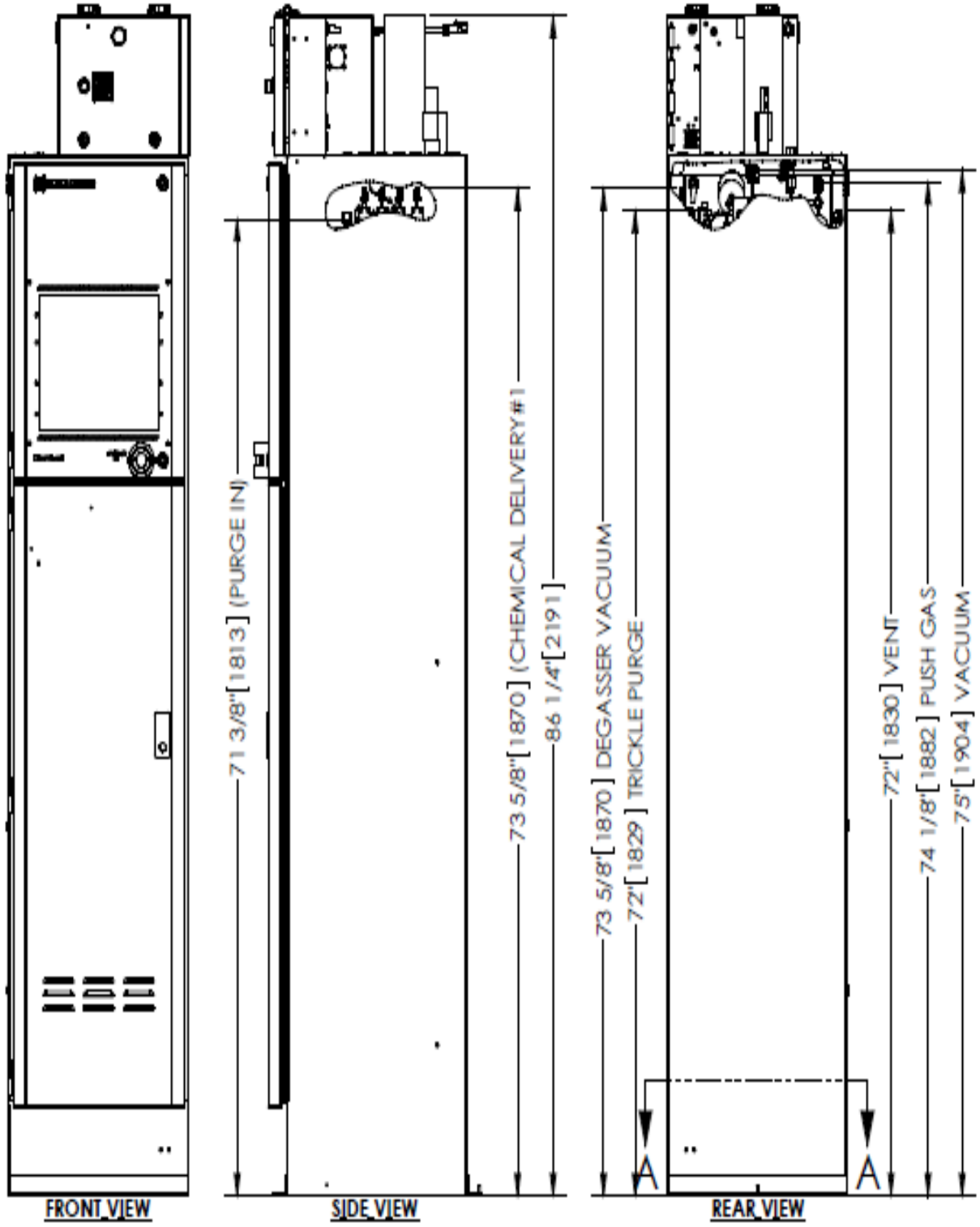


Figure 2-3: ChemGuard Gen II Cabinet Connections, Cabinet Views



2.2.1 Environmental Requirements

The customer is responsible for compliance with applicable environmental laws and regulations, including local governing agencies and state/local laws (i.e. Clean Water Act, Clean Air Act, Hazardous Waste Laws).

Table 2-2: Environmental Requirements

CONDITION	RANGE
Environmental	Operating Temperature: 0ºC to 40ºC Humidity: 5% to 95% RH, non-condensing Temperature must be compatible with chemical used.

2.2.2 Electrical Requirements

Versum Materials, Inc. recommends connection to an Uninterrupted Power Supply (UPS) and a Ground-Fault circuit Interrupter (GFCI). Versum Materials, Inc. recommends that customer electrically ground the ChemGuard® cabinet and plumbing.

S2 requires a lockout type circuit breaker setup for the AC power.

Table 2-3: Electrical Requirements

CONDITION	RANGE
AC Power	100 - 240 VAC, 100 W @ 50 - 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded; without optional degasser and pump 100 - 115 VAC, 900 W @ 50 - 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded, with optional degasser and pump

2.2.3 Process Tool Interface and Life Safety Interconnect

The external interface cable hookup between ChemGuard® product line and OEM Tool or Site Area Monitor System is customer responsibility. It is recommended to use multi-conductors shield cable with twisted pairs, 22-20 AWG, 7x30 stranded, rated 300-600V RMS, minimum 7-10 pairs (14-20 conductors) per interface.

Table 2-4: Digital I/O

DIGITAL INPUTS		DIGITAL OUTPUTS	
Input current, On	4.07 mA min.5.3 mA max.	**Resistive Load**	1.0 A @ 30 VDC, 0.5 A @ 120 VDC
Input voltage, On	3.0 VDC min.30.0 VDC max.	**Switching Power**	30 W max.

Input current, Off	100 µA max.	**Contact material**	Silver alloy, gold-etched clad
Input voltage, Off	1.0 VDC max.		
Protection	36V Zener		

2.2.4 Supply Gases

The customer is required to supply all gases, filters, check-valves, and regulators. Ensure that the required gases are available in close proximity to the ChemGuard® installation site. (see Chapter 3 for further details). Ensure there are shutoff valves and filters for gas lines feeding the ChemGuard®. Ensure the correct gases are used for the process chemical and the properties of the gas are correct for the process chemical (i.e. dry N2). (See Table 2-5).

To reduce the potential of flow fluctuations, the end-user must properly design the facilities for the ChemGuard®, i.e. incoming gas supplies and chemical delivery line layouts with adequate line size, vertical rise, horizontal length between the ChemGuard® and the process tool(s).

To avoid potential process failures here are some guidelines the end users should consider when facilitate ChemGuard® cabinets at central location.

- ChemGuard® cabinets centrally located and within close proximity to the process tool (s) to minimize the vertical and horizontal length of the chemical delivery lines.
- The incoming main gas supply to multiple ChemGuard® cabinets should be properly sized to provide adequate pressure and flow before branching out to multiple ChemGuard® cabinet connection points.
- After the main gas supply has been branched off to the individual ChemGuard® cabinets, Individual gas supply lines are equipped with individual regulators, check valves and isolation valves which have been properly sized to meet the pressure and flow requirements of the process tool (s).

A gas filter is required on the houseline supplying the ChemGuard® push gas. Failure to install a filter will void regulator and valve warranty if failed component found to have particles embedded on the seat. See Addendum B for recommended setup.

Minimum filter specifications:

- Filter = 0.003 micron.
- Flow = 50 slpm.
- Material = Electropolished 316L Stainless Steel.
- Membrane = 316L Stainless Steel or PTFE.

- Leak Tested = 100% Helium leak tested to $5x10^{-9}$ atm cc/sec ($3.8x10^{-9}$ Torr L/sec).

WARNING: DO NOT deliver process/purge gases from a high pressure gas cylinder source. The supply gases must be delivered from the house line gas source unregulated to not more than 120 psig with flow not greater than 250 slpm.

A pneumatic supply of inert gas without oxygen is recommended for the controller. **It is strongly advised to not use clean dry air for pneumatic supply.** The pneumatic supply may be shared in the controller between the pneumatic solenoids and the enclosure inerting/pressurizing service (Z-purge). Based on results from DC power harness testing, clean dry air may promote the corrosion of electrical connectors for interconnecting power cables. The presence of oxygen enhances the corrosion effect and may result in deterioration of controller performance.

Table 2-5: Supply Gases

PROCESS GAS	Helium gas is Ultra High Pure semiconductor-grade recommended. Water content < 10 ppb and O2 content < 2ppm. Recommended to use Inert Gas Purifier model # SS2500KFI4RR or equivalent. Required to install a 0.003 micron gas filter. Regulated to 722 ± 170 kPa (absolute pressure); (90 ± 10 psig, gauge pressure) Inline Filter 0.003 micron Cabinet 6.35 mm (¼ in.) VCR connection Connects to CABINET He IN port with .003 micron filter (See Figure 3-2) **For moisture sensitive chemicals, gas requirements are as follows:** Recommended the Water content < 10 ppb and O2 content < 2ppm. The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site. **WARNING:** DO NOT connect high pressure gas cylinder directly to the cabinet process/purge gas ports.
TRICKLE PURGE VENT (IF CG300, CG325, CG400NT) **TRICKLE PURGE BULK PIGTAIL (Option)**	Nitrogen gas is Pure semiconductor-grade or better recommended. Water and O2 content minimal. Required to install a 0.003 micron gas filter. Regulated to 653-723 kPa (absolute pressure); (80-90 psig, , gauge pressure) with check-valve and 100 psig PRV Inline Filter 0.003 micron Cabinet 6.35 mm (¼ in.) Swagelok connection Connects to CABINET N2 IN port with .003 micron filter (See Figure 3-2) **For moisture sensitive chemicals, gas requirements are as follows:**

	Recommended the Water content < 10 ppb and O2 content < 2ppm. The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site. **WARNING:** DO NOT connect high pressure gas cylinder directly to the cabinet process/purge gas ports.
PURGE GAS (IF OPTIONAL PURGE OUTLET MANIFOLD IS INSTALLED)	Nitrogen gas is Ultra Pure semiconductor-grade or better is recommended. Water content <10 ppb and O2 content <2 ppm. Recommended to use Inert Gas Purifier model # SS2500KFI4RR or equivalent. Required to install a 0.003 micron gas filter. Regulated to 170-515 kPa (absolute pressure); (10-60 psig, gauge pressure) with check-valve and 70 psig PRV Inline Filter 0.003 micron Cabinet 6.35 mm (¼ in.) VCR connection Connects to CABINET N2 IN port with .003 micron filter (See Figure 3-2) **For moisture sensitive chemicals, gas requirements are as follows:** Recommended the Water content < 10 ppb and O2 content < 2ppm. The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site. **WARNING:** DO NOT connect high pressure gas cylinder directly to the cabinet process/purge gas ports.
PNEUMATIC	Nitrogen gas is semiconductor-grade or better is recommended. Regulated to 722 ± 135 kPa (absolute pressure); (90 ± 5 psig, gauge pressure) Cabinet 6.35 mm (¼ in.) Swagelok connection Connects to PNEUMATIC port, coarse filter recommended (See Figure 3-2) A pneumatic supply of inert gas without oxygen is recommended for our controllers. **It is strongly advised to not use clean dry air for pneumatic supply.** The pneumatic supply may be shared in the controller between the pneumatic solenoids and the enclosure inerting/pressurizing service (Z-purge). Based on results from DC power harness testing, clean dry air may promote the corrosion of electrical connectors for interconnecting power cables. The presence of oxygen enhances the corrosion effect and may result in deterioration of controller performance. The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.

2.2.5 Vacuum Requirements

The customer is required to provide a vacuum source to ensure complete removal of vapors and atmospheric gases that invariably enter the ChemGuard® lines during reservoir change operation.

The pump should provide a vacuum pressure of less than 15 mTorr if chemical vapor pressure is < 500 mTorr at 20°C or < 80 mTorr if chemical vapor pressure is > 500 mTorr at 20°C, either by way of the Process Tool vacuum pump or through the use of a stand-alone vacuum pump.

If a stand-alone vacuum is used, Versum Materials, Inc. recommends a dry-vacuum pump. Connect it to the Vacuum IN port on the top of the cabinet. See Figure 2-2.

If Cabinet is sharing vacuum pump with Process Tool then provide an isolation valve in-line between Cabinet and Tool and/or interlock to prevent cross contamination.

Multiple ChemGuard® units can be connected to a shared single vacuum pump only when using compatible chemicals.

When multiple cabinets share a common pump, use the vacuum status outputs and bulk/process vacuum interlock inputs on the AP1551 Main I/O PCB to prevent cross contamination during container change out.

Table 2-6: Vacuum Requirements

VACUUM	Recommended customer to evaluate a dry vacuum pump requirement with the pump manufacturer in selection a compatible, adequate and suitable of handling the process chemical and/or solvent liquid as well as vapor. < 15 mTorr pressure for chemicals with a vapor pressure < 500 mTorr at 20°C < 80 mTorr pressure for chemicals with a vapor pressure > 500 mTorr at 20°C Minimum 19.05 mm (3/4 in.) Vacuum line or larger recommended. Connection is 12.70 mm (1/2 in.) male VCR, connects to cabinet VACUUM connection see (Figure 3-2) Isolation valve is recommended. Recommended vacuum line tube size versus distance: • 19.05mm (3/4 in) for distance < 5 meters (15 feet). • 25.40 mm (1.0 in.) for distance < 10 meters (32 feet). • 50.80 mm (2.0 in) for distance < 20 meters (65 feet). • 102.00 mm (4.0 in) for distance < 50 meters (164 feet).

2.2.6 Vacuum Pump Interlock

The vacuum pump interlock feature allows ChemGuard® to monitor a health status signal from the vacuum pump. A closed relay contact, or a 24 VDC signal connected to AP1551-T4 pins 3 and 4, indicates the proper operation of the vacuum pump connected to ChemGuard®.

Once the contact is opened or the voltage input is below 0 VDC, the cabinet detects a vacuum alarm condition and prevents any maintenance operation requiring the pump. A VACUUM PUMP INTERLOCK Alarm text message is displayed on the screen.

If the vacuum pump interlock signal is removed during a VACUUM Operation, the operation is terminated and all valves will be placed in safe mode. No other operation-requiring vacuum is allowed.

The VACUUM IN-USE output signal, AP1551-T9 pins 5 and 6, indicates the system is in an operation by another cabinet.

WARNING

WARNING: Pump exhaust contains chemical vapor. Pump exhaust must be connected to the appropriate abatement system for chemical used.

WARNUNG: Die Abgase der Pumpe enthalten chemische Dämpfe. Pumpenabgase müssen über ein für das jeweilig Chemikal geeignetes Abgassystem abgeführt werden.

AVERTISSEMENT: Le tuyau d'échappement de la pompe contient des vapeurs chimiques. Le tuyau d'échappement doit être connecté à un système de réduction adéquat au produit chimique utilize

.

WARNING

WARNING: Excess push gas from the Reservoir Container will be saturated with chemical vapor. Secure the vent line to the exhaust, and test to prevent vapors from escaping to the environment.

WARNUNG: Überschüssiges Treibgas vom Vorratsbehälter ist mit chemischen Dämpfen gesättigt. Um ein Austreten dieser Dämpfe in die Umgebung zu vermeiden, muß daher die Entlüftungsleitung an einen Abscheider angeschlossen und getestet werden.

AVERTISSEMENT: L'excès des gaz de poussée venant de la caisse du réservoir se trouve saturé de vapeurs chimiques. La conduite d'évent des gaz doit être installée solidement au scrubber afin d'empêcher ces gaz de s'échapper dans l'environnement.

2.2.7 Exhaust and Vent Requirements

NOTE: Vent line can be installed to the facility exhaust if exhaust is connected to the appropriate abatement system for the chemical used. Versum Materials, Inc. recommends facility exhaust controls/abatement in lieu of on-board (localized) controls/abatement system.

The reservoir vent function allows removal of pressure from the Reservoir Container. The vent should be connected to the appropriate abatement system for chemical used. Ventilation measurements should be made at a distance of four (4) duct diameters from the cabinet.

Versum Materials, Inc. recommends that ducting be made from zinc-plated steel, with operation at static pressure of 0.7 in. of water.

For chemicals authorized for use in ChemGuard®, and for exhaust flow requirements for specific process chemicals, refer to Table 5-2.

NOTE: If your installation has the combustible, lower explosion limit (LEL) vapor-detector option, see facilities requirements and Appendix F.

Table 2-7: Exhaust and Vent Requirements

EXHAUST	101.6 mm (4 in.) diameter circular duct Cabinet Exhaust Flow/Pressure Set Point: 850 Liter/minute (30 CFM) minimum recommended Connect to the appropriate abatement system for chemical used. **It is recommended to install the Exhaust line perpendicular and/or above the main abatement duct. DO NOT ENTER BELOW THE MAIN ABATEMENT DUCT TO AVOID LIQUID TRAP (See Below).**
VENT	Connect to the appropriate abatement system for chemical used. Cabinet 6.35 mm (¼ in.) Male Swagelok Connects to VENT port. See Figure 3-2. **Vent line is to be connected directly to the main abatement duct and not the ChemGuard exhaust duct.** **It is recommended to install the Vent line perpendicular and/or above the main abatement duct. DO NOT ENTER BELOW THE MAIN ABATEMENT DUCT TO AVOID LIQUID TRAP (See Below).**

2.2.8 Chemical Delivery Line Requirements

The end user must have knowledge of process flow requirements, prepare flow calculations for sufficient flow and have a carefully designed layout plan for the installation of the ChemGuard® cabinet – preferably at a central location where the facilities will meet the process tool requirements. Proper facilitation and installation will reduce and avoid potential failures, tool downtime and rework costs.

Chemical delivery line to each process tool(s) should be designed and install with minimum distance in vertical rise (height) and horizontal length between ChemGuard® cabinet and the process tool (s) to meet process operating pressure and flow rate required of the process tool (s).

NOTE: All chemical delivery line requirements are the customer's responsibility. Versum Materials, Inc. recommends installing coaxial Chemical Delivery Lines. Versum Materials, Inc. recommends customer install a lockable shutoff valve on the chemical delivery line, to comply with OSHA lockout/tagout requirements.

The customer provides the chemical delivery line. All bends should meet SEMATECH standards for bend radius.

The chemical line should be helium leak-checked, purged, cleaned and certified prior to installing and chemical introduction.

The chemical delivery line is connected to the chemical output manifold and is then directed to the Process Tool's chemical input manifold.

Table 2-8: Chemical Delivery Line Requirements

CHEMICAL DELIVERY LINE	6.35 mm (¼ in.) 316L stainless steel, electro-polished line. Bends should meet SEMATECH standards for bend radius. Versum Materials, Inc. recommends inside electro-polish rating 10RA maximum. Chemical Line should be Helium leak-checked, purged, and cleaned before installing ChemGuard. Optional Outer Coaxial Line (if required by customer or local regulations): 12.7 mm (½ in.) stainless steel.

2.2.9 Installing the Optional Coaxial Chemical Delivery Lines

The Optional Coaxial Chemical Delivery Lines comprised of:

- Outer line, 12.7 mm (1/2 in.) stainless steel line.
- Inner line, 6.35 mm (1/4 in.) stainless steel line.

Specification for outer lines

- Stainless steel line
- The line should be welded
- Sharp edges should be removed and de-burred at breaks in the line to prevent stainless steel inner line from being scratched or torn when routing through the outer line.

2.2.10 Chemical Refill Line (Optional)

The chemical refill line is an additional line, routed on top of the ChemGuard®. It allows the BULK reservoir container to be filled from an external source (i.e., ChemGuard® BCD cabinet).

2.2.11 Output Manifold (Optional)

The Output Manifold options allow the ChemGuard® to feed chemical up to four (4) tools simultaneously. Manual purge of the house lines is also available. A variety of manifolds are available, connected by 6.35 mm (¼ in.) VCR fittings. Consult your Versum Materials, Inc. sales representative for further details.

2.3 Tag and Lockout Routine

When performing certain maintenance procedures described in this manual, electrical power to the ChemGuard® must be de-energized, using site lockout/tag out procedures.

Consult your company's safety procedures for tagging and lockout instructions to be followed when performing such maintenance.

It is the customer's responsibility to ensure compliance with local electrical regulations external to the equipment.

2.4 Spill Cleanup Routine

In dealing with chemical spills/mitigating releases, 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 delivered by ChemGuard® cabinets. 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 **1-866-624-7677** (Chemical Emergency Option) or **1-610-481-4911** for specific chemical spill instructions and environmental regulatory information.

MSDS 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 from ChemGuard® Gen II.

Chapter 3: Installation

NOTE: Maintenance personnel shall make use of a step stool or small ladder to safely access the ChemGuard® GEN II controller. Operating personnel shall make use of a step stool to access the touch screen monitor as required.

3.1 Introduction

This chapter describes the installation of ChemGuard® Gen II cabinet.

Because each customer application may vary, these instructions are provided as a guideline and should not be considered as comprehensive.

Please do not begin installing the ChemGuard® Gen II unless trained individuals are present.

The ChemGuard® Gen II comes pre-calibrated and cabinet-tested. The ChemGuard® Gen II Reservoir Scale(s), dual float spill detector, banner sensor (optional), and combustible vapor detector are setup prior to leaving the factory. These items should not require calibration during installation. Please contact Versum Materials, Inc. if any of these components do not function properly.

Only ChemGuard® Gen II CG400NT included UVIR sensor.

Figures 2-2 and 2-3 show the items for making the connections to the ChemGuard® Gen II cabinet.

NOTE: When highly flammable chemicals are used and present within the equipment you must:

- Ensure the all connections made to the cabinet are leak tight.
- Use an inert gas purge to dilute the concentration of highly flammable vapors in the exhaust header to which the vent piping is connected.
- Use an inert gas purge to the vacuum pump gas ballast connection.

NOTE: The GEN II CG400NT Cabinet is equipped with UVIR sensor. If sensor trip, it will turn off all valves to the cabinet, vent the container head pressure and de-energize the fire output relay.

3.2 Installation

3.2.1 Pre-installation

This chapter describes items that should be identified and resolved prior to installing ChemGuard® Gen II.

The end user must have knowledge of process flow requirements, prepare flow calculations for sufficient flow and have a carefully designed layout plan for the installation of the ChemGuard® cabinet – preferably at a central location where the

facilities will meet the process tool requirements. Proper facilitation and installation will reduce and avoid potential failures, tool downtime and rework costs.

Chemical delivery line to each process tool(s) should be designed and install with minimum distance in vertical rise (height) and horizontal length between ChemGuard® cabinet and the process tool (s) to meet process operating pressure and flow rate required of the process tool (s).

- The maximum range that a standard ChemGuard® Gen II can deliver chemical is dependent on the chemical and the pressure of the push gas. Contact Versum Materials, Inc. for any specific delivery requirements beyond 250 meters of horizontal run and 10 meters of vertical run. These distances could be increased contingent on bends and valve count in the system.
- Install ChemGuard® Gen II using the earthquake bolt down points. Verify that the location has the stability and strength to permit the installation of support bolts.
- Verify AC power is available for ChemGuard® Gen II. (Power requirements are described in Chapter 2.)
- Verify all required gases are delivered to an area near the final position of ChemGuard® Gen II (Refer to Chapter 2).

NOTE: All chemical delivery line requirements are the customer's responsibility.

- Gases required for ChemGuard® Gen II cabinet operation are described in Chapter 2.
- The ChemGuard® Gen II requires vacuum in order to ensure complete removal of chemical vapors or atmospheric gases from the lines during a reservoir change operation.

NOTE: The customer must provide the vacuum source which is a requirement to operate the cabinet.

- The ChemGuard® Gen II requires an exhaust flow of 30 CFM. In addition to cabinet exhaust, ChemGuard® Gen II contains a reservoir vent function that permits the removal of pressure from the reservoir container. This vent should be connected to the appropriate abatement system for the chemical used.
- Coaxial chemical delivery lines are recommended for all process chemicals. In the event that a leak or rupture occurs in the main delivery lines, the liquid will be contained and be prevented from entering the environment.
- The liquid from any leak will be contained in the reservoir cabinet and be detected by the spill detector, and container then relieved to prevent any further spillage.

3.2.2 Available Configurations

The number and type of Process Tools installed limit the setup configuration of ChemGuard® Gen II. Before mixing Process Tool-types within one ChemGuard® cabinet, contact Versum Materials, Inc..

3.3 Installing the ChemGuard® Gen II Cabinet

Verify that the cabinet is in a level location with enough clearance around it so that its doors can be fully opened and so that it can be serviced easily.

Set the ChemGuard® Gen II cabinet over the bolt-down points and attach securely.

Per current United States UBC and SEMI requirements, floor bolts must be at least Grade 5 (metric Grade 8.8), at a recommended minimum length of 2.5 in. (6.35 cm).

The ChemGuard® Gen II must be grounded in accordance with Article 250 - Grounding, The National Electrical Code 1993. See Figure 2-1 for the location of the grounding lug. Versum Materials, Inc. recommends a ground resistance of <1 Ohms.

3.4 Electrical Connections

3.4.1 Installation

Versum Materials, Inc. recommends connection to an Uninterrupted Power Supply (UPS) and a Ground-Fault Circuit Interrupter (GFCI) for installations without the optional degasser and pump. A GFCI is included with the degasser option.

Versum Materials, Inc. recommends that the customer electrically ground ChemGuard® Gen II Cabinet and plumbing. OSHA standards require customer to install lockout-type circuit breaker for AC power. Per SEMI S2-93A requirements, all electrical work for ChemGuard® Gen II is Type 1 and Type 2.

Type 1 = Equipment fully de-energized.

Type 2 = Equipment is energized.

Live circuits are covered or insulated. Work is performed at a remote location to preclude accidental shock.

3.4.2 Electrical Requirements

AC POWER

100 - 240 VAC, 100 W @ 50 - 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded, without optional degasser and pump

100 -115 VAC, 900 W @ 50 or 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded, with optional degasser and pump

OSHA standards require customer to install lockout-type circuit breaker for AC power.

Versum Materials, Inc. recommends an over current protection of 10,000 Ampere Interrupt Capacity (AIC) be provided in close proximity to the unit.

WARNING

WARNING: Electrical connections should be made by a qualified electrician. AC power junction box requires Lock-out Tag-out ON/OFF capability. ½' AC power conduit hole exits top of cabinet.

WARNUNG: Elektrische Anschlüsse sollten nur durch qualifizierte Elektriker hergestellt werden. Wechselstrom-Verteilerkästen müssen einen EIN/AUS-Schalter zur Verriegelung bzw. Isolierung besitzen. Oben am Schrank wird ein ca. 15 cm (0,5 Fuß) langes flexibles Schutzrohr für Wechselstromleitungen herausgeführt.

AVERTISSEMENT: Les connexions électriques doivent être réalisées par un électricien qualifié. La boîte de dérivation de courant alternatif requiert une capacité de connexion et déconnection "ON/OFF". 15 cm (0,5 pieds) du tube souple de courant alternatif ressort du haut de la boîte.

WARNING

WARNING: Failure to follow the procedure for connecting the AC line voltage could result in injury to operator and damage to the ChemGuard Gen II unit.

WARNUNG: Nichteinhalten des Verfahrens zum Anschluß der Wechselstromspannung kann zu Verletzungen des Bedienpersonals und Beschädigung der ChemGuard Gen II-Einheit führen.

AVERTISSEMENT: Ne pas se conformer aux procédés pour le raccord de la conduite de voltage CA peut causer un danger pour l'opérateur et des dégâts à l'appareil ChemGuard Gen II.

WARNING

WARNING: To prevent electrical shock, the ChemGuard Gen II cabinet must be earth-grounded. Electrical connections should be made only by a qualified electrician.

WARNUNG: Um elektrische Schläge zu vermeiden, muß der Schrank des ChemGuard Gen II geerdet werden. Elektrische Anschlüsse sollten nur durch qualifizierte Elektriker hergestellt werden.

AVERTISSEMENT: Pour éviter tout choque électrique, la boîte ChemGuard Gen II doit être reliée à la masse. Les raccords électriques doivent être seulement exécutés par un électricien qualifié.

3.4.3 Connecting Line AC Power

WARNING

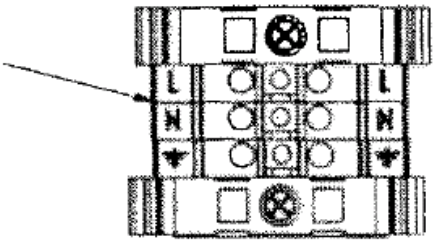
WARNING: Do not connect AC power to live line voltage until all electrical connections have been made and protective covers installed.

WARNUNG: Die Wechselstromleitung erst nach Erstellung aller elektrischen Anschlüsse und Einbau der Schutzabdeckungen an das Netz anschließen.

AVERTISSEMENT: Ne pas raccorder le cordon secteur à une tension d'une ligne active jusqu'à ce que tous les raccordements électriques aient été accomplis et tous les couvercles protecteurs installés.

WARNING
WARNING: ELECTRICAL HAZARD

A ½" conduit hole is supplied for connecting the 100-240 VAC AC line to the cabinet. The conduit hole is located on the upper back wall of the controller enclosure. The power input must be wired to the terminals shown below.



3.4.4 Connecting Degasser Vacuum Pump (Degasser option)

When degasser option is ordered, the ChemGuard® Gen II Cabinets come with a degasser vacuum pump and degasser already installed. For testing the degasser please refer to Appendix A.

NOTE: The new Degasser Vacuum Pump has larger pumping speed and it can support two degasser assemblies flow chemical simultaneously, where both degassers flow same or compatibility chemicals to each other. This is void damage to the vacuum pump in event of chemical leakage. Contact Versum Materials, Inc. EES group for detail of configuring a vacuum pump as vacuum source to degassing both degasser housings, a retrofit piping kit requires to chain both vacuum lines to a single vacuum pump.

Recommended customer to provide / hookup a larger dry vacuum sources that capable of pumping multiples degassers with same or compatibility chemicals flow, additional benefit for degassing uptime by adding a second dry vacuum as backup to primary pump in event that the primary pump is not operable.

3.4.5 Connecting Inputs/Outputs

Use the following tables to connect customer Inputs and Outputs:

Table 3-1: Cabinet Connections

Digital Input #	Input Label	AP1551 – T4	
		Signal	+24vdc
29	XFill is OFF	1	2
30	Bulk Vacuum Interlock	3	4
31	Process Vacuum Interlock	5	6
		AP1551 – T3	
36	Life Safety Shutdown	7	8
Bulk Container Code Cable option			
P2		P2J3	
26	Bulk Code Cable	2	1

NOTE: ETO software configuration is required to detect code cable option.

Outputs max. 1A @ 24vdc

Digital Output #	Output Label	AP1551 - T8		
		N.O.	COM	N.C.
9	Exhaust	11	12	10
10	Spill	8	9	7
11	Fire (UVIR Detect, ROR)	5	6	4
12	Door Open	2	3	1
		AP1551 – T10		
13	UVIR Fault	11	12	10
14	Z-Purge	8	9	7
15	LIQ IN VAC	5	6	4
16	Vapor	2	3	1
		AP1551 – T9		
17	Fill Active	11	12	10
18	XFill Request	8	9	7
19	Vac Status 1	5	6	4
20	Vac Status 2	2	3	1

		AP1551 – T11		
21	V11 Chem On	11	12	10
22	V12 Chem On	8	9	7
23	V13 Chem On	5	6	4
24	V14 Chem On	2	3	1

Table 3-2: Tool Interface – Terminal (AP1555) or DB-25

Outputs max. 1A @ 24vdc

Tool 1 Interface					
Digital Input #	**Input Label**	**AP1555 - T1**		**DB-25 (1)**	
		Signal	**+24vdc**	**Signal**	**+24vdc**
22	V11 Control	12	13	13	12
37	Fill B (Tool 1)	14	15	20	22
38	Fill A ->B (Tool 1)	16	17	23	25
Digital Output #	**Output Label**	**N.O.**	**COM**	**N.O.**	**COM**
29	Shutdown	2	3	8	15
30	Fault	4	5	10	16
31	Chemical On	6	7	9	17
32	Bulk Empty	8	9	6	18

Outputs max. 1A @ 24vdc

Tool 2 Interface					
Digital Input #	**Input Label**	**AP1555 - T2**		**DB-25 (2)**	
		Signal	**+24vdc**	**Signal**	**+24vdc**
23	V12 Control	12	13	13	12
39	Fill B (Tool 2)	14	15	20	22
40	Fill A ->B (Tool 2)	16	17	23	25
Digital Output #	**Output Label**	**N.O.**	**COM**	**N.O.**	**COM**
29	Shutdown	2	3	8	15
30	Fault	4	5	10	16
31	Chemical On	6	7	9	17
32	Bulk Empty	8	9	6	18

Outputs max. 1A @ 24vdc

Tool 3 Interface					
Digital Input #	**Input Label**	**AP1555 - T3**		**DB-25 (3)**	
		Signal	**+24vdc**	**Signal**	**+24vdc**
24	V13 Control	12	13	13	12
41	Fill B (Tool 3)	14	15	20	22
42	Fill A ->B (Tool 3)	16	17	23	25
Digital Output #	**Output Label**	**N.O.**	**COM**	**N.O.**	**COM**
29	Shutdown	2	3	8	15
30	Fault	4	5	10	16
31	Chemical On	6	7	9	17
32	Bulk Empty	8	9	6	18

Outputs max. 1A @ 24vdc

Tool 4 Interface					
Digital Input #	**Input Label**	**AP1555 - T4**		**DB-25 (4)**	
		Signal	**+24vdc**	**Signal**	**+24vdc**
25	V14 Control	12	13	13	12
43	Fill B (Tool 4)	14	15	20	22
44	Fill A ->B (Tool 4)	16	17	23	25
Digital Output #	**Output Label**	**N.O.**	**COM**	**N.O.**	**COM**
29	Shutdown	2	3	8	15
30	Fault	4	5	10	16
31	Chemical On	6	7	9	17
32	Bulk Empty	8	9	6	18

Degasser/PLIS Interface (AP1554)

Digital Output #	Output Label	PLIS1 / PLIS2 / PLIS3 / PLIS4	
		N.O.	COM
4	Degasser	7	8
30	Fault	3	4
31	Chemical On	1	2
32	Bulk Empty	5	6

Table 3-3: PLC DB25 Interface (Optional)

PLC	Assigned Function	DB25 Pin #	Polarity
Input 1	Precursor Change Ready	1	Positive
		8	Common
Input 2	LDS Valve Open	2	Positive
		9	Common
Output 1	Alarm	11	NC
		19	Common
Output 2	Warning	12	NC
		19	Common
Output 3	Information	13	NC
		19	Common
Output 4	Precursor Ready	14	NC
		19	Common
Output 5	Spare	15	NC
		19	Common
Input 6	EMO	24	NC
		25	Common

3.5 ChemGuard® Gen II I/O Interface with Controller Termination Points (Visual Aid)

System Inputs

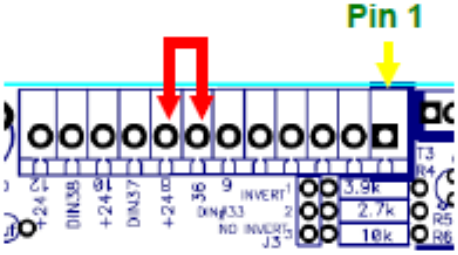
- Life Safety Shutdown – Stops all System Operation and places valves in normally de-activated state
  - Input to Main System IO board, AP1551
- External Functions - Bulk Vacuum Interlock, External Refill ON
  - Inputs to Main System IO board, AP1551
- Tool Commands - V11-14 ON, Process Fill ON, Bulk>Process Fill ON
  - Input to Tool IO board, AP1555
  - Jumpers on Cabinet Interface board, AP1552

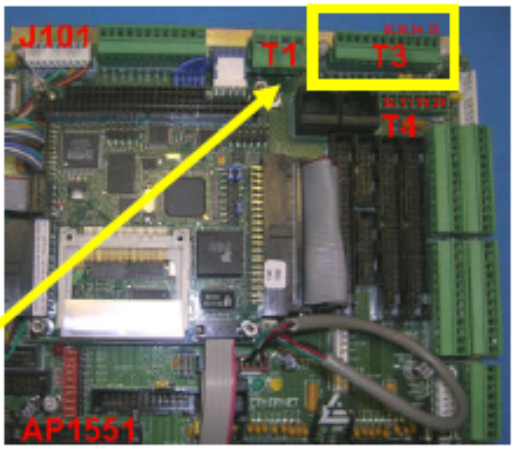
- Text in Red = Required
- Text in Blue = Recommended

- Life Safety Shutdown – To Main System IO board, AP1551

Main System IO board	ASSIGNED FUNCTION	T3	CONFIGURATION
DI36	Life Safety Shutdown	7	POLARITY
		8	Common +24

*Jumper must be installed or Customer Supplied Dry Contact Input

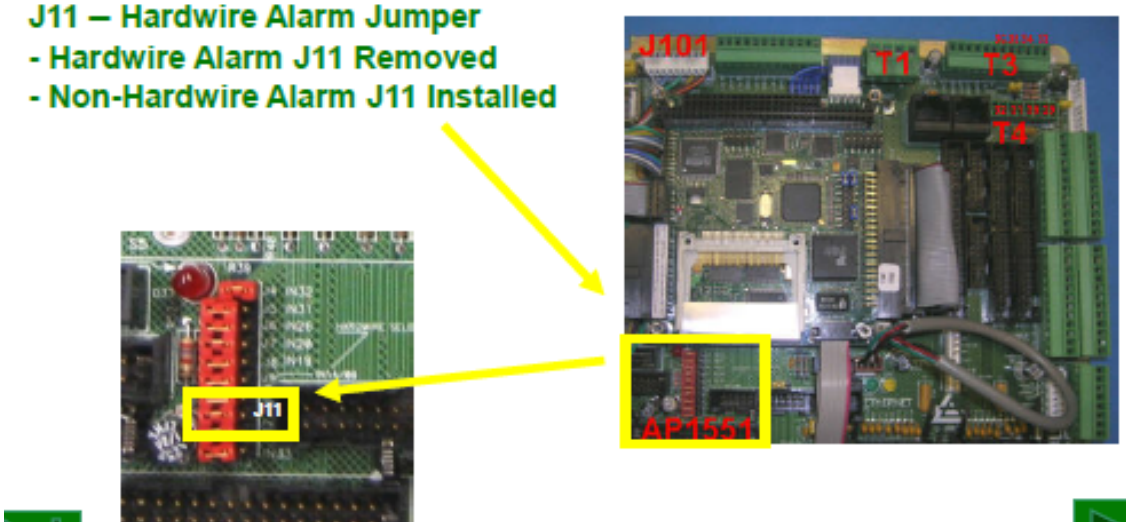




- Life Safety Shutdown – To Main System IO board, AP1551

Can select LSS to be a Hardwire Shutdown Input or a Non-Hardwire Shutdown Input

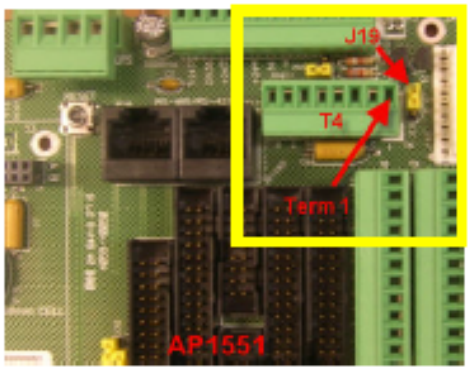
J11 – Hardwire Alarm Jumper
- Hardwire Alarm J11 Removed
- Non-Hardwire Alarm J11 Installed



• External Inputs – To Main System IO board, AP1551

Main System IO board	ASSIGNED FUNCTION	T4	SIGNAL	
DI29	XFILL OFF – from CGBCD / CG 10 Series	1	POLARITY	Configure J19 Jumper Pins 1 & 2 – Customer Supplied +24vdc Pins 2 & 3 – Dry Contact
		2	COMMON	
DI30	* VACUUM PUMP IS OFF	3	POLARITY	
		4	COMMON	
DI31	VACUUM INTERLOCK	5	POLARITY	
		6	COMMON	
DI32	SPARE	7	POLARITY	
		8	COMMON	

*Jumper must be installed or Customer Supplied Dry Contact Input to Start Change Bulk Operation

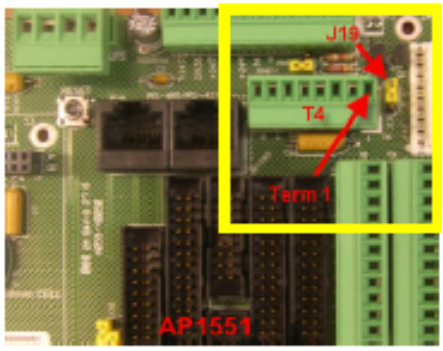


• External Inputs – To Main System IO board, AP1551

Main System IO board	ASSIGNED FUNCTION	T4	SIGNAL	
DI29	XFILL OFF – from CGBCD / CG 10 Series	1	POLARITY	Configure J19 Jumper
		2	COMMON	Pins 1 & 2 – Customer Supplied +24vdc
DI30	VACUUM PUMP IS OFF	3	POLARITY	
		4	COMMON	Pins 2 & 3 – Dry Contact
DI31	* VACUUM INTERLOCK	5	POLARITY	
		6	COMMON	
DI32	SPARE	7	POLARITY	
		8	COMMON	

*Input must be open to start Change Bulk operation

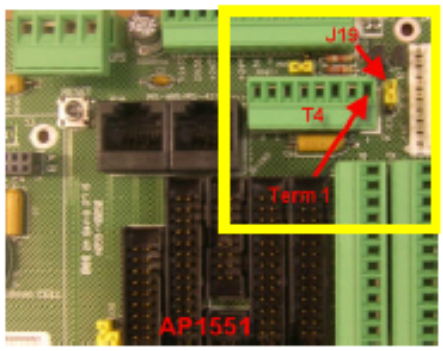
Interfaced to multiple CGs when sharing single vacuum pump



• External Inputs – To Main System IO board, AP1551

Main System IO board	ASSIGNED FUNCTION	T4	SIGNAL	
DI29	*XFILL OFF – from CGBCD / CG 10 Series	1	POLARITY	Configure J19 Jumper
		2	COMMON	Pins 1 & 2 – Customer Supplied +24vdc
DI30	VACUUM PUMP IS OFF	3	POLARITY	
		4	COMMON	Pins 2 & 3 – Dry Contact
DI31	VACUUM INTERLOCK	5	POLARITY	
		6	COMMON	
DI32	DEGASSER LEAK	7	POLARITY	
		8	COMMON	

*Input must be closed to enable/start XFILL operation from CGBCD/CG 10 Series and refill Bulk Container



▪ Tool Command Inputs – To Tool IO board, AP1555

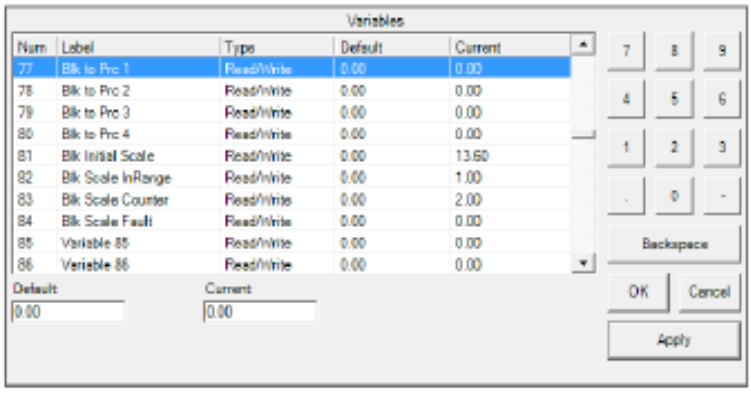
Tool Interface board, AP1555	ASSIGNED FUNCTION	T1-T4	J1-J4	SIGNAL	Valve Control Jumpers on Tool Interface PCB
DI22/23/24/25	V11-V14 VALVE CONTROL	12	13	POLARITY	V11 = J5 & J6 V12 = J7 & J8 V13 = J9 & J10 V14 = J11 & J12
		13	12	COMMON	
DI3739/41/43	Process FILL	14	20	POLARITY	Jumper at pins 2 & 3 – Dry Contact Input
		15	22	COMMON	
DI38/40/42/44	Bulk>Process FILL	16	23	POLARITY	Jumper at pins 1 & 2 – Customer Supplied +24vdc
		17	25	COMMON	
	GROUND	20	14		

New IO feature in Config File version 7.0 and greater

Variables – Bulk To Process Select Disables Bulk>Process Inputs

77 – 80 = Blk to Prc 1-4
- **Enter 0.00 to disable tool input 1-4**
- **Enter 1.00 to enable tool input 1-4**

When selected for 0, Bulk>Process inputs not required

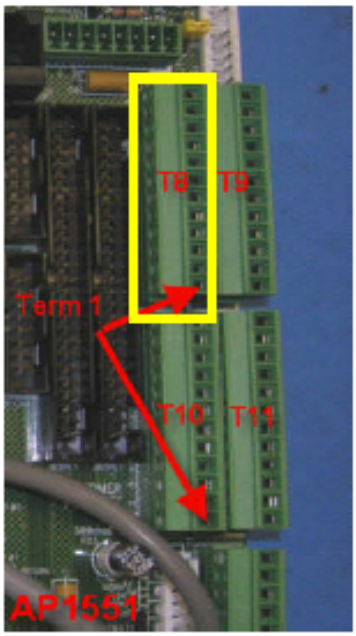


System Outputs

- Life Safety Alarm Outputs - Exhaust, Fire, Spill, Door Open, Vapor, Degasser, Liquid In Vacuum, Z-Purge
  - Outputs from Main System IO board, AP1551
- External Notifications - External Fill Active, Bulk Fill Active, Vacuum ON
  - Outputs from Main System IO board, AP1551
- Tool Alarm Outputs - Shutdown, Fault, Process Chemical ON
  - Outputs from Tool IO board, AP1555
  - Jumpers on Cabinet Interface board, AP1552
- Relay Config Option Select – Allows for customization of the 4 alarm relay outputs and LSS outputs to the tool and fab monitoring system
- Text in Red = Required
- Text in Blue = Recommended

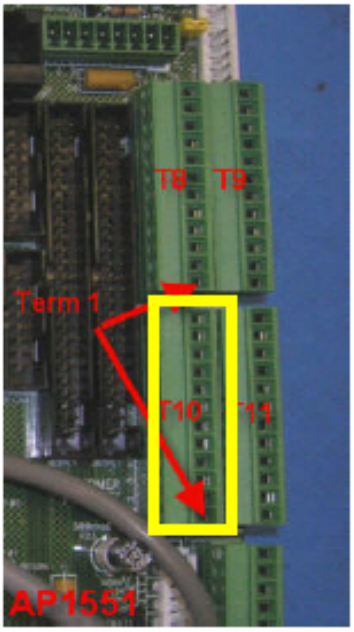
- Life Safety Outputs – From Main System IO board, AP1551

Main System IO board	ASSIGNED FUNCTION	T8	CONFIGURATION
D09	EXHAUST	12	Common
		11	N/O
		10	N/C
D010	SPILL (CG400 – UVIR Fault)	9	Common
		8	N/O
		7	N/C
D011	FIRE - (Option) - Heat ROR - UVIR -Smoke Detect	6	Common
		5	N/O
		4	N/C
D012	DOOR OPEN	3	Common
		2	N/O
		1	N/C



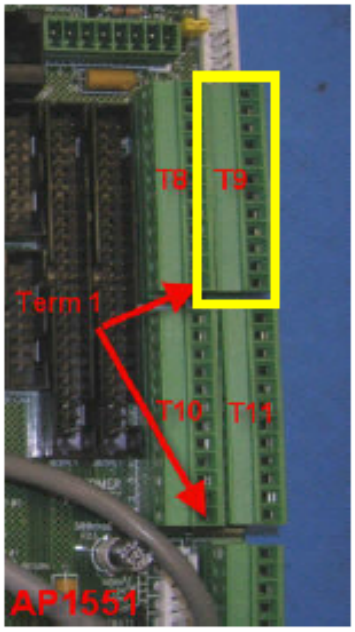
- **Life Safety Outputs – From Main System IO board, AP1551**

Main System IO board	ASSIGNED FUNCTION	T10	CONFIGURATION
D013	DEGASSER OUT	12	Common
		11	N/O
		10	N/C
D014	Z-PURGE	9	Common
		8	N/O
		7	N/C
D015	LIQUID IN VACUUM	6	Common
		5	N/O
		4	N/C
D016	VAPOR	3	Common
		2	N/O
		1	N/C



- **External Notifications – From Main System IO board, AP1551**

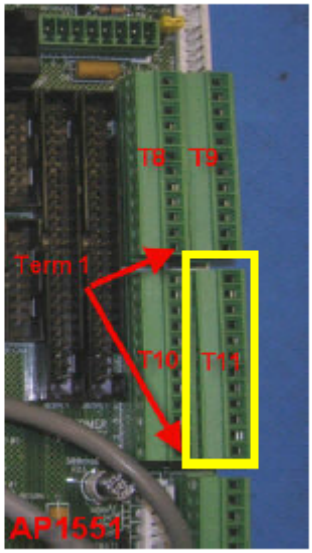
Main System IO board	ASSIGNED FUNCTION	T9	CONFIGURATION
D017	FILL ACTIVE	12	Common
		11	N/O
		10	N/C
D018	XFILL REQUEST	9	Common
		8	N/O
		7	N/C
D019	* VACUUM STATUS 1	6	Common
		5	N/O
		4	N/C
D020	VACUUM STATUS 2	3	Common
		2	N/O
		1	N/C



*Interfaced to multiple CGs when sharing single vacuum pump

▪ External Notifications – From Main System IO board, AP1551

Main System IO board	ASSIGNED FUNCTION	T11	CONFIGURATION
D021	V11 CHEM ON	12	Common
		11	N/O
		10	N/C
D022	V12 CHEM ON	9	Common
		8	N/O
		7	N/C
D023	V13 CHEM ON	6	Common
		5	N/O
		4	N/C
D024	V14 CHEM ON	3	Common
		2	N/O
		1	N/C



▪ Digital Outputs – Relay Power Condition

Configuration	Condition Power Off	Condition No Alarm	Condition Alarm
Common	Relay Energized	Relay De-Energized	Relay Energized
N/C			
Common	Relay De-Energized	Relay Energized	Relay De-Energized
N/O			

▪ Tool Alarm Outputs – From Tool IO board, AP1555

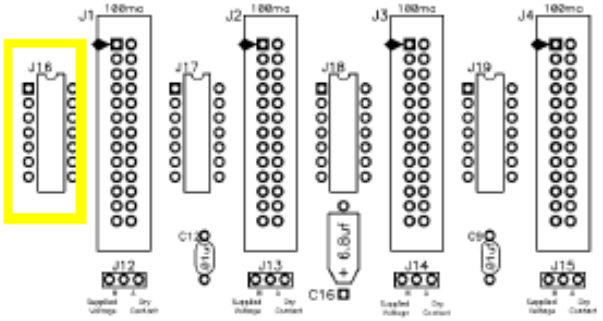
Tool IO board, AP1555	ASSIGNED FUNCTION	T1-T4	J1-J4	SIGNAL	Cabinet Interface board, AP1552
DO29	SHUTDOWN	2	8	N/O	J16-T1 J17-T2 J18-T3 J19-T4 Jumper Pack Removed – Normally Open Dry Contact Jumper Pack Installed – Connects all output commons to ground
		3	15	COMMON	
DO30	FAULT	4	10	N/O	
		5	16	COMMON	
DO31	CHEM ON (PROCESS FILL)	6	9	N/O	
		7	17	COMMON	
DO32	BULK EMPTY	8	6	N/O	
		9	18	COMMON	

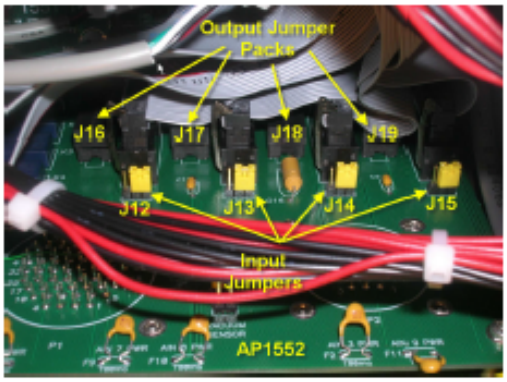
✶ SHUTDOWN Alarm = Use CHEM ON
➢ Output at T1-T4 , 6 & 7

Warning Alarm = Use Shutdown / Fault / Bulk Empty
➢ Output at T1-T4, 2 & 9
➢Jumper 3 to 4
➢Jumper 5 to 8

▪ Tool Alarm Outputs – From Tool IO board, AP1555

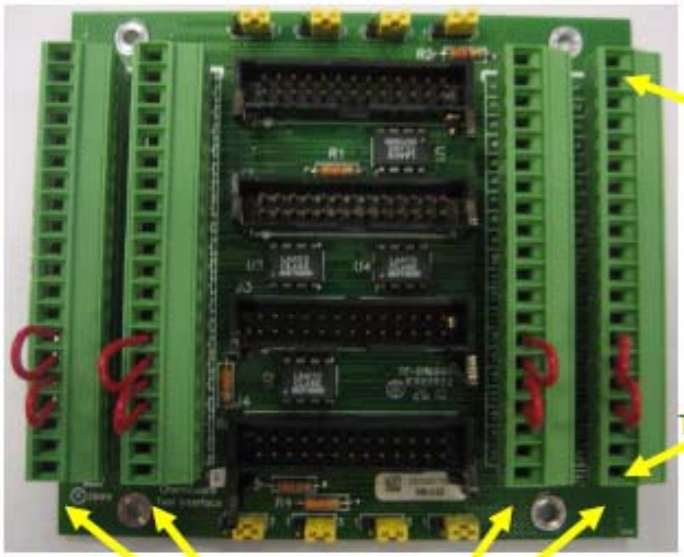
Output Jumper Packs J16, J17, J18, & J19 located on Cabinet Interface board, AP1552





Tool IO Board

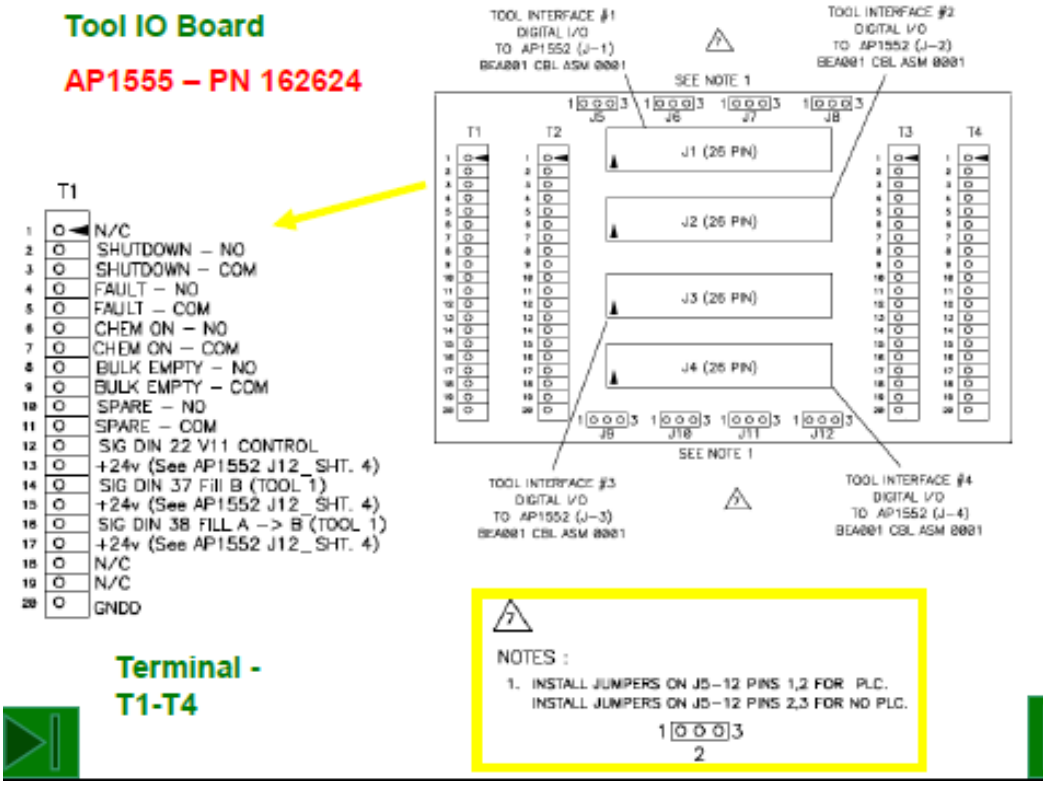
AP1555 – PN 162624



Terminal - T1-T4

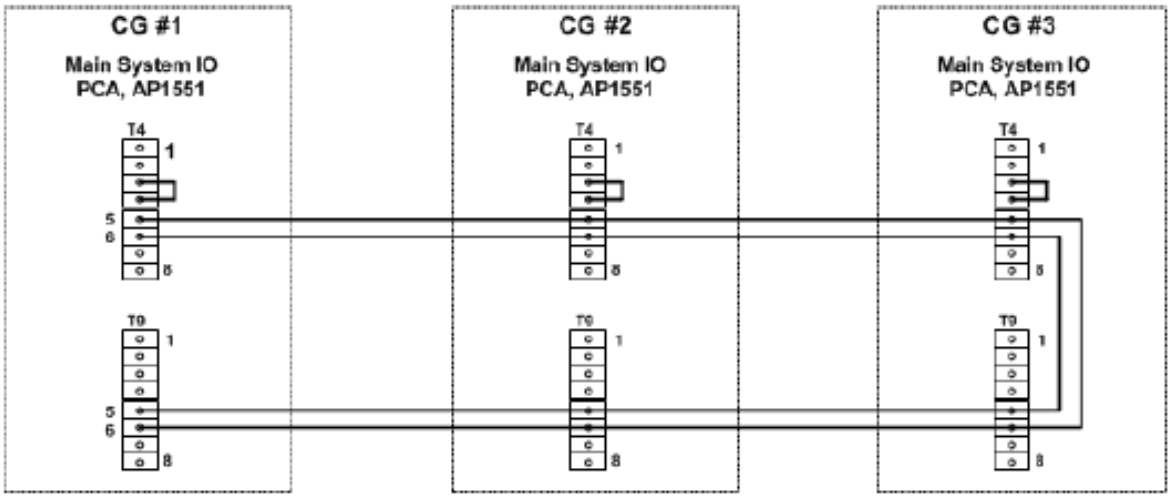
Tool IO Board

AP1555 – PN 162624



Terminal - T1-T4

Vacuum Interlock wiring for multiple CGs sharing the same vacuum pump – with Config File, version > 3.0

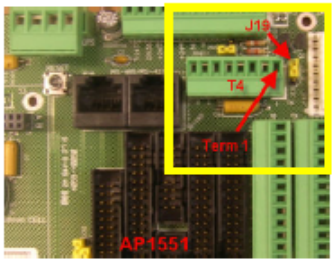


*Interfaced to multiple CGs when sharing single vacuum pump

- Vacuum Interlock Input – To Main System IO board, AP1551

Main System IO board	ASSIGNED FUNCTION	T4	SIGNAL	
DI30	VACUUM PUMP IS OFF – Input must closed to start Change Bulk Operation	3	POLARITY	Configure J19 Jumper Pins 2 & 3 set for Dry Contact
		4	COMMON	
DI31	* VACUUM INTERLOCK - Input must be open to start Change Bulk Operation	5	POLARITY	
		6	COMMON	

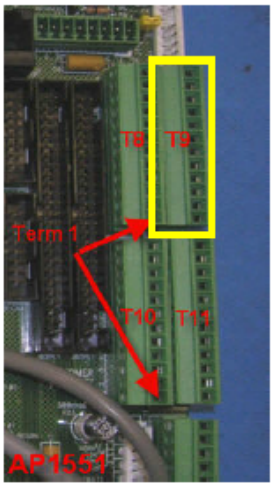
*Interfaced to multiple CGs when sharing single vacuum pump



- **Vacuum Status Output – From Main System IO board, AP1551**

Main System IO board	ASSIGNED FUNCTION	T9	CONFIGURATION
D019	* VACUUM STATUS 1	6	Common
		5	N/O
		4	N/C
D020	VACUUM STATUS 2	3	Common
		2	N/O
		1	N/C

*Interfaced to multiple CGs when sharing single vacuum pump



- **Digital Outputs – Relay Power Condition**

Configuration	Condition In Change Bulk	Condition Not in Change Bulk
Common	Relay Energized	Relay De-Energized
N/O		

*Interfaced to multiple CGs when sharing single vacuum pump

3.6 Connecting ChemGuard® Gen II Gas Lines

The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier. (See Chapter 2 for further details.)

Ensure there are shutoff valves and filters for gas lines feeding the ChemGuard® cabinet. See Figure 2-2 for ChemGuard® Gen II cabinet connections.

WARNING

WARNING: System pressures above 120 psig exceed the rating of Versum Materials, Inc. chemical containers.

WARNUNG: Bei Systemdrücken über 120 psig werden die Nennwerte für die Chemikalienbehälter der Fa. Versum Materials, Inc. überschritten.

AVERTISSEMENT: Les pressions du système dépassent l'échelle des récipients Versum Materials, Inc. au delà de 120 psig (827,76 kg/cm2).

WARNING

CAUTION: Use of a dry vacuum pump is strongly recommended. If an oil pump is used, provide trapping mechanism to minimize chemical vapor mixing with pump oil and molecular flow of oil back into mechanism.

VORSICHT: Der Einsatz einer Trockenvakuumpumpe wird unbedingt empfohlen. Wird jedoch eine Ölpumpe eingesetzt, so muß eine Scheidevorrichtung angebracht werden, um das Vermischen der chemischen Dämpfe mit dem Pumpenöl und eine Molekularströmung des Öls zurück zum Abscheider so gering wie möglich zu halten.

ATTENTION: Il est fortement recommandé d'utiliser une pompe à vide à air sec. Si une pompe à huile est utilisée, prévoir un mécanisme de rétention pour réduire au minimum tout mélange de vapeurs chimiques avec l'huile de la pompe et tout reflux moléculaire de l'huile au mécanisme de rétention.

CAUTION

CAUTION: Only one (1) ChemGuard Gen II should be open to the vacuum source at a time. Do not operate in any mode that requires using the vacuum concurrently in multiple ChemGuard Gen IIs. Possible cross-contamination could result.

VORSICHT: Es sollte nur jeweils eine (1) ChemGuard Gen II-Einheit zu einer Unterdruckquelle offen sein. Der Betrieb darf nicht in einem Modus stattfinden, der Saugdruck in mehreren ChemGuard Gen II-Einheiten gleichzeitig erfordert, da dies zu gegenseitiger Kontamination führen kann.

ATTENTION: Seulement un (1) ChemGuard Gen II doit s'ouvrir à la source d'aspiration à un moment donné. Ne pas l'opérer sous aucun mode qui exige l'utilisation simultanée d'aspiration dans des ChemGuard Gen II multiples. Une contamination croisée peut en résulter.

3.7 Chemical Delivery Line Requirements

NOTE: All chemical delivery line requirements are the customer's responsibility.

Table 3-4: Chemical Delivery Line Connections

CHEMICAL DELIVERY LINE	CONNECTS TO VALVE	VALVE CONTROL
Chemical Delivery Line #1	Valve V11	Electrically controlled by Process Tool. Table 3-2.
Chemical Delivery Line #2	Valve V12	Electrically controlled by Process Tool. Table 3-2.

Chemical Delivery Line #3	Valve V13	Electrically controlled by Process Tool. Table 3-2.
Chemical Delivery Line #4	Valve V14	Electrically controlled by Process Tool. Table 3-2.

Purge Valve on Chemical Delivery Lines

NOTE: These valves are normally stay closed during normal flow chemical to the Tools.

INDIVIDUAL PURGE CHEMICAL DELIVERY LINE	**CONNECTS TO VALVE**	**VALVE CONTROL**
Chemical Delivery Line #1	MV15	Manually operate.
Chemical Delivery Line #2	MV16	Manually operate.
Chemical Delivery Line #3	MV17	Manually operate.
Chemical Delivery Line #4	MV18	Manually operate.
COMMON PURGE CHEMICAL DELIVERY LINE	**CONNECTS TO VALVE**	**VALVE CONTROL**
Common Purge Line 1-4	MV10	Manually operate.

3.7.1 Bulk Reservoir Refill (OPTIONAL)

The BULK Reservoir (Remote) Refill is an additional line connected to the refill port (Figure 3-3) on top of the ChemGuard® cabinet. This allows the BULK reservoir container to be filled from an external source.

NOTE: The Primary valve to operate Remote Refill mode is V8A.

3.7.2 Bulk Trickle Purge Pigtail (OPTIONAL)

The Bulk Trickle Purge Pigtail is an option that cannot be utilized in conjunction with the Bulk Remote Refill option. A ChemGuard® unit cannot have both the Bulk Trickle Purge Pigtail and Bulk Remote Refill options installed simultaneously. The trickle purge provides a flow of purge gas to the Bulk Inlet / Outlet pigtails when disconnecting the Bulk container during Change Bulk operation. The trickle purge can be operated manually to purge pigtails at any time prior to installing a fresh Bulk container.

NOTE: The primary valve to operate Trickle Purge Pigtail mode is V15.

3.8 Installing ChemGuard® Gen II Reservoir Scale(s)

One (1) scale is shipped with the ChemGuard® cabinet and installed inside the cabinet for the Process reservoir. As an option a second scale may be obtained for use with the Bulk reservoir. Please contact your Versum Materials, Inc. representative for further details. (For the Bulk scale and Process scale calibration procedures please refer to Chapter 7.).

3.8.1 Bulk Scale (optional) Installation

If ordered for your installation, carefully remove the optional ChemGuard® Bulk reservoir scale assembly from its shipping carton. This is a precision instrument that can be damaged if mishandled.

NOTE: If customer desires to upgrade ChemGuard® cabinet from no scale option to scale option, then customer must order new software conversion kit as well to operate the scale.

NOTE: The new ChemGuard® cabinet sheet metal re-design released in August 2013 is no longer include the SCALE TOP PLATE [5] as shown on figure 3-1, it is an optional item. It is only included with the 38L sump spill kit option when order, it is simply place on top of the Bulk scale option without a need of bolt down.

CAUTION

CAUTION: Do not connect or disconnect scale with power ON.	VORSICHT: Die Waage nicht bei eingeschaltetem Strom anschließen.	ATTENTION: Ne pas raccorder la balance lorsque qu'elle est sous tension.

NOTE: In steps below, refer to numbered items in Figure 3-1.

NOTE: These steps apply to installation of optional scale (BULK Reservoir). (Refer to Figure 3-1.)

1. Remove the existing SCALE TOP PLATE [5] assembly from the CABINET [6].
2. Invert the SCALE TOP PLATE [5] assembly and remove the ChemGuard® Gen II NO-SCALE [2] by removing the existing SCREWS [4]. Retain the SCREWS [4] for installation of the RESERVOIR SCALE [1]. Discard the ChemGuard® Gen II NO-SCALE [2].
3. Turn the RESERVOIR SCALE [1] so that the SCALE CONNECTOR [3] points are facing toward the back of the CABINET [6]
4. While the SCALE TOP PLATE [5] is upside down, install RESERVOIR SCALE [1] into the SCALE TOP PLATE [5] using the existing SCREWS [4] removed in Step 2.

5. Flip the new SCALE TOP PLATE [5] assembly right-side up and gently set it onto the reservoir shelf inside the CABINET [6]. Ensure the new SCALE TOP PLATE [5] assembly is centered on the shelf, and not touching the side walls of the CABINET [6] at any point.

NOTE: When the SCALE TOP PLATE [5] assembly is turned right-side up, the old style RESERVOIR SCALE [1] will be upside down.

6. Press and turn to attach the SCALE CONNECTOR [3] to the socket inside the CABINET [6] under the shelf. The SCALE CONNECTOR [3] has been designed so that it can only be installed one way.

7. Perform scale calibration per chapter 7.

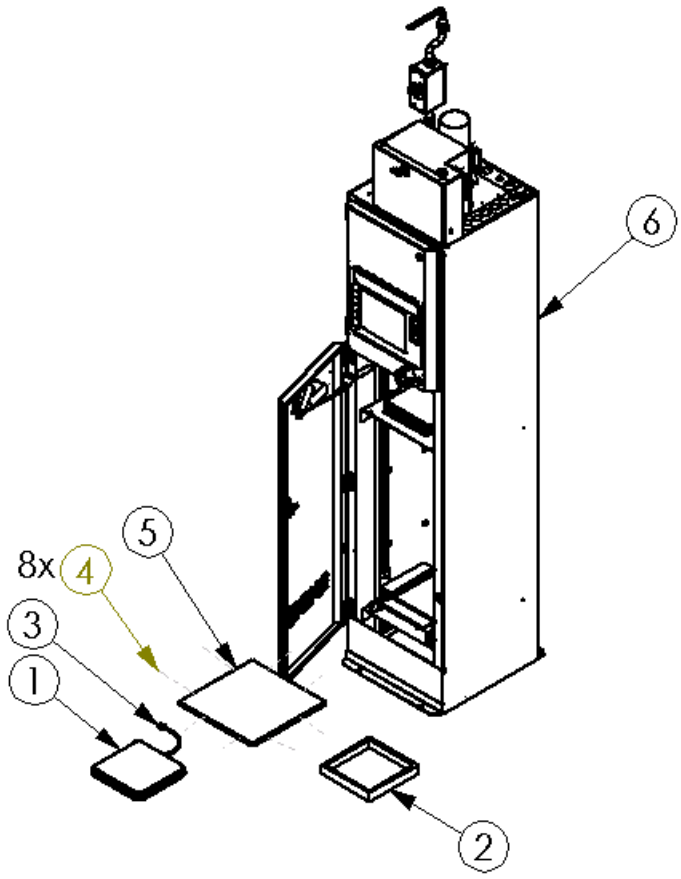
CAUTION

CAUTION: Do not drop ChemGuard Gen II Reservoir Scale while installing. This may cause damage.

VORSICHT: Die Waage beim Einsetzen nicht aufschlagen lassen da sie dadurch baschadigt warden kann.

ATTENTION: Ne pas faire tomber la balance lors de son installation. Cela pourrat causer des dommages.

Figure 3-1: ChemGuard Gen II BULK Reservoir Scale Installation



ITEM KEY

ITEM #	ITEM
1	CHEMGUARD GEN II RESERVOIR SCALE
2	CHEMGUARD GEN II NO-SCALE
3	SCALE CONNECTOR
4	SCREW
5	SCALE TOP PLATE
6	CHEMGUARD GEN II CABINET

3.9 Process Tool Interface Connection

The Process Tool Interface Connection enables the Process Tool to automatically control the main functions of ChemGuard® Gen II. It also provides alarms used by the Process Tool to automate the interface with ChemGuard® Gen II. (See Table 3-2 for connector and signal identification.). Refer to Chapter 2 for general cable specification.

3.10 Installing System Vacuum

3.10.1 Vacuum Requirements

The customer must provide a vacuum source to ensure complete removal of chemical vapors and atmospheric gases that invariably enter the ChemGuard® Gen II lines during the RESERVOIR CHANGE Operation.

Connect a vacuum line from the vacuum pump to the VACUUM connection port on top of the ChemGuard® Gen II cabinet (Figure 2-2).

WARNING

Warning: Pump exhaust contains chemical vapor. Pump exhaust must be connected to the appropriate abatement system for chemical used.

WARNUNG: Die Abgase der Pumpe enthalten chemische Dämpfe. Pumpenabgase müssen über ein für das jeweilig Chemikal geeignetes Abgassystem abgeführt warden.

AVERTISSEMENT: Le tuyau d'échappement de la pompe contient des vapeurs chimiques. Le tuyau d'échappement doit être connecté à un système de réduction adéquat au produit chimique utilisé.

3.10.2 Multiple ChemGuard® Gen II's Connected To A Single Vacuum Pump

Multiple ChemGuard® Gen IIs can be connected to a shared single vacuum pump only when using compatible chemicals.

To use this feature, the "VACUUM STATUS" output of each ChemGuard® must be connected to the "VACUUM INTERLOCK" input on all the other ChemGuard® units.

3.11 Installing System Exhaust and Vent

3.11.1 Exhaust and Vent Requirements

For Exhaust and Vent installation requirements please refer to Table 2-7.

3.11.2 Connecting ChemGuard® Gen II Exhaust

1. Connect Exhaust line to the 101.6 mm (4 in.) EXHAUST port on ChemGuard® cabinet (Figure 2-2).
2. The ChemGuard® cabinet also requires exhaust for venting of the reservoir container. During system operation the reservoir container will relieve excess push-gas to the vent connection on ChemGuard® Gen II (Figure 2-2).

Table 3-5: Connection Verification Checklist

CONNECTION	Complete
Installing the cabinet	
Electrical connections	
Supply gas	
Vacuum	
Exhaust and vent	
Chemical delivery lines 1 – 4	
Optional outer coaxial line	
Optional Bulk scale	
Optional Bulk refill line	
Optional Bulk Trickle Purge Pigtail	

3.11.3 Connecting ChemGuard® Gen II to Monitoring System

ChemGuard® Gen II cabinets can be connected to a Global Communication System (GCS) that provides continuous, 24-hour, on-line monitoring of the status of all connected ChemGuard® cabinet. The connection should be made with a 10BaseT Ethernet cable.

3.12 Initializing the System

3.12.1 System Setup

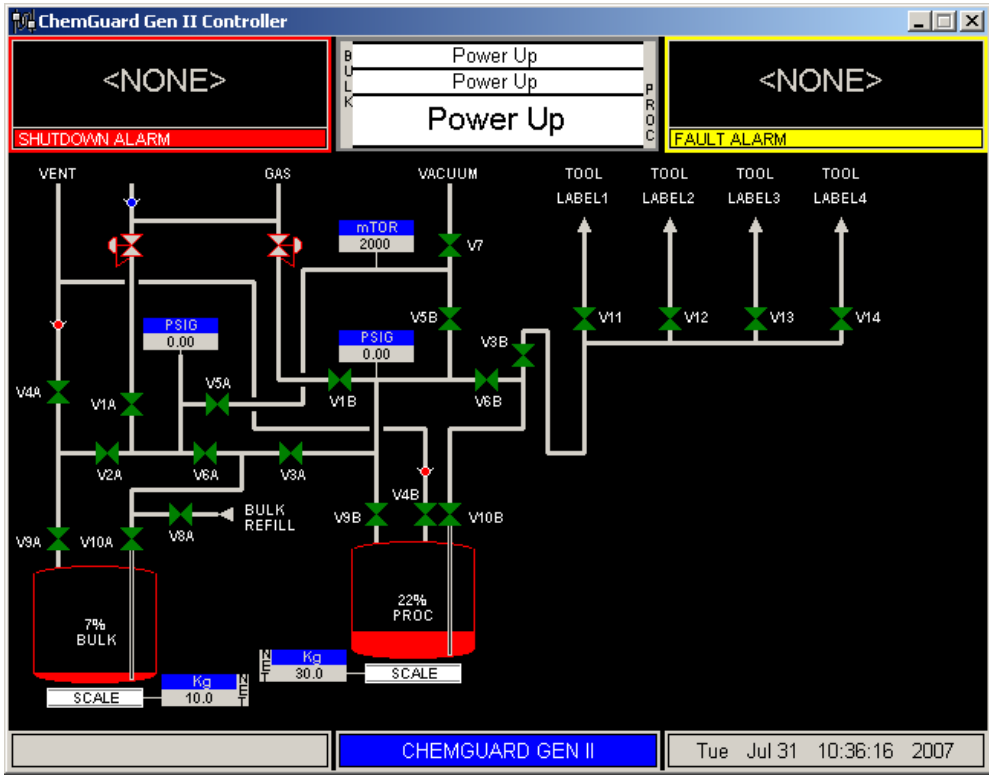
The ChemGuard® Gen II cabinet have an LCD on the front face of the cabinet that

shows a graphical display of the Bulk and Process reservoir, shutdown and fault alarm boxes, a controller status box and the selection window.

The system screen allows the operator to easily understand the operation and to quickly identify operating status. The chemical flow path is indicated by an animated dashed line and controller status is displayed in the middle of the top of the screen. Any alarm that requires the system to be shutdown is displayed in the SHUTDOWN ALARM box in the top left hand corner of the screen. Any alarm that requires operator attention is displayed in the FAULT ALARM box in the top right hand corner of the screen.

The screen that is displayed when the system is powered up is shown below.

Figure 3-2: ChemGuard Gen II Controller Power Up Screen



Main Menu and Configuration Selection Window

Once a password is successfully entered, the selection window will display on the right side of the screen to show prompts and menu selections. It will remain displayed for a configurable amount of time or until the “LOGOUT” key is pressed.

Figure 3-3: ChemGuard Gen II Controller Main Menu

To view the Main Menu in full screen mode, touch the words “Main Menu at the top of the window.

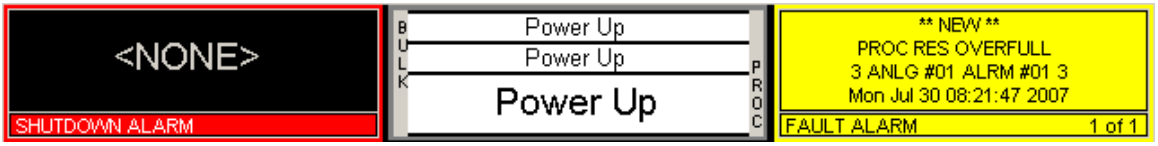
To return the Main Menu to its normal size, simply touch the words, “Main Menu,” again.

Alarm and Controller Status Boxes

Shutdown alarms will appear on the SHUTDOWN ALARM box, located in the top left hand corner of the screen. Fault alarms will appear on the FAULT ALARM box, located in the top right hand corner of the screen. A time stamp of when the alarm occurred will be displayed with each alarm.

If <NONE> is displayed, no alarm conditions are present.

Figure 3-4: Alarm and Controller Status Boxes



VGA LCD Display

The VGA LCD display, located on the door of the ChemGuard® Gen II controller, provides visual indication of pneumatic valve positions. Conforming to ISA standards, open valves are shown in red and closed valves are shown in green. A legend for the color code is on the side of the LCD for reference.

Display LEDs

LEDs displaying ChemGuard® Gen II functions are located to the right of the LCD display. The table below describes these LEDs and their functions.

Table 3-6: Controller LEDs

LED	FUNCTION
SHUTDOWN ALARM	This LED flashes red on power up and for an un-acknowledged shutdown alarm. Once acknowledged, the LED stops flashing but remains red until it is reset.
FAULT ALARM	This LED flashes yellow on power-up and for a fault alarm. Once acknowledged, the LED stops flashing but remains yellow until it is reset.
CHEMICAL FLOWING	This LED lights green when process fill is enabled and tool inputs are satisfied.
POWER	This LED indicates that there is +5 VDC power to the unit.

Screen Saver

When the programmed amount of time has elapsed since the operator's last keypad action, the screen saver blanks the screen and a randomly-moving mode indicator box appears. This occurs during the following states: idle, Process Fill, Bulk->Proc Fill and External Fill (in systems with a Bulk refill option.)

The screen saver will de-activate if a new alarm appears.

To manually de-activate the screen saver, touch the screen

The screen saver function will not be active while a fault or shutdown alarm is present, an active prompt is displayed, or during any mode/sequence other than idle and Process on (Process Fill, Bulk->Proc Fill or External Fill, if Bulk refill option is available).

3.12.2 Source System Configuration

ChemGuard® Gen II controller files may be modified to customize the system

operation for a particular installation or application using a second or third level security code. These modifications are referred to as the “source system configuration”. Cabinet parameters for Bulk Reservoir, Process Reservoir, Bulk Change and Process Change must be defined and entered into the system memory. Select this item to set up the ChemGuard® Gen II cabinet operating parameters.

From the Main Menu, select the Configuration Menu to display some configurable parameters and change user configurable parameters.

For safety considerations, most configuration parameters may be changed only by Versum Materials, Inc. technical personnel. The following paragraphs describe the parameters that the operator may view and/or change.

Net Product

You can enter the Net Liquid Weight and the Current Weight. For example, since all vessels are shipped from the factory with a fill weight, a typical 19L vessel has a full net weight of 17.4kg. Enter the Net weight in the NET window and the fill weight scribed on the vessel in the “Current Weight” window. Tap the OK button. This will generate the ratio of the Net and the Current weights as a percentage of full on the animated graphical screen. The gross value will display the normal analog reading with no adjustment.

User Set points

Choose an analog input device from a drop down menu. When the operator chooses an analog input device, the corresponding setpoints will be displayed and can be changed. The User Analog Setpoints window displays the customer/user-defined analog alarm data. The window displays the alarm number, alarm label, and current alarm setpoint for each user-defined alarm. A total of ten setpoints exist per analog input. The number of user setpoints will be equal to ten minus the number of VERSUM MATERIALS, INC. setpoints. This window allows the operator to enter a new setpoint value for one or more chosen alarms or exit the window without changes.

Enter parameters for each of the analog items, referring to the appropriate table for recommended parameters and settings for your specific installation.

NOTE: Numbers displayed in these illustrations are for theoretical purposes only. Refer to the information in the tables and to your own system requirements for actual parameter values.

To change a setpoint, first select the analog input device from the drop down menu. Then highlight the setpoint of your choice by touching the screen. Using the keypad, enter a numeric value into either the “Setpoint” or “Setpoint Percent” box. Press “APPLY” to accept the changes or “OK” to exit the window. Any change in

the “Setpoint Percent” will change the value of the “Setpoint” and vice versa.

NOTE: To change Scale values, enter them in the “Setpoint Percent” box, but do not change the “Setpoint” box. For vacuum and push pressure values, change the “Setpoint” box, but do not change the “Setpoint Percent” box.

The following section describes the Bulk reservoir setup parameters and how to set them in ChemGuard® Gen II controller. The table below lists all the Bulk reservoir setup parameters.

BULK RESERVOIR Setup General Parameters

PARAMETER	RECOMMENDED	Unit
BULK FULL	Weight indicated on container label	gms
CURRENT WEIGHT (i.e., chemical currently in reservoir)	Automatically updated during CHANGE RESERVOIR Operation	gms
PUSH HIGH	59 psig	psig
PUSH LOW	30 psig	psig
LEVEL LOW (i.e., low-level alarm point)	7%	%
LEVEL EMPTY (i.e., empty alarm point)	3%	%
FILL TIME	0 seconds	sec
REFILL LEVEL	0%	%
START XFILL LEVEL (If system has external fill option, external fill operation will start when level reaches this setpoint)	17%	%

To setup Bulk reservoir parameters in ChemGuard® Gen II:

From the Main Menu, select CONFIGURATION MENU to display the Configuration Menu. From the Configuration Menu, select USER SETPOINTS.

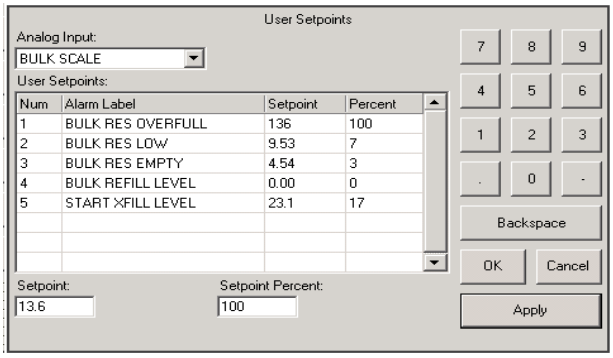
Bulk Scale:

To set/change Bulk scale-related setpoint parameters, select BULK SCALE from the pulldown menu in the USER SETPOINTS screen. Highlight the parameter to be changed and enter the value in the “Setpoint Percent” box. Click “APPLY” to

accept the changes. Bulk scale parameters have to be entered in terms of percentage (%). Use the “Setpoint Percent” box to set/change any Bulk scale parameters.

Note that this will automatically change “Setpoint” parameters also.

- Bulk Res Overfull
- Bulk Res Low
- Bulk Res Empty
- Bulk Refill Level
- Start XFill Level



NOTE: If the cabinet has an external fill option, the external fill operation will start when the Bulk level reaches Start XFill Level setpoint.

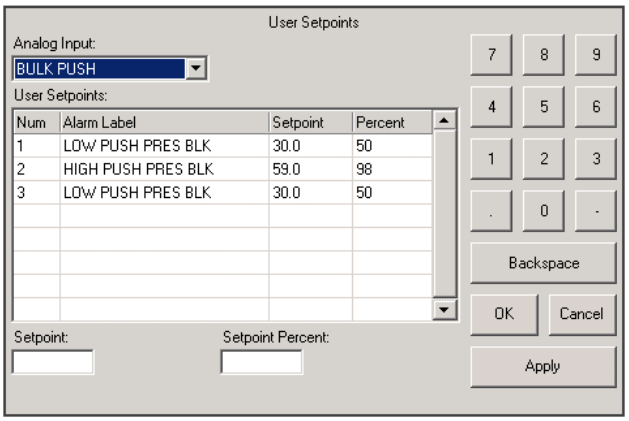
NOTE: For Bulk scale parameter, do not enter a value in the “Setpoint” box. Enter only in the “Setpoint Percent” box.

Bulk Push Pressure:

To set/change Bulk pressure-related setpoint parameters, select BULK PUSH from the pull-down menu in the USER SETPOINTS screen. Highlight the parameter to be changed and enter the value in the “Setpoint” box. Click “APPLY” to accept changes.

NOTE: Bulk push parameters are not used in terms of percentage, so use the setpoint box to enter new values.

- Low Push Pres Blk
- High Push Pres Blk
- Low Push Pres Blk



Setpoint for Low Push Pres Blk should be set at both places in the above screen (Num 1 and Num 3). It is very important that these values are set to the same value since both setpoints are used to trigger the Low Push Pres Blk alarm.

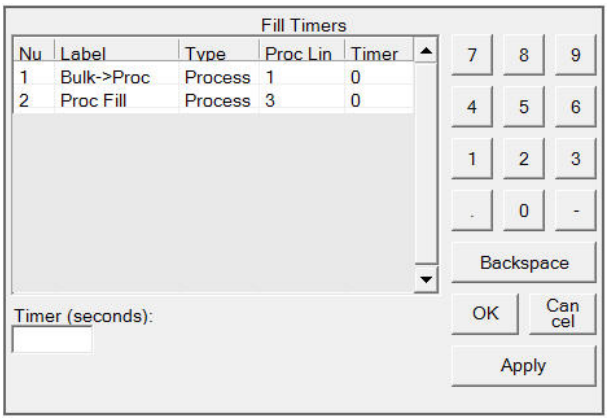
Fill Time:

To change/set fill timer values, from the Configuration Menu, select SYSTEM SETUP to display the System Menu. Select FILL TIMERS.

NOTE: A zero for any timer value means no timeout value will exist.

Bulk Fill Time:

To select the Bulk fill timer, select Bulk->Proc and key in a numeric value for the timer. Press “APPLY” to accept the changes. Press “OK” to exit the window.



Process Fill Time:

To select Process fill timer, select Proc Fill and key in the numeric value for timer. Press “APPLY” to accept the changes. Press the “OK” button to exit the window.

NOTE: Process Fill Timer is use as desire option for refillable ampoule onboard the process tool.

The following section describes all Process reservoir setup parameters and how to set them in ChemGuard® Gen II controllers. The table below lists all the Process reservoir setup parameters.

PROCESS RESERVOIR Setup General Parameters

PARAMETER	RECOMMENDED	UNIT
PROC FULL	Enter value from Table 3-15	gms
CURRENT (i.e., chemical currently in reservoir)	Enter 0 (zero) if container is empty	gms
PUSH HIGH	30 psig	psig
PUSH LOW	20 psig	psig
LEVEL LOW (i.e., low-level alarm point)	65%	%
LEVEL EMPTY (i.e., empty alarm point)	50%	%

FILL TIME	0 seconds	sec
HI REFILL	70%	%
LOW REFILL	68% (HI REFILL – 2)	%

To set-up Process reservoir parameters in ChemGuard® Gen II:

From the Main Menu, select CONFIGURATION MENU to display the Configuration Menu. From the Configuration Menu, select USER SETPOINTS.

Process Scale:

To set/change Process scale-related setpoint parameters, select PROCESS SCALE from the pull-down menu in the USER SETPOINTS screen. Highlight the parameter to be changed and enter the value in the “Setpoint Percent” box. Click “APPLY” to accept changes.

NOTE: Process scale parameters have to be entered in terms of percentage (%). Use the “Setpoint Percent” box to set/change Process scale parameters. This will automatically change “Setpoint” parameters also.

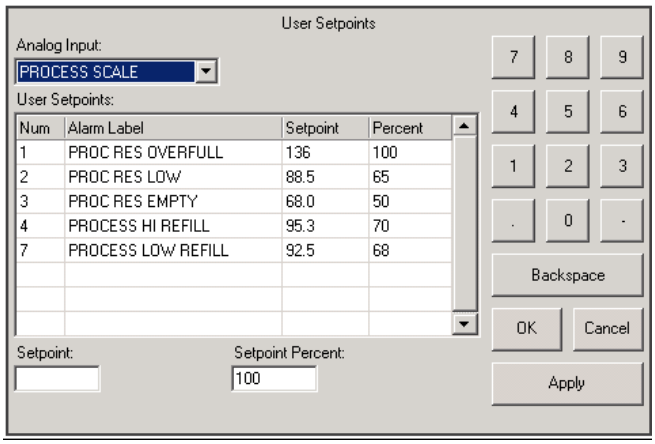
Proc Res Overfull

Proc Res Low

Proc Res Empty

Process Hi Refill

Process Low Refill



NOTE: When Bulk to Process operation is enabled, Bulk to Process operation starts when the Process level reaches the “Process low refill” setpoint and stops when the Process level reaches the “Process hi refill” setpoint.

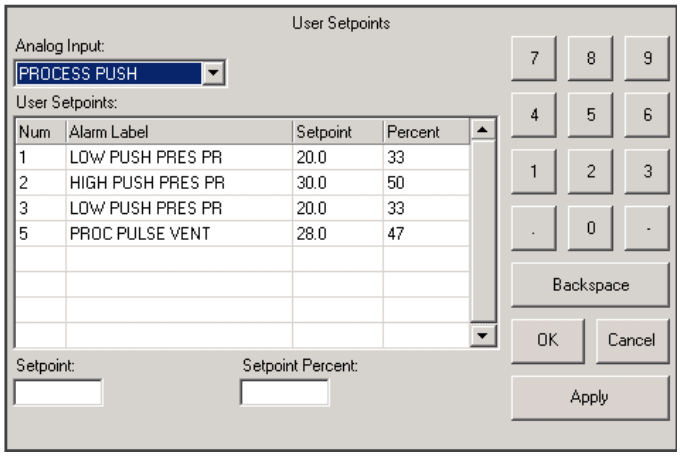
NOTE: For Process scale parameter, do not enter value in “Setpoint” box. Enter only in “Setpoint Percent” box.

Process Push:

To set/change the Process scale related setpoint parameters, select PROCESS

SCALE from the pull down menu in the USER SETPOINTS screen. Highlight the parameter to be changed and enter the value in the “Setpoint” box. Click “APPLY” to accept changes. Process push parameters are not used in terms of percentage.

- Low Push Pres PR
- High Push Pres PR
- Low Push Pres PR
- Proc Pulse Vent



It is very important that the Setpoint for Low Push Pres PR be set at both places in the above screen (Num 1 and Num 3) since both setpoints are used to trigger Low Push Pres PR alarm.

The “Proc Pulse Vent” setpoint should be set at least 2 psi below High Push Pres PR – 2.

NOTE: Any time “High Push Pres PR” setpoint is changed, please remembers to change “Proc Pulse Vent” setpoint.

Subcycle Parameters

This option displays the current values for the purge parameters, which are primarily used during Bulk change and Process change operations. You may increase these values, but may not decrease them below their pre-programmed minimum.

NOTE: The maintenance routines are embedded into the change routines.

The table below identifies the parameters used in bulk change and process change operations along with location from where these options can be changed.

BULK RESERVOIR Change General Parameters

Parameter	Recommended	Option for Changing Parameter
BULK PMPDN SPT	200 mT	User Setpoints->Vacuum
BASE SPT	PUMP BASE PRESSURE + 10 mT	User Setpoints->Vacuum
LEAK RATE	20 mT/min	Leak Test Parameters

PURGE CYCLES	99	Subcycle Parameters->Cycl Prg B
INITIAL PURGE	15 sec.	Alarm Delays->Initial Purge Bulk
EXTRA CYCLES	5	Subcycle Parameters->Ext Cyc B
POST CYCLES	3	Subcycle Parameters->Pst Cyc B

PROCESS RESERVOIR Change General Parameters

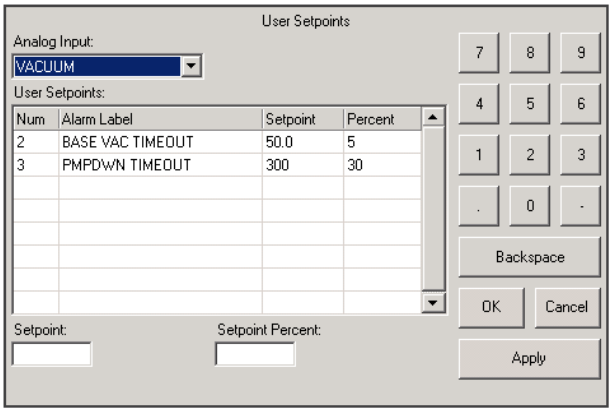
Parameter	Recommended	Option for Changing Parameter
PROC PMPDN SPT	200 mT	User Setpoints->Vacuum
BASE SPT	PUMP BASE PRESSURE + 10 mT	User Setpoints->Vacuum
LEAK RATE	20 mT/min	Leak Test Parameters
PURGE CYCLES	99	Subcycle Parameters->Cycl Prg P
INITIAL PURGE	15 sec.	Alarm Delays->Initial Purge Proc
EXTRA CYCLES	5	Subcycle Parameters->Ext Cyc P
POST CYCLES	3	Not Available since parameter is not used in sequence

The vacuum-related setpoints can be changed from the USER SETPOINTS section of the Configuration menu. To access user setpoints, select the CONFGURATION MENU button from MAIN MENU and select the USER SETPOINTS button. From the ANALOG INPUT pull-down menu, select VACUUM. Highlight the parameter to be changed and enter the value in “Setpoint” box. Click “APPLY” to accept changes.

NOTE: Vacuum parameters have to be entered in terms of setpoints. This will automatically change “Setpoint Percent” parameters also. Press “OK” or “CANCEL” to exit the window.

Vacuum:

- Base Vac Timeout
- PmpDwn Timeout



Since the Vacuum source for Bulk and Process reservoirs are the same, vacuum-related setpoints need to be set once for both Bulk and Process.

NOTE: Enter vacuum setpoints as SETPOINT and do not enter them as SETPOINT PERCENT.

The following are important purge parameters:

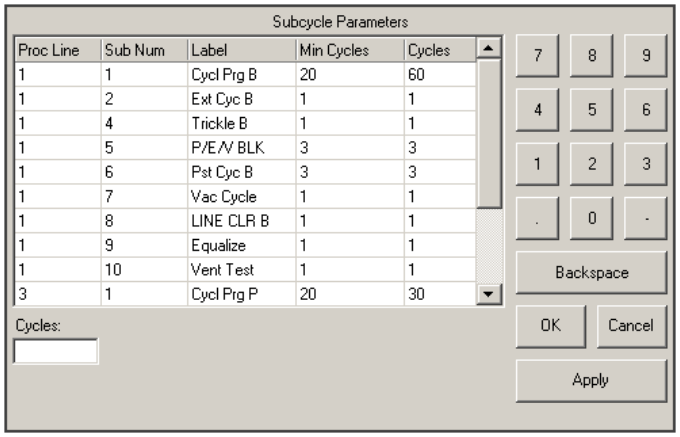
Cycl Prg B = 20
(Bulk Purge Cycles)

Ext Cyc B = 1
(Bulk Extra Cycles)

Pst Cyc B = 3
(Bulk Post Cycles)

Cycl Prg P = 20
(Process Purge Cycles)

Ext Cyc P = 1
(Process Extra Cycles)

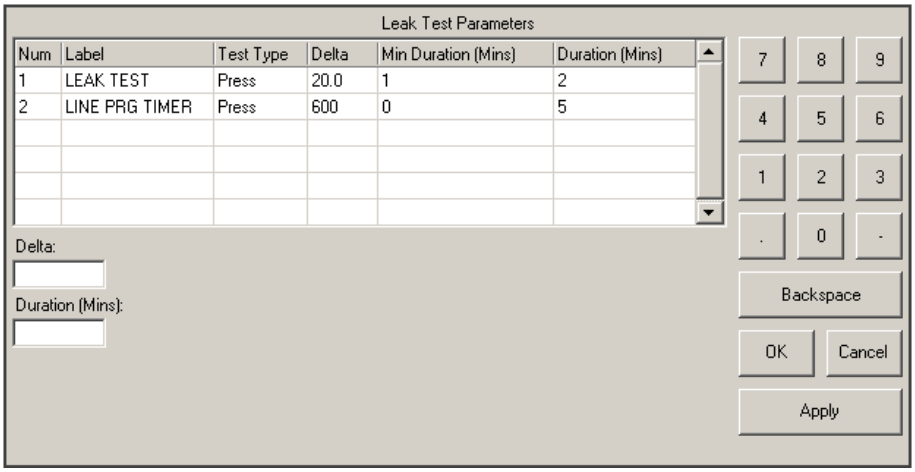


Highlight the parameter to be changed and use the keypad to type in a numeric value. Press “APPLY” to accept the changes. Press “OK” or “CANCEL” to exit the window.

Leak Test Parameters

This option displays the current values for the leak parameters. You may increase these values, but may not decrease them below their pre-programmed minimum.

Highlight the parameter to change and use the numeric keypad to enter a value for Delta or Duration. Click “APPLY” to accept the changes. Click “OK” or “CANCEL” to exit the window.



3.13 SYSTEM FEATURES

3.13.1 Manual Operation

⚠CAUTION

Only experienced operators should operate the ChemGuard® Gen II in manual mode. Operating valves out of their proper sequence could potentially cause damage to the product by interrupting or providing insufficient gas flow. Manual operation should not be used for normal, daily operation.

Manual mode provides a means of flowing purge gas through the purge and process gas panels during cabinet installation and pre-start-up procedures. It also provides a means of flowing purge gas while maintenance or repairs are being performed.

How to Operate in Manual Mode

⚠WARNING

Operating in Manual Mode could cause the following hazards which can result in PERSONAL INJURY OR DEATH.

- **Opening valves when high pressure push gas is present.**
- **High pressure gas could be vented.**
- **Opening vent valves when high pressure gas is present.**

NOTE: Due to the potential hazards listed above, Manual Mode operation requires a second level security code.

Select anywhere on the graphics portion of the screen and enter the password.

Press “OK”

From the Main Menu screen, click "MANUAL MODE".

The MANUAL MODE window will display

Operate valves referring to “How to Open and Close valves” section below.

To exit MANUAL MODE, press “CANCEL”.

NOTE: Pressing “CANCEL” will automatically close any valves which were left open unless the secure mode feature is used as seen below.

How to Open and Close Valves

To open a valve:

Select the valve by touching the screen. The valves that can be operated from the screen will be highlighted with a yellow box

The valve confirmation window will appear, asking you to confirm that you want to open the valve by pressing “OPEN VALVE”. Pressing “CANCEL” will close the window, leaving valve closed

To close a valve:

Touch the valve you want to close by selecting the valve on the touch screen.

To SECURE Manual Mode:

The Secure option allows the operator to exit the Manual Mode menu while remaining in manual mode with valves open. (The Secure option will not be selectable if no valves are open.) When the operator chooses Secure Mode from the Manual Mode window, the controller leaves the bank in manual and allows the operator to go to other screens. Any open valves will remain open, and the Mode Status Box will continue to indicate manual mode. Manual mode will remain active or ‘secured’ until an operator reenters the Manual Mode window. While manual mode is ‘secured’, Manual Mode will be the only selectable option on the Main Menu.

ChemGuard® Gen II must not be left unattended in Manual Mode, as access to the system in Manual Mode is open to anyone.

3.13.2 System Test

Test Digital In

This option displays a list of the digital inputs and their current state. The state may be used to determine if the digital device is operating properly.

This file operates in a similar manner to manual operation as described in Section 3.13.1. It is the customer's responsibility to adhere to all operational warnings in Section 3.13.1 when performing the Digital Out Test.

Use the scroll bar to view all the digital input values.

Test Digital Out

This option displays a list of the digital outputs and their current values. Outputs may be forced "on" (energized) or "off" (de-energized) to determine if the output is operating properly.

Use the scroll bar to view all the digital output values.

Extreme care must be taken when forcing a digital output either on or off as there is no confirmation in Digital Out Test, as a reminder, like that which is used in manual operation for critical valve operation.

Test Analog In

This option displays a list of the analog inputs, their current values (net or gross), and the raw signal input. The current value may be used to determine if the analog device is providing accurate output (controller input).

Use the scroll bar to view all the analog input values.

Test Internal Flag

The Test Internal Flags window will display the internal flag number, label, and state (Set or Clear) for all internal flags in the system. This window will allow the operator to exit the window or change one or more internal flag states to SET or CLEAR. To change an internal flag state, highlight the desired internal flag to change and select SET or CLEAR at the bottom of the window. Clicks APPLY. Upon exiting the Test Internal Flags window, any changes made to internal flag states will be ignored and the internal flag states will return to their original state.

Extreme care must be taken when changing the state of an internal flag. The operator must fully understand the use of the flag prior to any edits.

Test Remote In

This option is not available in ChemGuard® Gen II cabinet.

3.13.3 Valve Setup

The Valve Setup window displays the solenoid number, valve label, and valve confirmation for each valve in the system. This window allows the operator to change the valve confirmation mode for one or more valves or exit the window without changes. The valve confirmation mode will be set to CONFIRM or NO CONFIRM.

3.13.4 Valve Counts

The Valve Counts window displays each valve in the system and the count for each valve. The valve count represents the number of times a pneumatic valve has cycled (opened and closed). This window allows the operator to change the valve count for one or more valves or exit the window. New valve counts are written to the NV Data File upon exiting and saving the Configuration Menu.

3.13.5 Operation Sequences

The Operation Sequences window displays a menu, listing the following for each

operational sequence defined in the Configuration File: process line number, an indication of whether the sequence is a main menu sequence, sequence type, sequence number, and sequence label. This menu allows the operator to exit the window or view an operational sequence by choosing the desired sequence. Changes to operational sequences are not allowed.

3.13.6 Sequence Flow Options

The Sequence Flow Options window displays a list of all Main Menu Sequences in the system. The operator is allowed to choose one of these sequences. When the operator chooses a sequence, a window appears with the sequence label as the title. The window displays the end, stop, and fail options lists defined in the Configuration File for the chosen sequence. The end, stop, and fail options lists contains the sequence label of each main menu sequence that is permitted to be selected from the main menu after an end, stop, or fail of the chosen sequence. Changes to sequence flow options are not allowed.

3.13.7 Prompt List

The Prompt List window displays the prompt number and prompt label for each of the prompts in the system. The window allows the operator to view the prompt list or exit the window. Changes to the prompt list are not allowed.

3.13.8 Set Time/Date

The Set Time/Date window displays the current time and date for the system. The window allows the operator to exit the window or enter a new time and/or date by selecting to the appropriate prompt.

3.13.9 Analog Scaling

The Analog Scaling window displays all the analogs used in the system. The operator can choose an analog or exit the window. After selecting an analog, the operator can change the maximum and minimum scaling values using the keypad. The Analog Scaling window displays the analog number, analog label, device type (milliamps or volts), minimum analog value, and maximum analog value for each analog point. This window allows the operator to exit the window or enter a new analog range minimum and/or analog range maximum for one or more analog points.

3.13.10 Setpoints

The VERSUM MATERIALS, INC. Setpoints window displays all analogs used in the system. The operator can choose an analog from the drop down menu and the

corresponding setpoints for that analog will be displayed. The VERSUM MATERIALS, INC. Setpoints window displays the VERSUM MATERIALS, INC.-defined analog alarm data. The window displays the alarm number, alarm label, and current alarm setpoint for each VERSUM MATERIALS, INC. alarm. A total of ten setpoints will exist per analog input. The number of VERSUM MATERIALS, INC. setpoints will be equal to ten minus the number of user setpoints. This window allows the operator to enter a new setpoint value for one or more chosen alarms or exit the window without changes. The VERSUM MATERIALS, INC. Setpoints window will only be accessible with an VERSUM MATERIALS, INC. level password.

3.13.11 Alarm Conditions

The Alarm Conditions window displays the alarm input type, alarm number, alarm label, and alarm condition for each system alarm. This window allows the operator to change the alarm condition for digital alarms to closed, open, or not used and the alarm condition for analog alarms to high, low, or not used. The window allows the operator to change one or more alarms or to exit the window without changes.

3.13.12 Alarm Delays

The Alarm Delays window displays the alarm input type, alarm number, alarm label, and current alarm time delay (in seconds) for each alarm in the system. The window allows the operator to enter a new time delay value for one or more alarms or exit the window. A delay entry of ‘0’ equates to no delay. The range of values is from 0 to 255 seconds.

3.13.13 Alarm Types

The Alarm Types window displays the alarm input, alarm number, alarm label, and alarm type for each alarm in the system. The possible alarm types are Fault, Shutdown, Sequence controlled, and Non-Latching. The window allows the operator to exit the window or change the alarm type of one or more alarms. An alarm having an alarm type of “Sequence Controlled” cannot be changed to a different type. All other alarm types can be changed; however, the alarm type cannot be changed to “Sequence Controlled.”

3.13.14 Alarm Sequences

The Alarm Sequences window displays the alarm number and alarm label for each alarm in the system. The window also displays the alarm response sequence and alarm response sequence label for those alarms that have an alarm response associated with them. The window allows the operator to exit the window or select one or more alarms to view the alarm response sequence. Changes to alarm

response sequences are not allowed.

3.13.15 Relay Defaults

The Relay Defaults window displays the relay number, relay label, and relay default state for each relay in the system. The window allows the operator to exit the window or change the relay default state of one or more relays. Each relay default state will be set to No Default, Energize, or De-energize.

3.13.16 Helium Leak Check

This option is not applicable for ChemGuard® Gen II cabinet.

3.13.17 1st Security List

The 1st Security List window displays the password number and password for each first level password. The 1st level security list will be accessible to 2nd level security users and higher. This window allows the operator to exit the window or change, add, or delete one or more 1st level passwords. To delete a password use the BACKSPACE button on the keypad. Only numeric characters are permitted in 1st level passwords and the first character will always be the number one.

3.13.18 2nd Security List

The 2nd Security List window displays the password number and password for each second level password. The 2nd level security list is accessible to 3rd level security users and higher. This window allows the operator to change, add, or delete one or more 2nd level passwords or exit the window without changes. To delete a password, use the BACKSPACE button on the keypad. Only numeric characters are permitted in 2nd level passwords and the first character will always be the number two.

3.13.19 3rd Security List

The 3rd Security List window displays the password number and password for each third level password. The third level security list is accessible to 3rd level security users and higher. This window allows the operator to exit the window or change, add, or delete one or more third level passwords. To delete a password, use the BACKSPACE button on the keypad. Only numeric characters are permitted in 3rd level passwords and the first character will always be the number three.

3.13.20 2nd Security Access

The 2nd Security Access window displays all available user functions. For each function, the window displays the current operator's degree of access at the 2nd level of security. The degrees of access will be No Access, Read Only, or Write. The operator is allowed to view the access list or exit the window. Operators at 3rd level of security and higher that have Write access to the 2nd Security Access window are allowed to change one or more degrees of access. Changes to the degree of access cannot allow a 2nd level operator greater access than a higher level operator.

3.13.21 3rd Security Access

The 3rd Security Access window displays all available user functions. For each function, the window displays the current operator's degree of access at the 3rd level of security. The degrees of access will be No Access, Read Only, or Write. The operator is allowed to view the access list or exit the window. Only users with the VERSUM MATERIALS, INC. password are allowed to change the 3rd security access.

3.13.22 System Setup

The System Setup window allows the operator to change local or network options as well as the IP settings.

Local Setup

The Local Setup selection displays the Local Setup window. This window displays the menu timeout values. The window allows the operator to exit the window or change one of the following:

Change Exhaust Stack Size

This option is not used in ChemGuard® Gen II cabinet.

Password Protected Reset

The Password Protected Reset option allows the operator to toggle the password protected reset feature between ENABLED and DISABLED. When this feature is enabled, the operator will be required to enter a valid password when resetting alarms.

Screen Saver

The Screen Saver option allows the operator to change the screen saver time

delay. The box will accept the values 0 or 31–99. A time delay of zero will disable the screen saver.

Key Press Feedback

Key Press Feedback is a toggle option that allows the operator to set whether a beep will sound as feedback when a menu option is enabled or an alarm is acknowledged.

Simulation

Simulation option allows the operator to toggle the simulation feature between ENABLED and DISABLED. This option should be set to DISABLED in the field.

Network Setup

The Network Setup option displays the Network Setup window, which displays the network port number, the network device type, the Network Control state, the RS-485 channel numbers, the Ethernet channel numbers, and the network communication type. The window allows the operator to exit the window or change one or more of the network parameters.

Enable/Disable Network Control

The Enable/Disable option allows the operator to change the Network Control state to either Enable or Disable.

RS-485 Channel Number

The RS-485 Channel Number allows the operator to change the left and right RS-485 channel number within the range of 0 to 63. Changes to the channel number will be written to the NV data file.

Ethernet Channel Number

The Ethernet change channel option allows the operator to change the left and right channel numbers within the range of 0 to 9999. Changes to the channel number will be written to the NV data file.

Network Comm Type

The network comm type can be set to either RS-485 or Ethernet.

Peer To Peer IP Settings

This option is not applicable for ChemGuard® Gen II product line.

IP Settings

The IP settings option allows the user to modify the IP address, subnet mask, and default gateway.

Set Product Code

The set product code option allows the user to define the product code within the barcode string.

Calibrate Touch Screen

This option allows the User to Calibrate the Touch Screen.

Bar Codes

This feature allows the sequence to prompt for one or more barcodes during a change cylinder operation, provides a user interface window to view/modify the barcodes, and communicates the barcodes to the Network Monitor via the network protocol.

Alarm History

Alarms that appear in ChemGuard® cabinets are stored in the non-volatile memory of the controller and can be viewed via either the Alarm History button of the System Setup menu or the System Information window. Alarms can be stored overtime up to 200 alarm events, then FIFO (First In First Out).

In addition, alarms can be sorted by alarm type - fault, shutdown or in chronological order. Also there is ability to clear all history for either fault or shutdown and to dump the alarm history to a CSV file or similar on a USB memory device.

If the Alarm History window is opened from the System Information window, the Clear History buttons and the Export button will not be visible since the System Information window can be viewed by anyone without logging into the controller. If the Alarm History window is opened from the System Setup menu, the Clear History buttons and the Export button will be visible, but enabled per the operator's view/modify security permissions.

The Alarm History window will always open showing the most recent alarms to the least recent alarms in a multicolumn list. On top of the Alarm List will be the Sort By radio button selection list. The Sort By selections will be Date/Time, Shutdown Alarm and Fault Alarm. If a different Sort By criteria is selected, the Alarm List will

refresh and update based on the Sort By selection. If the Shutdown Alarm Sort By is selected, fault alarms will not be shown, and if the Fault Alarm Sort By is selected, shutdown alarms will not be shown.

The Alarm List will have three columns: Date/Time, Type and Description. The Date/Time column will contain the date/time of the alarm event. The Type column will indicate the alarm event type being Shutdown, Fault, Ack, Reset, Login, Logout and Power Up. The Alarm column will show the description of the alarm including the alarm input type, input number and alarm number, and will show the affected process lines.

Below the Alarm List are six buttons: Clear All History, Clear Shutdown History, Clear Fault History, Export, Refresh and Cancel. The Clear All History will clear all of the alarm history prior to the most recent alarm reset event. The Clear Shutdown History and Clear Fault History will clear just the selected shutdown or fault history. The Clear buttons will not clear any of the alarm events for active alarms.

The Export button exports the alarm history to a CSV text file in a selected directory on a USB memory device. The USB directory selection will be similar to the directory selection used when performing a firmware or configuration file transfer. The exported file will contain the following columns:

- Alarm Event Number – resorts the alarm events back to their original chronological order (most recent alarms to the least recent alarms starting at Alarm Event Number 1).
- Date/Time – alarm date and time string.
- Type – alarm event type being Shutdown, Fault, Ack, Reset, Login, Logout and Power Up.
- Description – event description string including the alarm input type, input number and alarm number, and affected process lines.
- PL1 through PL8 – a column for each process line that contains either a 0 or 1 to allow the alarm events to be sorted by process line.

The Refresh button refreshes the Alarm List with the latest alarm events. The Cancel button closes the Alarm History window.

The alarm history ring buffer will be completely cleared if the non-volatile memory is cleared via the memory management configuration menu.

Fill Timers

The fill timers option is used to set the timer value for Bulk to Process operation or Process Fill operation or External Fill operation. Refer 3.12.2 Source System Configuration section for details of how fill timers are used in ChemGuard® Gen II cabinets.

Tool Names

The tool names option is used in ChemGuard® Gen II product lines to set the tool name for each of the manifold lines (V11, V12, V13 and V14) that may be present in the system. On the screen, Num 1 and Num 2 correspond to tool name for V11. Num 3 and Num 4 correspond to tool name for V12, etc. Highlight any tool name to set/modify and using the keypad on the display type the tool names on the "Name" box. Click "Apply" to accept the changes. Click "OK" or "CANCEL" to exit out of this option.

3.13.23 Config Transfer

The Configuration Transfer window will display the Configuration File transfer options listed below. The operator will be allowed to choose an option or exit the window. All other controller operations will be suspended during a PC to Controller file transfer.

USB to Controller

The USB to controller transfer option will begin the file transfer of the configuration file from the source device connected to the controller USB port. This option will only be accessible by users with the VERSUM MATERIALS, INC. level password.

Controller to USB

The controller to USB transfer option will begin the file transfer of the Configuration File from the controller to the target device connected to the controller USB port.

3.13.24 Memory Management

The Memory Management window is not accessible to the customer. Only Versum Materials, Inc. authorized personnel has access. It will display the options listed below. The operator will be allowed to choose an option or exit the window.

USB to Controller Firmware

This option will begin the Firmware file transfer from the source device attached to the controller USB port. The identical transfer must be initiated by the user in the Transfer Program.

Controller to USB Memory Contents

This option will begin the file transfer of the firmware executable files, Configuration File, and NV Data File from the memory of the Controller to the attached PC. Once this option is selected, the following text "FILE TRANSFER IN PROGRESS - DISPLAY INFORMATION WILL NOT BE UPDATED DURING

TRANSFER” will be displayed in bold at the bottom of the current selection window.

Delete Nonvolatile Data File and Reboot

The Delete Nonvolatile Data File option will delete the nonvolatile (NV) data file from the memory. The controller will reboot after completing deleting the NV data file from memory.

Return to Power Up Mode

The Return to Power Up Mode option returns the Controller to Power Up Mode.

Reboot

The Reboot option reboots the Controller.

Reboot to OS

The Reboot to OS option reboots the Controller to the Operating System.

Disable/Enable OS Access

The Disable/Enable OS Access option permits access to the Operating System Task Bar.

Variables

The Variables option allows the user to see the list of variables used in the sequence.

3.13.25 Source System Information

To access the Source System Information screen, touch the blue title button at the bottom of the screen. The Source System Information window displays the firmware, network, and configuration information and has options for testing the shutdown and/or fault alarms as well as cleaning the screen.

3.14 System Startup

At this point in the installation procedure, the PROCESS Reservoir should be installed in the upper shelf of the ChemGuard® Gen II Cabinet. Refer to Chapter 4

for detailed Reservoir Container procedures. The PROCESS and BULK Refillable Reservoir will remain in the cabinet unless removed for maintenance or shutdown procedures. The non-refillable BULK Reservoir is changed as required.

3.14.1 Initial Installation of PROCESS Reservoir Container

- Install PROCESS reservoir.
- Perform manual leak check by pressure decay test and then vacuum rate of rise at Inlet, Outlet and Vent VCR connections.
- If Empty Process container installed then perform manual leak check by pressure decay test and then vacuum rate of rise at Inlet, Outlet and Vent VCR connections throughout the container.
- If Empty Process container installed then pump down to base vacuum pressure for a minimum of eight (8) hours to remove any atmospheric moisture from the container before starting the Chemical fill.

NOTE: The Process reservoir requires installation only once with replacement for cleaning, as necessary based on the shelf-life of the chemical and residency time in the container based on flow rates / tool usage.

NOTE: The CG325, or CG400NT PROCESS Reservoir is a unique container, which is equipped with an ultrasonic level detection probe. The probe is interfaced to the ChemGuard® cabinet to prevent an overfill condition which could result from a BULK to PROCESS chemical transfer operation.

3.14.2 Optional Refillable BULK Reservoir Container, Initial Installation

- Install Refillable Bulk reservoir.
- Perform manual leak check by pressure decay test and then vacuum rate of rise at Inlet and Outlet VCR connections.
- If Empty Bulk container installed then perform manual leak check by pressure decay test and then vacuum rate of rise at Inlet and Outlet VCR connections throughout the container.
- If Empty Bulk container installed then pump down to base vacuum pressure for a minimum of eight (8) hours to remove any atmospheric moisture from the container before starting the Chemical fill.

NOTE: Refillable BULK reservoir requires installation only once with replacement for cleaning. Versum Materials, Inc. recommends that the refillable BULK reservoir be replaced approximately once a year to eliminate potential chemical impurity build-up.

3.14.3 Delivery Manifold with Optional Purge Capabilities

The output valves allow chemical to flow to the Process Tool. Chemical passes from the Reservoir Container, through the degasser (option), and out to the Process Tool.

The optional functions of the five manual valves are:

- MV15, MV16, MV17, and MV18: Opening each valve to allow Nitrogen purge liquid chemical from the house delivery line toward Process Tool(s). This option can be use to decommission the equipment for long term shut down or relocate the equipment to a new location. See Figure 3-5.
- MV10: Opening this valve to allow Nitrogen purge liquid chemical from the degasser (for units with degasser) toward the PROCESS container. This option can be use to decommission the equipment or replace the degasser unit. See Figure 3-5.
- Ensure MV10, MV15 – MV18 are in the closed position during normal operation.

3.14.4 Performing a Leak Check of the Stainless Steel Plumbing
(Post-Installation and Pre-Introduction of Chemical)

1. Before powering up the system, ensure the EMO button is in the UP (released) position. Verify by pulling button outward.
2. Turn on the power. Refer to setup parameters.
3. Check to see the vacuum pump is ON and that the exhaust is ON.
4. Close the incoming (Facilities) Helium control valve and the incoming (Facilities) Nitrogen purge control valve. Ensure R1 and R2 pressure regulators are fully opened (clockwise).
5. Enter Manual Mode and open V7.
6. Check the displayed mT (millitorr) value for base pump pressure indication. Record indication.
7. Next open V5A and V5B. Then open V6A, V6B, V3A, V3B, V2A, V1A, and V1B. This will open all the tubing inside the system.
8. If an EMPTY PROCESS container is installed the open V9B. This is to pump down the empty Process container.
9. If the Degasser is installed, then follow the sub-steps below:
    a) Ensure the Degasser vacuum pump is turn on and verify that V8 valve is open. This is pumping the Degasser Chamber Housing section.
    b) Verify the Degasser Inlet and Outlet valves are opened (Teflon Inlet and Outlet valves will not turn [rigid]; Bypass Inlet and Outlet valves will turn [loosely]).
    c) Allow the Teflon line inside the Degasser to be pump down for two (2) hours by the vacuum pump used to pump through the main manifold.

d) Remove clip-pin and disconnect one of the fiber optic cables from the banner sensor which is mounted through the bottom of the controller. This will cause the Degasser to switch to the Bypass mode (Bypass Inlet and Outlet valves will not turn [rigid]; Teflon Inlet and Outlet valves will turn [loosely]).

e) Disconnect signal control from V8 solenoid valve at the right solenoid valve block to keep V8 close. This is isolating the Degasser vacuum pump from pumping the Degasser Chamber housing to prevent possible oil back stream from the Degasser vacuum pump.

f) If possible; find away to have both Degasser Teflon line and By-pass line all valves open to allow pump down by the vacuum pump used to pump through the main manifold.

10. If Nitrogen Purge option applicable, close the main Nitrogen incoming source before open valves MV10, MV15 – MV18, (located on the inside right-hand wall of the cabinet). Ensure Facilities Helium (push gas) control valve and Nitrogen (purge gas) control valve are closed. Pump out the atmosphere pressure to obtain a pure vacuum environment.

NOTE: OEM is responsible for the delivery line(s) vacuum integrity, particle count and moisture content. Moisture levels and particle count should not exceed the chemical manufacturer specifications.

11. Close all the chemical delivery lines at the first isolation valve at the Process Tool.

12. Manually switch on V11 – V14. This will open all the delivery lines toward the Process Tool upon the first isolation valves.

13. Allow the system to pump to base pressure. Compare the displayed mT (millitorr) value with the base pump pressure from above step.

14. If applicable a refillable Bulk (an EMPTY BULK container) installed then follow sub-steps below:

    a) Attach pneumatic lines to the Bulk Reservoir and Manually open V9A. This is to pump down the empty Bulk container.

    b) Close (isolated) the Refill delivery line isolation valve at the main refill source before manually open V8A. This is to pump down the Refill delivery line unto the isolation valve at the main refill source.

15. Allow the unit to pump uninterrupted for a minimum of 12 hours.

16. At the end of the pump-down period, ensure the mT (millitorr) indication is not greater than base pressure as noted in Step 10 + 10mT. If pressure reading is greater than base pressure + 10 mT, possible canister “out gassing” could be present.

17. Perform a leak check by switching off V7 and watch the reading on the display. If the reading shows a leak rate greater than 5mT/min. for the duration of 30 – 60 minutes run time, then start closing the valves one at a time to isolate the source of the leak.

18. If leak check fails and current base pressure is greater than pressure indication in Step 10 + 10mT, isolate the canister by closing V9B and repeat the leak check. If

leak check now passes, troubleshoot canister for out-gassing and/or leaks.

19. If applicable for Refillable Bulk, If leak check fails and current base pressure is greater than pressure indication in Step 10 + 10mT, isolate the canister by closing V8A or V9A and repeat the leak check. If leak check now passes, troubleshoot canister for out-gassing and/or leaks.

20. If necessary hook up a helium detector to the system to isolate the exact source of the leak. Once the leak is repaired, pump until base pressure is reached.

21. Switch all pneumatic valves OFF and manually close MV10, MV15 – MV18.

22. Place the Degasser in Normal mode by reconnecting the fiber optic cable on the banner sensor which is mounted through the bottom of the controller. Verify the Degasser is in Normal mode by attempting the turn the Nupro valves on the Degasser unit (Teflon Inlet and Outlet valves will not turn [rigid]; Bypass Inlet and Outlet valves will turn [loosely]). If any override or any bypass done in the Degasser section from previous step above then return them to normal position.

23. Verify all conditions on the cabinet and manifold are return to normal position.

3.14.5 Degasser Leak Check

If your installation does not have the optional degasser, the following does not apply.

If your installation has the optional degasser, perform the following sub-steps to pressure-test the degasser. If Helium is used as test gas, follow the steps below. If nitrogen is used as test gas, change the 30 minutes times to 1 hour. See Appendix A.

NOTE: Refer to Appendix A for more detail testing. For further info about vacuum pump then refer to the OEM pump Operation manual.

PRESSURE DECAY CHECK OF TEFLON COIL TUBING:

1. Verify the Degasser is in Normal mode by attempting the turn the Nupro valves on the Degasser unit. (Teflon Inlet and Outlet valves will not turn [rigid]; Bypass valves will turn [loosely]).

2. Disconnect signal control from V8 solenoid valve at the right solenoid valve block to keep V8 close.

3. Disconnect a downstream VCR fitting of V8 valve port, this port is connected to the Degasser Chamber Housing.

4. IMPORTANT: This is to ensure the Degasser housing is open to atmosphere pressure, NOT under vacuum.

5. Open incoming gas line valves and apply pressure to the system.

6. Open V1B and adjust PROCESS Pressure Regulator (R2) to read 55 psig at PT-P2.

7. Open V6B, and V3B. Allow ten minutes for pressure to stabilize.
8. Close V1B.
9. Monitor PROCESS pressure for 30 minutes. If pressure drops 1.5 psig or more, there is a leak in the degasser.
10. If pressure drops less than 1.5 psig in 30 minutes, there is no leak in the degasser.
11. Close R2 completely.
12. IF Process container had chemical then skip the next two steps.
13. Open V9B (V9B is on PROCESS Container).
14. Disconnect signal control to V4B and allow to vent.
15. Open V1B and allow venting through Process container.
16. Reconnect signal control to V4B.
17. DO NOT open V9B if Process container had chemical.
18. Open valves V7 and V5B.
19. Allow pumping down to base pressure.
20. Close V1B, V3B, V6B, V9B, V5B and V7.
21. Reconnect a downstream VCR fitting with new VCR gasket at the V8 valve port, this port is connected to the Degasser Chamber Housing.
22. Reconnect signal control from V8 solenoid valve at the right solenoid valve block to open V8 valve for normal operation.
23. Refer to Appendix A. for more details testing relate to Degasser unit.

3.14.6 Pressure Regulator Adjustment

1. Turn Bulk (R1) and Process (R2) Regulators fully counter clockwise (CLOSE).
2. Turn on the incoming (Facilities) Helium control valve and the incoming (Facilities) Nitrogen purge control valve. Set external Helium Regulator for 60 psig and Nitrogen purge regulator 40 psig (if Nitrogen Purge option applicable).
3. Manually open V1B and slowly adjust R2 to set the Process pressure to the desired process delivery pressure as read on ChemGuard® Gen II Display.
4. Close V1B.
5. Manually open V1A and slowly adjust R1 to set the Bulk pressure to 10 psig above the desired process delivery pressure as read on ChemGuard® Gen II Display.
6. Close V1A.
7. Ensure MV10, MV15 – MV18 are in the closed position (if Nitrogen Purge option applicable) during normal operation.
8. Regulators adjustment is now completed.

NOTE: Regulators are not self venting. If the desired push pressure is exceeded the system must be vented then the pressure regulator adjustment must be repeated.

3.14.7 Install Non-Refillable BULK Reservoir

Install BULK Reservoir per procedure in Chapter 4.

3.14.8 Optional refillable BULK Reservoir Canister

1. Enter gram value for chemical type and container size for BULK container, per Table 3-15. Then, enter 0%.
2. From the dropdown menu of Main menu, select EXTERNAL FILL and click START EXT FILL. The controller status box on top will change to “EXT FILL” indicating external fill operation is on.
3. If XFILL ENABLE digital input is present, the system initiates filling the Bulk reservoir from an external source.
4. The external fill operation stops when Bulk level reaches “Bulk refill level” setpoint set in USER SETPOINTS.

3.14.9 Chemical Delivery Path Preparation

1. Verify and confirm the Chemical Delivery Lines have finished leak check and pump down to base vacuum pressure for a minimum of eight (8) hours to remove any atmospheric moisture before starting the Chemical fill.
2. Manually open valves V7, V5B, V6B and V3B.
3. If the house chemical delivery line(s) is empty then open V11 – V14. To pump down upon the first isolation valve(s) at the Process Tool(s).
4. Monitor vacuum indication on the display is approximately 50 mT.
5. Close V11 – V14 if opened.
6. Manually Close V7, V5B, V6B and V3B.

NOTE: It is the OEM’s responsibility to evacuate the delivery line to the ChemGuard® Gen II Delivery Manifold.

3.14.10 BULK Reservoir to PROCESS Reservoir Initial Fill

1. Enter gram value for chemical type and container size for PROCESS container, per Table 3-15. Then, enter 0%.
2. From the dropdown menu of Main Menu select BULK and click “Start Bulk->Proc.” The Controller status box for Bulk will change to “Bulk->Proc,” indicating Bulk to

Process fill operation is on.

3. If all the IO connections in the system has “Fill A->B” digital input present, system initiates filling Process reservoir from Bulk reservoir.

4. Bulk to Process fill operation stops when Process reservoir level reaches ”Process hi refill” setpoint set in USER SETPOINTS.

3.14.11 PROCESS Reservoir Initial Fill to Delivery Manifold

1. To place the Process reservoir into fill operation, from the dropdown menu of Main Menu select PROCESS. Click “Start Proc Fill.” The Controller status box for Process will display “Proc Fill,” indicating Process is in fill mode.

2. Any one of the IO connections in the system should have “Fill B’ digital input present to start Process fill operation.

NOTE: Units with Degasser, chemical must remain in the Degasser for a minimum period of 30 minutes before introducing chemical into the delivery line.

3.14.12 Delivery Line Initial Fill

NOTE: Verify the OEM has completed the evacuation of chemical line to the ChemGuard® Gen II final output valve.

Recommend the Process Tool(s) controls the Chemical Output Valves V11 – V14 by closing the input signals on the AP1555 Tool Interface PCB.

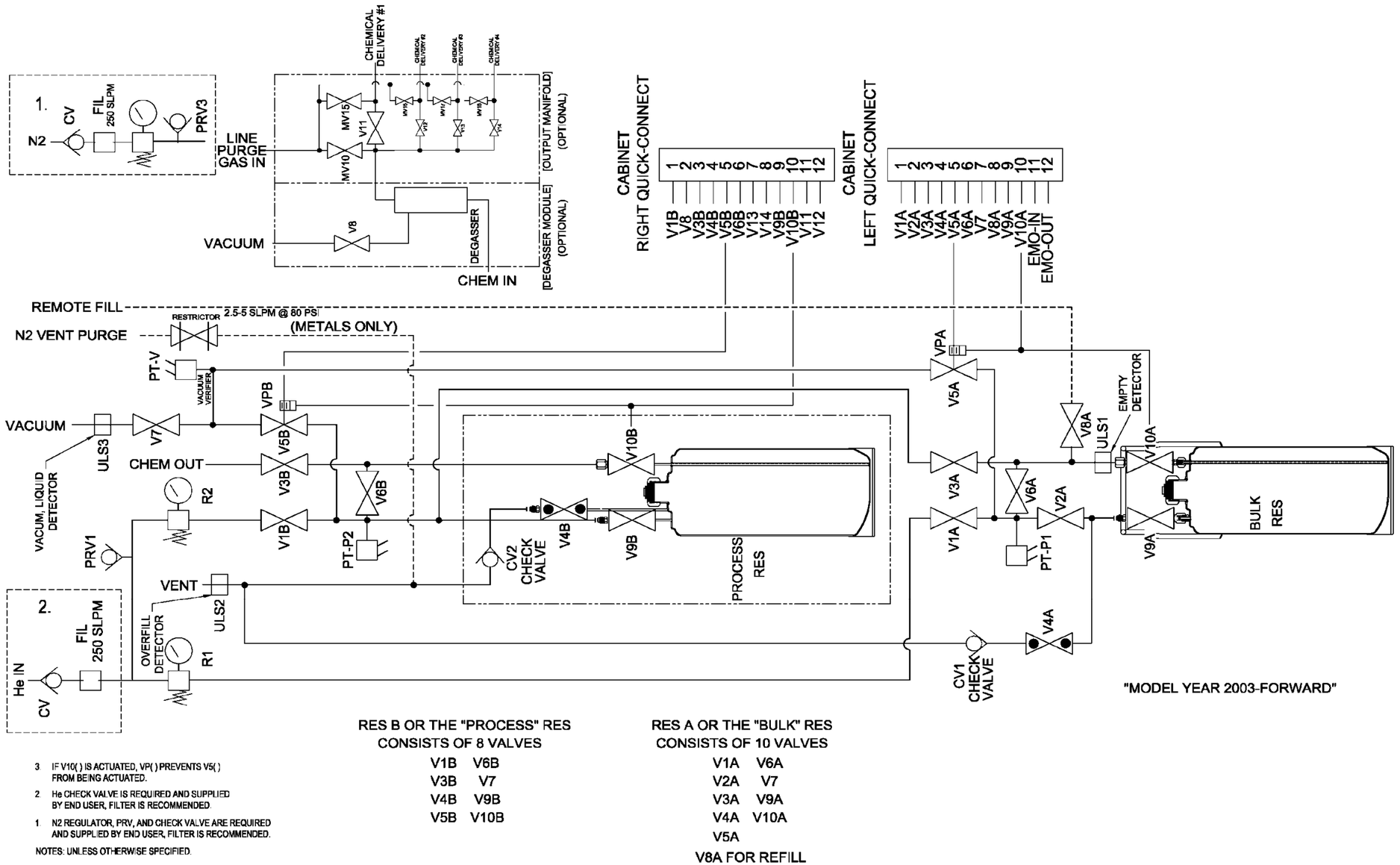
- V11 Control T1, pins 12 & 13
- V12 Control T2, pins 12 & 13
- V13 Control T3, pins 12 & 13
- V14 Control T4, pins 12 & 13

Table 3-7: Chemical Maximum-Fill Values for Versum Materials, Inc. Containers

CONTAINER		BK4000SW	BK6280ST	BK11000SU	BK18900ST	BK38000SY
ACTUAL VOLUME	ChemGuard Gen II	4098cc	6450cc	11128cc	19645cc	39800cc
STYLE	Model	4 Liter	6.2 Liter	11 Liter	19 Liter	38 Liter
FTES	100	3400	5300	9200	16300	N/A
TEB	100	3000	5165	8900	15700	N/A
TEOS	100	3200	5600	8800	17400	34800
TEPO	100	3700	6000	11200	20000	N/A
TMB	100	3150	5250	9300	16700	N/A
TMPI	100	4600	6400	11000	19600	N/A
TMPO	100	4100	7000	12000	22000	N/A
4MS	100	2180	3500	6100	11000	N/A
HMDS	100	3050	4350	7500	13400	N/A
TMCTS	100	4450	6100	10600	18000	N/A
OMCTS	100	4200	9900	10025	17800	N/A
BTBAS	200	3550	4800	8500	14700	N/A
CUPRA	300	5500	7460	12300	22800	N/A
$TiCl_4$	300	7250	10300	17800	31350	62200
GECL	300	8475	11600	20170	35750	N/A
Pyridine	325	3900	5650	9700	N/A	N/A
HCDS	325	6475	9175	15850	28000	N/A
DEMS	100	N/A	N/A	7800	13500	N/A
ATRP	100	N/A	N/A	9050	15650	N/A
BCHD	300	N/A	N/A	9600	16700	N/A
MDEOS	100	N/A	N/A	8900	15400	N/A
TMSDMA	300	2800	N/A	6900	12200	N/A
Hexane	100	N/A	N/A	7400	N/A	N/A
Vitamin2	250	N/A	N/A	N/A	16666	N/A
****						

This page intentionally left blank.

Figure 3-5: ChemGuard Gen II Plumbing and Valves Schematic



RES B OR THE "PROCESS" RES
CONSISTS OF 8 VALVES
V1B V6B
V3B V7
V4B V9B
V5B V10B

RES A OR THE "BULK" RES
CONSISTS OF 10 VALVES
V1A V6A
V2A V7
V3A V9A
V4A V10A
V5A
V8A FOR REFILL

3 IF V10( ) IS ACTUATED, VP( ) PREVENTS V5( ) FROM BEING ACTUATED.

2 He CHECK VALVE IS REQUIRED AND SUPPLIED BY END USER, FILTER IS RECOMMENDED.

1 N2 REGULATOR, PRV, AND CHECK VALVE ARE REQUIRED AND SUPPLIED BY END USER, FILTER IS RECOMMENDED.

NOTES: UNLESS OTHERWISE SPECIFIED.

This page intentionally left blank.

Chapter 4: Changing Reservoir Containers

The change reservoir operation is an automated procedure that guides the operator through the steps required to change out the reservoir containers.

NOTE: This warranty is expressly conditioned on compliance with Versum Materials, Inc. operating instructions and the use of the equipment only for authorized chemicals. Operation of the equipment other than as set forth in Versum Materials, Inc. operating instructions or the use of the equipment for unauthorized chemicals shall void all of Versum Materials, Inc. warranties hereunder.

NOTE: The remove-and-replace procedure described in Section 4.1 and 4.2 applies to both the Process reservoir container and the Bulk reservoir container except as noted. The appearance of your reservoir container(s) may vary slightly from those shown in the illustrations in this chapter.

NOTE: Ensure the product in the Bulk reservoir container is at room temperature prior to installation and start up of the ChemGuard®. Some chemicals have relatively high freezing points.

NOTE: The Process reservoir container requires installation only once with periodic replacement for cleaning. Versum Materials, Inc. recommends that the Process reservoir container be replaced approximately once a year to eliminate potential chemical impurity build-up.

NOTE: The CG325, CG400NT Process reservoir is a unique container, which is equipped with an ultrasonic level probe. The ultrasonic probe is interfaced to the cabinet controller to prevent an overfill condition due to the result of the Bulk to Process chemical fill operation.

NOTE: Optional the Bulk reservoir container is equipped with a unique code cable pin-out configuration associated with the chemistry for which the cabinet is intended. The software checks the pin-out configuration during Bulk container change-out whenever a new container is installed. If the proper pin-out configuration is not detected, the software will prompt code cable error alarm and will not resume the change operation until the proper pin-out configuration is detected. Refer to code cable assembly part number and contact Versum Materials, Inc. EES Technical support group for details pin-out.

WARNING

WARNING: Review corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should follow procedures in the Material Safety Data Sheet (MSDS) on chemical being used. Secondary containment and cleanup material should be available in the event of chemical spill. Proper personal protective equipment must be used.

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 Material-Sicherheitsdatenblättern (MSDS) aufgeführten Verfahren über die jeweils verwendete Chemikalie vertraut sein. Ein Zweitbehälter und Reinigungsmittel sollten bereitstehen, falls Chemikalien verschüttet werden.

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 suivre les procédés prescrits dans les feuilles de normes pour matières (MSDS) concernant les produits chimiques en usage.Un récipient secondaire et du matériel de nettoyage doivent être disponibles au cas où le produit chimique se renverse.

4.1 Safety Notes

Review corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should be familiar with the MSDS and chemical being used.

For caution, all appropriate personal safety protection equipment should be used. Secondary containment and clean-up material should be available in the event of chemical spill or breakage of the container.

When lifting fully filled chemical containers, Versum Materials, Inc. recommends that two (2) persons perform the lifting.

4.2 Removing and Replacing The Reservoir Containers

WARNING

WARNING: Be sure the manual valves on the reservoir are closed before disconnecting the lines.

If pneumatic valves are used on the reservoir, disconnect the pneumatic tubes prior to disconnecting the container connections.

WARNUNG: Vor dem Trennen der Leitungen sicherstellen, daß die handbetätigten Ventile am Vorratsbehälter geschlossen sind.

Werden am Vorratsbehälter Druckluftventile verwendet, müssen zuerst die Druckluftleitungen getrennt werden, bevor die Anschlüsse am Behälter entfernt werden.

AVERTISSEMENT: Avant de débrancher la ligne, s'assurer que les soupapes de manoeuvre se trouvant sur le réservoir soient fermées.

Si les valves pneumatiques sont utilisées sur le réservoir, alors déconnecter les tubes pneumatiques avant de débrancher les connexions du récipient.

CAUTION

CAUTION: Do not allow valves on container to rotate.

Damage to VCR faces may result in leaks, preventing proper system operation.

VORSICHT: Die Ventile am Behälter dürfen sich nicht drehen.

Eine Beschädigung der VCR-Berührungsflächen kann zu Leckage führen, die den ordnungsgemäßen Betrieb des Systems beeinträchtigen.

ATTENTION: Ne pas laisser tourner les soupapes sur la boîte métallique.

Tout dégât aux surfaces des pièces en VCR peut causer des fuites et, donc, empêcher le fonctionnement propre du système.

WARNING: TO PREVENT BACK INJURY, USE PROPER LIFTING TECHNIQUE WHEN HANDLING CONTAINERS.

1. Have the following equipment ready:
   a) New container containing desire (correct) chemical
   b) Wrenches (5/8 in., 11/16 in. and 3/4 in. open end)
   c) 6.35mm (¼ in.) stainless steel, VCR gaskets

d) Proper personal protective equipment

2. Put on personal protective equipment.

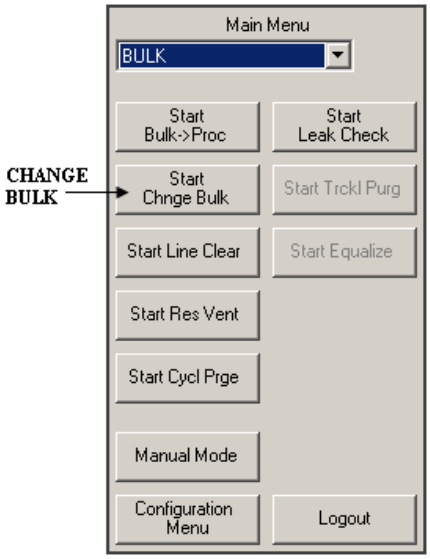
4.3 Change BULK Reservoir Operation

4.3.1 Changing the BULK Reservoir Container

This option guides the operator through steps to remove and replace Bulk reservoir container. Change Bulk operation must be performed any time to remove or install Bulk container.

To start change Bulk operations:

- BULK button.
- Selecting START CHNGE BULK button will enable STOP CHNGE BULK push button, which can be used to stop change Bulk operation.
- Controller status box for Bulk will display CHNGE BULK STARTED
- Click on STOP CHNGE BULK button to stop change bulk operation
- Select Bulk from the pull-down menu of Main Menu and press START CHNGE



Change Bulk operation will not proceed if any of the following conditions exists:

- The Vacuum pump is not turned on
- A Shutdown alarm present in the cabinet
- If any automatic operation BULK->PROC or EXTERNAL FILL (if Bulk refill option is available) is enabled. To disable BULK->PROC select STOP BULK->PROC from Bulk Main Menu. If Bulk refill option is available, EXTERNAL FILL operation can be disabled by selecting STOP EXTERNAL FILL from External fill Menu.

The change Bulk operation continues to run until one of the following conditions occurs:

- Operator terminates operation by selecting STOP CHNGE BULK from Bulk menu
- A shutdown alarm occurs

NOTE: The operation will not proceed unless the vacuum pump is turned on. If a shutdown alarm occurs, all automatic operations are terminated. For

any reason if change Bulk routine is terminated before its completion, the technician/operator must restart the change Bulk routine to prevent contamination.

The software has additional Pre and Post Leak Check routine during the Change Bulk operation and well as the Trickle Purge Pigtail (additional hardware option) for the BULK CHANGE operation. Contact Versum Materials, Inc. EES Group for further details.

In order to perform a change Bulk operations do the following steps:

1. When you click on the main screen, a ”Password” window displays. Enter a valid password and click ”OK.”. Select “Bulk” from the pull-down menu, if Bulk was not chosen. If Bulk to Process operation is enabled, click STOP BULK->PROC to disable Bulk to Process fill operation.
2. If external fill option is available in the cabinet, select EXTERNAL FILL from the pull-down menu of Main Menu. If external fill operation is enabled click STOP EXT FILL to disable the external fill operation.
3. Select Bulk from the pull-down menu of Main Menu and click START CHNGE BULK to start the Bulk change operation.
4. At any time, the operator can terminate the operation by selecting STOP CHNGE BULK from the Main Menu. If Bulk change operation is stopped before its completion, it is recommended to restart Change Bulk Reservoir Operation to prevent any contamination.

NOTE: The Bulk change operation continues to run until either one of the following occurs:

a) Technician/Operator terminates the operation by selecting **STOP CHNGE BULK.**

b) A shutdown alarm occurs.

5. During the Bulk change operation, the system first performs a LINE CLEAR function, pushing liquid chemical back into the reservoir. The duration of this step depends on the time selected on INITIAL PRGE DELAY section of Alarm Delays in Configuration Menu.
6. The operator/technician is prompted to close the reservoir manual valves, if the container has manual valves.
7. The system performs a series of CYCLE PURGE’s to ensure chemical is removed from the lines.
8. When the CYCLE PURGE operation is complete, the screen will prompt the operator to enter valve type of the bulk container. Follow the prompts to enter the valve configuration of the new container which will be installed. Press OK.

9. The system will prompt the operator to disconnect code cable from the Bulk container if option is present and enabled.

10. The system will prompt the operator to change the bulk container. **DO NOT** press OK until bulk container is replaced.

NOTE: Ensure the product in the Bulk reservoir container is at room temperature prior to installation and start up of the ChemGuard®. Some chemicals have relatively high freezing points.

11. Disconnect code cable option from Bulk container.

12. Disconnect the pneumatic quick-disconnect fittings, if the container has pneumatic valves.

13. Disconnect the two (2) VCR connections on top of the container valves.

14. Remove empty container.

15. If the system will prompt the operator to calibrate the scale. Operator to verify and calibrate scale as needed (refer to Chapter 7 for detail).

16. Replace pigtail with new VCR gaskets, install the new container with full chemical.

17. Reconnect the two (2) VCR fittings.

18. If there is a barcode option, the software will prompt to ENTER OR SCAN THE BARCODE ON THE NEW BULK CAN. Following this there will be a prompt which says INSTALL NEW CAN (this prompt will appear regardless of whether the system has a barcode option or not). At this point install the new Bulk can and press the OKAY button on the screen.

19. Reconnect code cable option to Bulk container.

20. Reconnect the pneumatic airline and press OK.

21. When prompted by the system, enter the valve type.

22. The system will perform an automatic LEAK CHECK Operation and prompt the operator to enter the chemical weight. This value is printed on the label on front of the container.

23. Enter these values with the keypad on the screen and click “APPLY” to accept the change. Click “OK” or “CANCEL” to exit the screen.

24. The system will perform additional automatic functions. If manual valves are used on the container, the display will prompt the operator to open the manual valves.

25. Controller status box in Bulk section will display CHNGE BULK COMPLETED.

NOTE: The operator can stop the change Bulk operation at any time by selecting STOP CHNGE BULK from the Bulk menu.

26. Select Bulk in the pull-down menu of Main Menu and click on START BULK->PROC pushbutton to start Bulk to Process reservoir fill operation.

27. The Change BULK operation is complete.

4.3.2 BULK Reservoir Diagnostics

WARNING

WARNING: Do NOT disconnect any fittings until all chemical has been removed.

WARNUNG: KEINE Verschraubungen lösen, bis nicht alle Chemikalien entfernt worden sind.

AVERTISSEMENT: NE PAS détacher les raccords de tuyauterie avant que tout produit chimique no soit extrait.

Table 4-1: BULK Reservoir Diagnostics

The following are errors that could occur during the Change Bulk Operation:

ERROR	POSSIBLE CAUSES	REMEDY
Base Vac Timeout Pmpdwn Timeout	Vacuum Pump failure Loose VCR connection	Replace pump Replace gaskets and re-tighten fittings
Leak Check Failure	Loose VCR fitting Failed valve	Replace gaskets and re-tighten fitting Replace container
Low Push Pres Blk High Push Pres Blk Bulk Vent Failed	Supply gas source problem Push Pressure Transducer fail	Check supply gas sources Adjust regulators Check Transducers

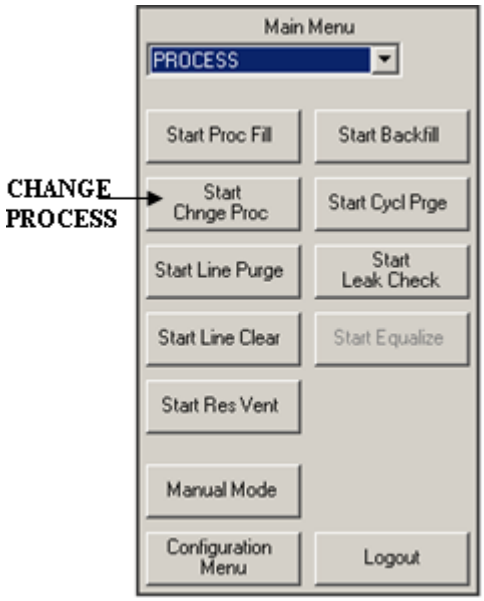
4.4 Change PROCESS Reservoir Operation

4.4.1 Changing The PROCESS Reservoir Container

This option guides the operator through steps to remove and replace the Process reservoir. When the Process reservoir is to be removed or installed, the automated change Process reservoir operation must be performed.

To start Change Process Reservoir operations:

- Stop Process fill operation if Process is filling tool, controller status box for Process will display PROC FILL. To stop Process fill, select Process from the pull down menu of Main Menu and choose STOP PROC FILL pushbutton
- Stop Bulk to Process fill if Bulk reservoir is filling Process reservoir, controller status box for Bulk will display BULK->PROC. To stop Bulk to Process fill select Bulk from the pull-down menu of Main Menu and choose STOP BULK->PROC pushbutton



- Stop **Bulk external fill** if an external source is filling Bulk reservoir, controller status box for Bulk (middle one) will indicate EXT FILL. To stop external fill select EXTERNAL FILL from the pull-down menu of Main Menu and choose **STOP EXT FILL** pushbutton. Note: External fill is an option and may not be available in all ChemGuard® products
- Select Process from the pull-down menu of Main Menu. Choose **START CHNGE PROC** pushbutton to start change Process routine

At any time, the operator can terminate the operation by selecting **STOP CHNGE PROC** from the Main Menu.

WARNING

WARNING: Review corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should follow procedures in the Material Safety Data Sheet (MSDS) on chemical being used.

Secondary containment and cleanup material should be available in the event of chemical spill. Proper personal protective equipment must be used.

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 Material-Sicherheitsdatenblättern (MSDS) aufgeführten Verfahren über die jeweils verwendete Chemikalie vertraut sein.

Ein Zweitbehälter und Reinigungsmittel sollten bereitstehen, falls Chemikalien verschüttet werden.

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 suivre les procédés prescrits dans les feuilles de normes pour matières (MSDS) concernant les produits chimiques en usage.Un récipient secondaire et du matériel de nettoyage doivent être disponibles au cas où le produit chimique se renverse.

NOTE: The change Process reservoir operation continues to run until one of the following conditions occurs:

- The Technician/Operator terminates the change Process operation by selecting **STOP CHNGE PROC**
- A shutdown alarm occurs
- Process push pressure is low at the ChemGuard®. (A LOW PUSH PRES, PR will display)

NOTE: Change Process reservoir operation cannot be started if the vacuum pump is not turned on, if a shutdown alarm is present, or if all automatic operations are terminated. If, for any reason, Change Process Reservoir Operation is terminated before its completion, the operator must restart Change Process Reservoir Operation to prevent any contamination.

To Change Process Operation:

1. When you click on the main screen, a ”Password” window displays. Enter a valid password and click ”OK.”. Stop Process fill operation if Process is filling tool, the controller status box for Process will display PROC FILL. To stop Process fill, select Process from the pull-down menu of Main Menu and choose **STOP PROC FILL** push button.
2. Stop Bulk to Process fill if Bulk reservoir is filling Process reservoir, controller status box for Bulk will display BULK->PROC. To stop Bulk to

Process fill select Bulk from the pull-down menu of Main Menu and choose **STOP BULK->PROC** push button.

3. Stop Bulk external fill if an external source is filling Bulk reservoir, controller status box for Bulk (middle one) will indicate EXT FILL. To stop external fill select EXTERNAL FILL from the pull-down menu of Main Menu and choose **STOP EXT FILL** pushbutton. **Note**: External fill is an option and may not be available in all ChemGuard®.

4. Select Process from the pull-down menu of Main Menu. Choose **START CHNGE PROC** push button to start change Process routine. This will start the Process change routine.

5. At any time operator can terminate the operation by selecting **STOP CHNGE PROC** pushbutton from Main Menu. If Process change operation is stopped by selecting STOP CHNGE PROC before its completion, it is recommended to restart Change Process Reservoir Operation to prevent any contamination.

WARNING

WARNING: Review corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should follow procedures in the Material Safety Data Sheet (MSDS) on chemical being used.

Secondary containment and cleanup material should be available in the event of chemical spill. Proper personal protective equipment must be used.

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 Material-Sicherheitsdatenblättern (MSDS) aufgeführten Verfahren über die jeweils verwendete Chemikalie vertraut sein.

Ein Zweitbehälter und Reinigungsmittel sollten bereitstehen, falls Chemikalien verschüttet werden.

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 suivre les procédés prescrits dans les feuilles de normes pour matières (MSDS) concernant les produits chimiques en usage.Un récipient secondaire et du matériel de nettoyage doivent être disponibles au cas où le produit chimique se renverse.

NOTE: The operation continues to run until either one of the following occurs:

a) Technician/Operator terminates the operation by selecting **STOP CHNGE PROC.**

b) A shutdown alarm occurs.

6. During Process change operation, the system first performs a LINE CLEAR operation, pushing liquid chemical back into both reservoirs. The duration of this step depends on the time selected for INITIAL PURGE PROC of ALARM DELAYS in the CONFIGURATION MENU.
7. The System then performs a series of CYCLE PURGE's to ensure chemical is removed from the lines.
8. When the CYCLE PURGE operation is complete, the system prompts the operator to change the container. Do not press OK until container replacement is complete.
9. Disconnect VCR fittings at pigtail of CV2 and V4B while pneumatic air is still connected to V4B to keep it closed.
10. Install a VCR cap on the pigtail tubing and at the reservoir container valve.
11. Disconnect the signal control to V4B.
12. Remove all the pneumatic airlines from the Process reservoir container valves and disconnect all remaining VCR connections.
13. Disconnect the Ultrasonic Probe cable from Process container and cabinet as needed.
14. Remove and replace the Process reservoir container.
15. Replace all VCR gaskets and ensure all the VCR connections are properly made.
16. Reconnect the pneumatic lines and reconnect the signal control to V4B.
17. Reconnect the Ultrasonic Probe cable from Process container and cabinet as needed.
18. Verify all connections are made and click "OK.".
19. The system performs an automatic leak check and prompts the operator to enter the container weights. Refer to Table of Chemical Fill Matrix for weight to entry values for empty containers.
20. The system continues with several automatic functions and then prompts the operator when they have completed. The Controller status box for Process will indicate **CHNGE PROC COMPLETED.**
21. Please refer to the START CHNGE BULK (Change Bulk Operation) section and install a new Bulk container, if needed.

NOTE: Ensure the product in the Bulk reservoir container is at room temperature prior to installation and start up of the ChemGuard®. Some chemicals have relatively high freezing points.

22. If the new PROCESS Reservoir container is empty, it is recommended to perform manual leak check of the newly installed empty PROCESS Reservoir after the CHANGE PROCESS Reservoir routine is complete. Afterwards, perform a pull vacuum for a minimum of eight (8) hours to remove any atmosphere moisture within the container before starting the Chemical fill.

23. From the Main Menu, select Bulk from the pull-down menu and click **START BULK->PROC** to start filling the Process reservoir from the Bulk reservoir. The Controller status box for Bulk will display BULK->PROC when Bulk to Process fill operation is enabled.

24. Select Process from the pull-down menu of Main Menu and press **START PROC FILL** pushbutton to start fill from Process container. Controller status box for Process will display PROC FILL.

25. The Process change operation is complete.

4.4.2 PROCESS Reservoir Diagnostics

WARNING

WARNING: Do NOT disconnect any fittings until all chemical has been removed.

WARNUNG: KEINE Verschraubungen lösen, bis nicht alle Chemikalien entfernt worden sind.

AVERTISSEMENT: NE PAS détacher les raccords de tuyauterie avant que tout produit chimique no soit extrait.

Table 4-2: PROCESS Reservoir Diagnostics

The following are errors that could occur during Change Process Operation.

ERROR	POSSIBLE CAUSES	REMEDY
Base Vac Timeout Pmpdwn Timeout	Vacuum Pump failure Loose VCR connection	Replace pump Replace gaskets and re-tighten fittings
Leak Check Failure	Loose VCR fitting Failed valve	Replace gaskets and re-tighten fitting Replace container
Low Push Pres Proc High Push Pres Proc	Supply gas source problem Push Pressure Transducer fail	Check supply gas sources Adjust regulators Check Transducers

Chapter 5: ChemGuard® Features and Components

5.1 Overview

5.1.1 Operational Features

The ChemGuard® cabinet is automated for control and monitoring of all major operations, including CHANGE RESERVOIR, FILL, BACKFILL, and LINE PURGE Operations.

Supporting features of ChemGuard® are:

- Programmable Leak Rate and Cycle Purge parameters.
- All purge, process gas lines, exhaust line and pneumatic lines can be monitored continuously for chemical flow and pressure.
- Display shows all operating parameters, current status of each reservoir, chemical levels of each reservoir container, and system setup.
- Full set of alarms including FIRE, COMBUSTIBLE VAPOR, SPILL, EXHAUST, LOW PNEUMATICS, DOOR OPEN, HIGH/LOW PUSH PRESSURE, FILL TIME-OUT, VACUUM INTERLOCK, RESERVOIR LEVEL LOW/HIGH, LIQUID IN VACUUM and DEGASSER (if degasser option is used) alarms.
- Only CG400NT cabinet included a UVIR sensor.

5.1.2 Purity Control Features

- Process gas lines welded, electro-polished 316L stainless steel.
- All wetted surfaces constructed of 316L stainless steel, the valve seats made of KEL-F on certain model, other valve seat materials are available on certain models as well.
- All orbital TIG welded plumbing using VCR fittings to maximize leak integrity.
- Reservoir container constructed of 316L stainless steel.
- Cycle Purge and Leak Checks automated to prevent atmospheric contamination of the chemical during reservoir change out.
- Patented Ultrasonic empty level sensor for 100% chemical utilization.

5.1.3 Safety and Security Features

- No spark sources in chemical storage area of cabinet for inherently safe design
- Built-in seismic safety bolts down points per S2 Standard
- Specially designed scale for accurate weight detection of both Reservoir Containers, ± 150 gr. (± 0.1% of full scale) weight (NOTE: The scale for the BULK Reservoir is optional)
- Pull-out tray to simplify reservoir replacement

- 110% primary spill containment is standard on ChemGuard® Gen II
- Redundant overfill protection of all canisters, including ultrasonic sensors in vent and vacuum lines
- Self-closing, latching cabinet front door with key lock
- Spill detection standard in all cabinets
- Bulk and Process ChemGuard® Reservoir Canisters ASME-certified for pressure
- All process gas, exhaust, and pneumatic lines are monitored continuously for either correct flow or correct pressure. Pressure-relief is built in to prevent over-pressure of Reservoir Containers.
- Designed using SEMI S2, CE Heavy Industry and U.L. safety specifications as guidelines
- Optional lower explosion limit (LEL) combustible vapor detection sensor is available. Consult your Versum Materials, Inc. Sales Representative.
- Optional fire (temperature rate of rise) detection sensor is available. Consult your Versum Materials, Inc. Sales Representative.
- Optional Fire Suppression System is available. Consult your Versum Materials, Inc. Sales Representative.
- Redundant overfill protection of Process Reservoir for model CG325, CG400NT

5.1.4 Installation in Classified Locations

The GEN II ChemGuard® is approved for use in NEC (National Electric Code) Class I, Division 2 (U.S.A) and ATEX Zone (Group) 2, Category 3 (Europe) classified locations provided that the controller Type Z purge in enabled. The Type Z purge is required to maintain a positive pressure of Nitrogen at or above 0.10 in. W.C. as dictated by the National Fire Protection Agency (NFPA) and European directives (ATEX). In applications where Type Z purge is required, the controller will be equipped with a pressure switch to monitor the presence of purge gas. The Type Z purge will require a flow rate of approximately 11.8 LPM (25 CFH).

Z-Purge Setup and Procedure

The Z purge pressure is controlled by a needle valve at rear of controller. After opening the controller in a suspected hazardous area it is necessary to use the following procedure to re-establish the Z-purge before operating the controller:

1. Close the controller door and secure latch completely.
2. Open the needle valve 4 to 5 turns (counter-clockwise). Allow the controller to purge for 20 minutes.

Flow requirements to operate the solenoid valves are very small, less than 1 LPM (2 CFH). If Type Z purge is required, a flow rate of 11.8 LPM (25 CFH) will be needed, depending on the tightness of the individual controller and the installation.

5.2 Component Description

The ChemGuard® cabinet consists of these major subassemblies:

- ChemGuard® Cabinet
- ChemGuard® Electronics Enclosure
- Emergency Manual Off (EMO)
- ChemGuard® Display Screen
- ChemGuard® Cabinet and one (1) PROCESS Reservoir Container, the BULK Container is not part of the ChemGuard® Bill of Materials and it must be ordered separately with a chemical shipment. Consult your Versum Materials, Inc. representative for more details.

Figure 5-1: ChemGuard Cabinet External Connections

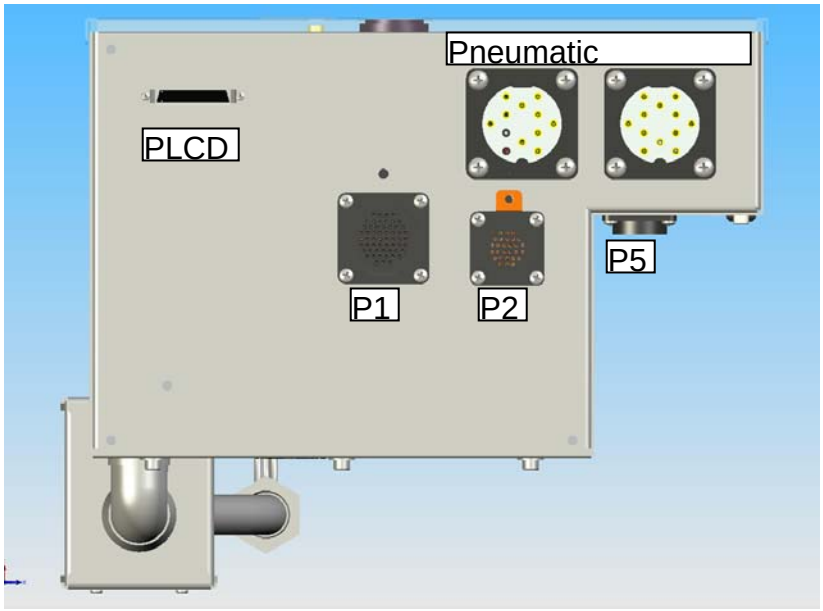
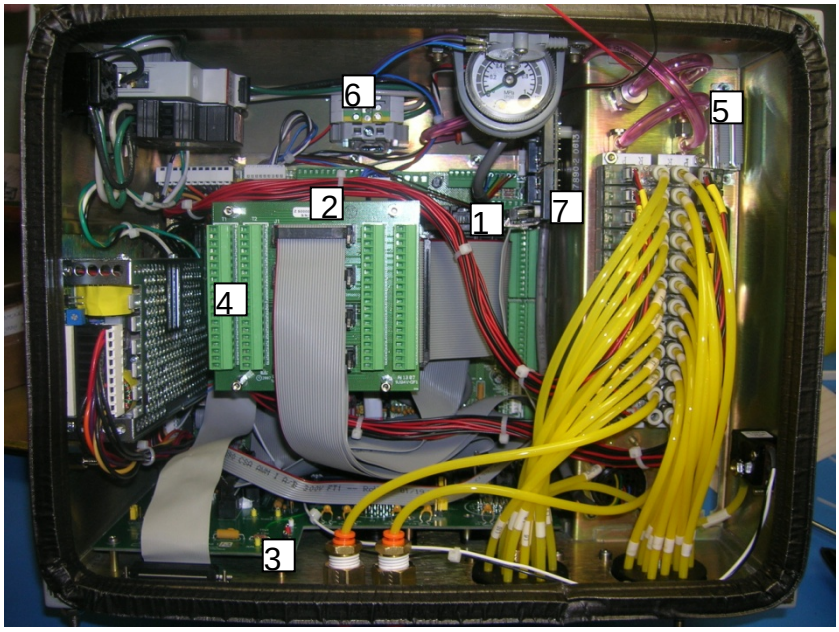


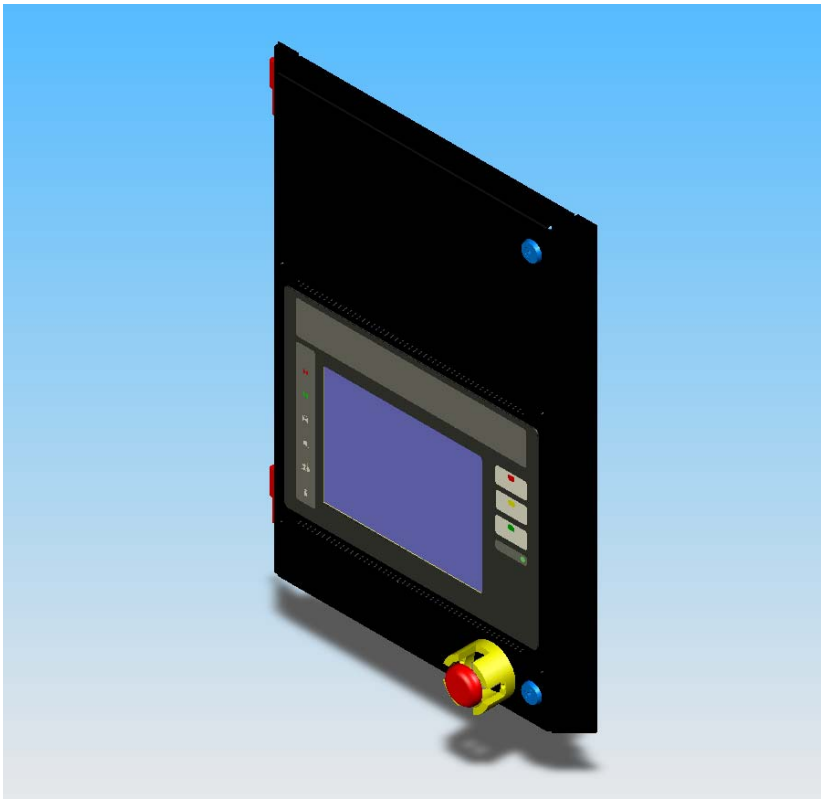
Figure 5-2: ChemGuard Electronic Enclosure



ITEM KEY

ITEM#	ITEM	FUNCTION
1	AP1551	Main I/O PCB.
2	PC104 stack	Several PCA's assembled in a stack using the PC104 bus architecture.
3	AP1552	ChemGuard Cabinet Interface
4	AP1553 / AP1555	Tool Interface (Screw Terminal)
5	DB25	Tool Interface (DB-25 Connection)
6	AC POWER CONNECTION	Provides screw terminal access to make power connections inside cabinet.
7	AP1554	Degasser/PLIS Output Interface

Figure 5-3: Emergency Manual Off (EMO)

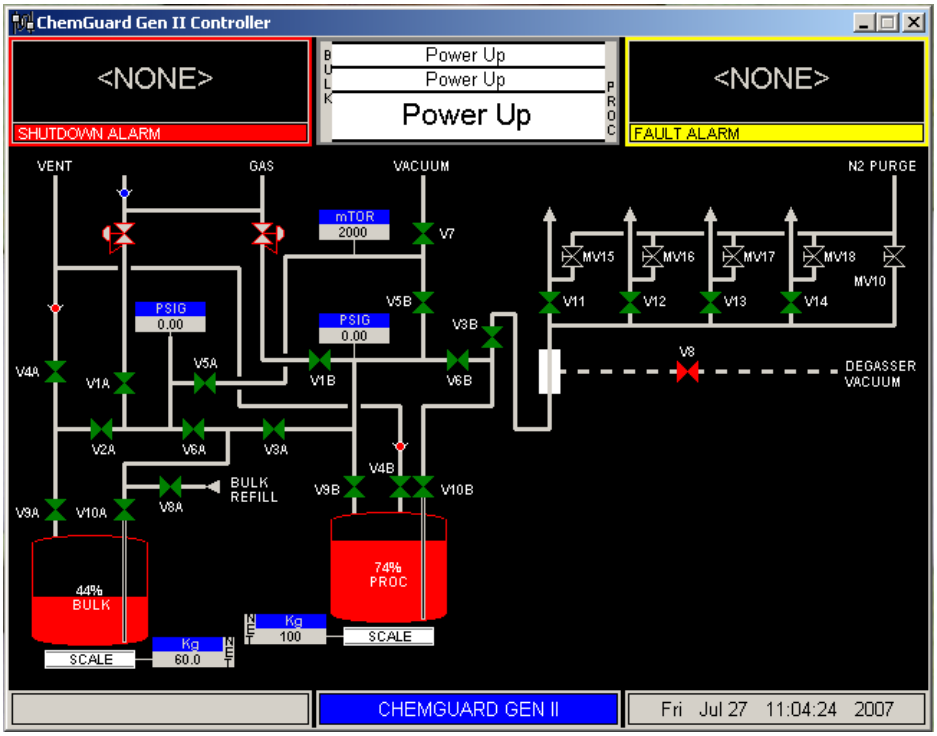


The Emergency Manual Off (EMO) circuit provides for emergency shutdown, including a standard red emergency OFF switch.

The Emergency Manual Off (EMO) switch is located on the upper door, immediately on the lower right of the upper door.

If the Emergency Manual Off (EMO) switch is pressed, it will disrupt the pneumatic air pressure to the solenoids which return the valve actuators to normal status.

Figure 5-4: ChemGuard Gen II Display Screen



The above figure is a general display screen of the ChemGuard® Gen II cabinet.

5.2.1 Reservoir Containers

The two (2) Reservoir Containers hold the process chemical used in customer applications:

- BULK Reservoir Container (bottom container).
- PROCESS Reservoir Container (top container).

In some related ChemGuard® documentation, such as interconnect and plumbing diagrams, the PROCESS Reservoir may be designated as RES B, and the BULK Reservoir may be designated as RES A.

NOTE: The CG325, CG400NT Process reservoir is a unique container equipped with an ultrasonic level probe. The ultrasonic probe is interfaced to the cabinet controller to prevent an overfill condition due to the result of the Bulk to Process chemical fill operation.

At any given time, depending on the operation performed, one or both containers may be full, partially full, or empty. These operations are described in later chapters in this manual.

Several Reservoir Container-types are available for use with ChemGuard®. They are described in Table 5-1. Depending on customer requirements, containers of different capacities may be used in one ChemGuard® installation.

Standard Bulk Pigtail Connections:

- Inlet Pigtail has 1/4 inch female VCR (1/4” FVCR) connection to container valve on headspace (gas) side.
- Outlet Pigtail has 1/4 inch male VCR (1/4” MVCR) connection to container valve on diptube (liquid) side.

NOTE: It is the customer’s responsibility to determine container requirements based on their processes and chemical usage needs.

Reservoir Container installation is described in Chapter 4.

Chemicals authorized for use in ChemGuard® are described in Table 5-2.

Figure 5-5: Typical ChemGuard Stainless Steel Reservoir Container

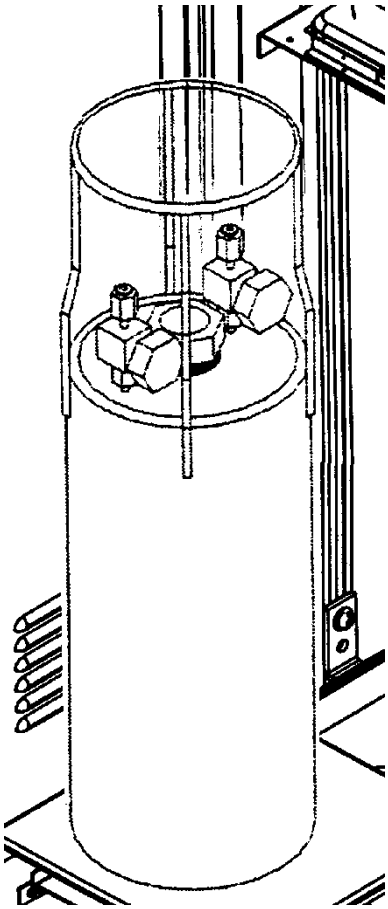


Table 5-1: ChemGuard® Stainless Steel Reservoir Container Specifications

MODEL	
	4 LITER (1.1 GALLONS) BULK Container: BK4000SWH (uses pneumatic valves) PROCESS Container: BK4000SWQ (uses pneumatic valves)
	11 LITER (~2.9 GALLONS) BULK Container: BK11000SUH (pneumatic valves available) PROCESS Container: BK11000SUQ (pneumatic valves available) **BTBAS-specific Containers** BULK Container: BK11000BUH (uses pneumatic valves) PROCESS Container: BK11000BUQ (uses pneumatic valves)
	18.9 LITER (~4.9 GALLONS) BULK Container: BK18900STH (uses pneumatic valves) PROCESS Container: BK18900STQ (uses pneumatic valves) **BTBAS-specific Containers** BULK Container: BK18900BTH (uses pneumatic valves) PROCESS Container: BK18900BTQ (uses pneumatic valves)
	38 LITER (~10 GALLONS) BULK Container BK38000SYH (uses pneumatic valves)

Chemicals Authorized for Use in ChemGuard®

Some of these chemicals require specially-configured ChemGuard® cabinets. For physical hazards and hazard thresholds (in parts per million) associated with these chemicals, contact Versum Materials, Inc. for MSDS information for each chemical-type.

It is the customer's responsibility to comply with OSHA Hazard-Communication Standards regarding chemical container-labeling and cabinet-labeling. Versum Materials, Inc. advises the customer to affix a label outside the ChemGuard® cabinet, identifying the chemical therein.

Use of chemicals in ChemGuard® may fall under the guidelines of specific government agencies. It is the customer's responsibility to determine and comply with appropriate guidelines for specific chemicals used. For further information, contact Versum Materials, Inc. EH&S Department.

Versum Materials, Inc. recommends that exhaust connection to the ChemGuard® be a facility-based control.

WARNING: RISK OF SERIOUS INJURY OR EVEN DEATH FROM CHEMICAL INHALATION

Table 5-2: Chemicals Authorized For Use In ChemGuard®

ABBREVIATION	CHEMICAL NAME
FTES	Fluoro Triethoxy Silane
TEB	Triethyborate
TEOS	Tetraethyl Orthosilicate
TEPO	Triethylphosphate
TMB	Trimethylborate
TMPI	Trimethoxyphosphine
TMPO	Trimethoxyphosphine oxide
4MS	Tetramethylsilane
HMDS	Hexamethyldisilazane
TMCTS	Tetramethycyclotetrasiloxane
OMCTS	Octamethylcyclotetrasiloxane
BTBAS	Bistert-butylaminosilane
CUPRA	(Trimethylvinylsilyl) hexafluoroacetylacetonato copper1
$TiCl_4$	Titanium Tetrachloride
GECL	Germanium Tetrachloride
Pyridine	Pyridine
HCDS	Hexachlorodisilane
Vitamin2	Proprietary
****	****

Refer to Chapter 3 of the manual for more chemicals name for use in ChemGuard.

All Chemicals listed in Table 5-2 require an exhaust flow of 30 cfm and the abatement system shall include activated carbon scrubbers.

NOTE: Connect exhaust vent to the appropriate abatement system for chemical used. There is no significant expected exposure level from residue in the exhaust system.

DISPOSAL

Disposal must be in accordance with local, state, and federal laws and regulations. Contact the appropriate agencies for specific laws and procedures.

MODEL CG325, CG400NT PROCESS RESERVOIR CONTAINER

The Process reservoir container is a unique container, which is equipped with an ultrasonic probe level detection. The ultrasonic probe is interfaced to the

cabinet controller to prevent an overfill condition due to the result of the Bulk to Process chemical fill operation.

5.3 System Combustible Vapor Detection (optional)

An optional combustible vapor detector is located near the exhaust flow stream of the ChemGuard®. When combustible chemical vapors come from the inner ChemGuard® cabinet, a VAPOR Alarm is activated.

This alarm will terminate any operation in progress, and will return all valves to their safe (deactivated) condition to prevent further chemical flow.

The vapor pressures of many process chemicals used in the ChemGuard® are too low to be detected by the vapor detector, and also are too low to be in their flammable/combustible ranges. However, most are air-sensitive chemicals that will develop byproducts detectable by the combustible vapor detection system. Examples of these byproducts include, but are not limited to:

Refer to Chapter 7 for vapor detector calibration and maintenance. Refer to Appendix F for detail.

NOTE: The combustible vapor detector is calibrated to trip at approximately 20% or less of the lower explosion limit of the chemicals used in the ChemGuard®. The VAPOR Alarm is activated after the flammable vapor sensor has detected the presence of vapor for 30 consecutive seconds.

NOTE: The combustible vapor detection system is not designed for use in detecting Threshold Limit Value (TLV) concentrations of process chemical. The customer is responsible for determining whether such protection is required and for providing this equipment.

5.4 Fire (Rate of Rise) Detection (optional)

The cabinet provides an optional rate of rise detector. The sensor will trigger an alarm if a rise of 40 °C is detected in a period of less than one (1) minute. Its activation will generate a shutdown alarm and return the cabinet to IDLE state.

Refer to Chapter 7 for calibration and maintenance.

5.5 Fire Suppression System (optional)

The Fire Suppression System is an independent system, equipped with a rate of rise detection sensor. The sensor will trigger an alarm if a rise of 40°C is detected in a period of less than one (1) minute. The Fire Suppression System will activate the CO_2 bottle solenoid valve to cause CO_2 to spray inside the ChemGuard®

cabinet, terminating the fire within the cabinet. It will also send a signal to the ChemGuard® Network to display an alarm status, thereby generating a shutdown alarm and returning the cabinet to IDLE state.

The actuator valve:

(1) the HF Electric Actuator [wire leads Lt. Blue (+) and Black (-)] with the CV-98 Booster Actuator are resettable and do not require a reset tool as you can press the extended pin back with a rod against any hard surface until it clicks into place. The CV-98 Booster Actuator requires a reset tool ANSUL p/n 429847 to reset the fired pin until it clicks into place.

NOTE: The CG Fire option is an external and independent Fire Detection and Suppression System. The CG Fire option installs directly onto ChemGuard® (CG) and Bulk Chemical Delivery (BCD) cabinets to minimize space requirements and piping connections. While the CG Fire option is not certified to meet CE Standard, it does meet the minimum safety requirements outlined in the manufacturer's operating manual. CG and BCD cabinets with the CG Fire option are not certified to meet the CE Standard. However, CG and BCD cabinets without the CG Fire Option are CE certified.

Refer to Chapter 7 for calibration and maintenance.

5.6 Degasser (optional)

The degasser is an optional component to be installed prior to the Outlet plumbing manifold. It can be installed on most ChemGuard® models. The degasser removes dissolved push gas (Helium) from the chemical delivery stream when vacuum is applied to the internal semi-permeable membrane coil. Contact Versum Materials, Inc. EES group for more detail.

5.7 Degasser Vacuum Pump (optional)

An oil-sealed, rotary vane vacuum pump is offered as standard with the degasser option. If desired, the owner may employ an alternative vacuum pump provided that it can reach a base vacuum of at least 50 mTorr.

NOTE: The primary vacuum valve to operate Chemical Degasser mode is V8.

5.8 Bulk Reservoir Refill Line (optional)

The Remote Refill requires optional hardware to be installed on model CG100 with BULK Reservoir Container for refilling. A line connects to the REFILL port (Figure

2-2) on top of the ChemGuard® cabinet. The option allows the BULK reservoir Container to be filled from an external source.

NOTE: The primary valve to operate Remote Refill mode is V8A.

5.9 Bulk Trickle Purge Pigtail (optional)

The Trickle Purge is an optional hardware to be installed on plumbing. It can be installed on most ChemGuard® models except units that have Remote Refill option. A line connects to the REFILL port (Figure 2-2) on top of the ChemGuard® cabinet. The trickle purge operation sends purge gas to the Bulk Inlet / Outlet pigtails while disconnecting the Bulk container during Change Bulk operation. It can be used to manually purge pigtails at any time prior to installing a fresh Bulk container. Contact Versum Materials, Inc. EES group for more detail.

NOTE: The primary valve to operate Trickle Purge Pigtail mode is V15.

5.10 USB Barcode (optional)

The cabinet can be setup to scan product code with the barcode scanner, it is intended for intermittent use and USB devices connected to it should be used for as short time as possible.

Refer to section of the USB Barcode Setup and Operation for further detail.

5.11 Degasser PT (Pressure Transducer) (optional)

The Degasser PT is an optional vacuum pressure transducer installed on the degasser vacuum source to provide vacuum measurement and display on the HMI to ensure sufficient vacuum for effective degassing. A fault alarm displays if the vacuum increases above a parameter setpoint value (default 500 mTorr). A valve “VPT” provides isolation of the Degasser PT in event of chemical leak. It normally remains open along with the Degasser Inlet and Outlet valves while the degasser is in operation. Refer to Addendum G for more detail.

5.12 Only CG400NT; Cabinet Ultraviolet/Infrared (UVIR) Detector

The GEN II CG400NT comes standard with an Ultraviolet/Infrared Detector. The UV/IR combines a UV and an IR flame detector in one device to respond to a flame condition. This will provide an early indication of a leak at the PROCESS container area. When a fire is detected by the UVIR inside the GEN II CG400NT, the cabinet will be shutdown (factory default) and a “UVIR DETECT” Alarm will be shown on the display. Digital Output 11 (Fire) will de-energize during a fire to provide alarm output capability to the process tool or life safety system.

This alarm will terminate any operation in progress, returns all valves to their safe (deactivated) condition and releases pressure from the Reservoir Container to prevent further chemical flow.

Refer to Chapter 7 for calibration and maintenance. For detail UV/IR maintenance, refer to Addendum Y.

Chapter 6: System Operation

NOTE: Maintenance personnel shall make use of a step stool or small ladder to safely access the ChemGuard® GEN II controller. Operating personnel shall make use of a step stool to access the touch screen monitor as required.

6.1 Theory of Operation

6.1.1 Overview

The ChemGuard® is designed to deliver liquid chemical from the Process reservoir to the OEM process Tool through the use of Helium gas. It provides a constant outlet pressure and a constant flow of chemical without the downtime associated with the Bulk reservoir replacement.

The liquid chemical is supplied in bulk in 11-, 19- and 38-Liter replaceable stainless steel reservoirs. These are installed in the area designated Bulk reservoir.

Using Helium, or other appropriate gas, the cabinet pushes the chemical into the Process reservoir whenever the Process reservoir drops below the PROCESS LOW REFILL set-point (set in USER SETPOINTS of the CONFIGURATION MENU.) The fill continues until the Process reservoir level reaches PROCESS HI REFILL set-point (set in USER SETPOINTS of CONFIGURATION MENU), while the chemical is being continuously delivered to the process tool.

Adjust the Push pressure regulator to the desired pressure then select PROCESS set up menu and enter the push pressure high and low limits. The default setting for the outlet pressure is 25 psig and the defaults high and low limits are +/- 5 psig, but a wide variety of pressure ranges are available.

Helium gas must be controlled in a process fluid in order to prevent damage or improper operation of the liquid MFC. This is accomplished by keeping the chemical level constant at all times in the PROCESS Reservoir and by the use of an optional degasser module. (The use of a particular degasser is specified by the CVD tool manufacturer.) Reduction of process pressure also helps to reduce the amount of helium incorporation in the process fluid.

The ChemGuard® is a microprocessor-based system that monitors all key parameters that control operations. The controller automatically performs most maintenance functions. For example, the CYCLE PURGE and LEAK CHECK operations are automated functions designed into the CHANGE RESERVOIR operation. This automation reduces the time and effort involved in performing common maintenance tasks. The ChemGuard® also provides zero downtime for normal operations as it permits replacement of BULK Reservoir while the PROCESS Reservoir is filling the tools.

The ChemGuard® is designed to ensure maximum purity of process chemicals used in normal operations while reducing the cost of ownership through improved efficiencies (footprint, exhaust, MTBF, MTBR). Automated CHANGE RESERVOIR functions are incorporated, providing customers with the ability to change chemical reservoirs without contaminating chemical lines or causing harm to the Technician/Operator or environment.

The main cabinet power supply is 100 - 240 VAC, auto-switched, for use in all countries (unless an optional degasser is installed, which requires 115 VAC).

Password protection prevents unauthorized personnel from attempting key tasks. Operating modes are displayed to simplify operation.

The Emergency Manual Off (EMO) circuit provides emergency shutdown, including standard red emergency OFF switch (see Figure 5-3). If the EMERGENCY MANUAL OFF (EMO) switch is pressed, it will disrupt the pneumatic air pressure to the solenoids which return the valve actuators to normal status.

The lines leading to the reservoir are designed with flexibility to aid in the installation of the reservoir. Pressure relief is built in to prevent over pressurization of the reservoir.

The ChemGuard® has been designed to meet or exceed industry environmental / safety regulations and specifications. The cabinet is steel, and contains 110% spill containment. All power sources capable of providing shocks or sparks have been isolated and contained completely outside of the chemical cabinet.

Communication to the Process Tool is provided via the input/outputs from the AP1553 / AP1555 PCA (reference Chapter 3). The exact configuration required would depend greatly on the Process Tools in use. Please contact Versum Materials, Inc. service or marketing to determine the best setup for your application.

6.1.2 Relay Output Circuit

The AP1553 / AP1555 PCA Input / Output board provides a set of contacts which are configured for normally open outputs.

6.1.3 Valves and Solenoid Output Circuit

All major system functions are accomplished through the opening and closing of pneumatic valves. The valves each have a unique designation and function and are controlled by a corresponding solenoid.

Chapter 3 describes the plumbing, valves, and solenoids in the cabinet. These solenoids are controlled through the system software based on system requirements and set-up parameters.

WARNING

WARNING: Using solenoid manual over ride to turn on valves can cause spills if they are not returned to the OFF position when the ChemGuard is powered. Always verify that all solenoids are manually OFF before applying power to the unit.

WARNUNG: Werden zum Aktivieren der Ventile die Magnetschalter manuell umgangen und nicht wieder auf OFF zurückgestellt, kann es beim Einschalten des ChemGuard-Systems zum Verschütten von Chemikalien kommen. Vor dem Einschalten der Einheit stets sicherstellen, daß alle Magnetschalter auf Manuell OFF stehen.

AVERTISSEMENT: Surpasser le solénoïde manuellement pour mettre en route les valves peut causer des écoulements lorsqu'elles ne sont pas remises sur la position "OFF" et que le container ChemGuard est en fonctionnement. Toujours vérifier que les solénoïdes sont sur la position manuelle "OFF" avant de mettre en marche l'unité.

6.1.4 Contact / Voltage Input Signals

The microprocessor-based system can accept either CONTACT or VOLTAGE input signals to drive internal circuitry. If the input signal is selected as contact closer then the internal voltage will be used to drive the TTL logic.

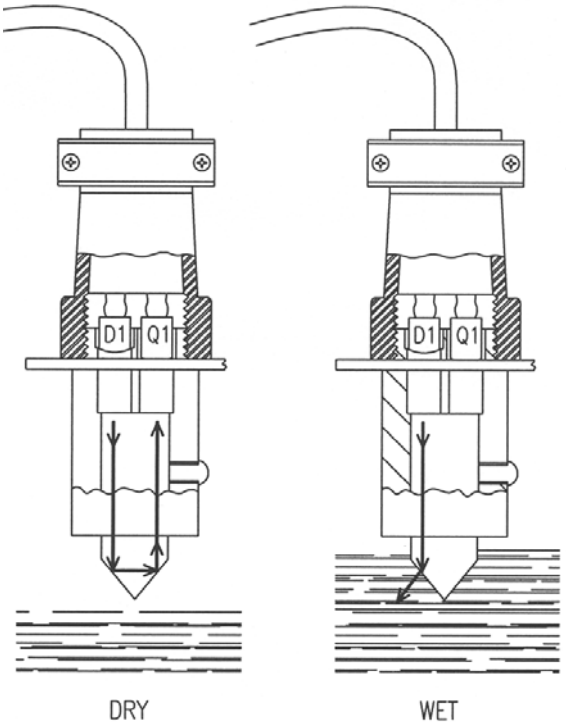
6.1.5 Spill Detection

Optical Spill Detection Circuit and Probe (Optional)

The ChemGuard® has optical spill detection circuitry. The Spill Detection probe is made up of an IR diode/phototransistor pair assembled with a quartz rod.

When the quartz probe is dry the phototransistor receives light waves and closes the digital input. When the quartz probe is exposed to a chemical spill, the phototransistor will not receive the light waves and opens the digital input and displays a spill detect shutdown alarm. A spill detect shutdown alarm will return all sequences to idle and both containers will be vented.

Figure 6-1: Spill Sense Probe



The Spill Sensor does not require calibration; however it is recommended that field verification be performed to ensure proper operation. Verification of the probe is performed by squirting the probe end with IPA. This should cause a spill alarm to trip.

Remove the IPA from the probe tip and verify the alarm status goes away after clear alarm. Please refer to Chapter 7 for more detail test on the Spill Sensor.

WARNING

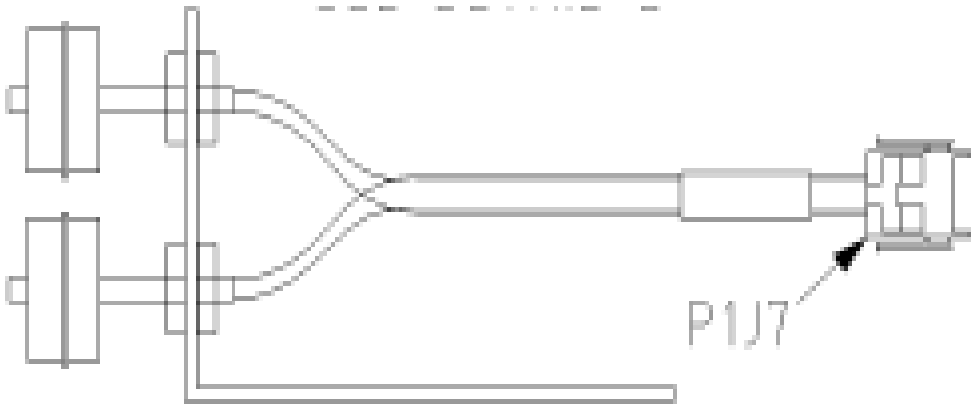
Disconnection or bypass of the spill detect circuit can result in exposure of the Technician/Operator to hazardous chemicals. Always confirm that the circuit has been tested and calibrated prior to operation of the ChemGuard® unit.

Sump Spill (Dual Float Sensors)

The ChemGuard® is equipped with dual float switches as standard offer for spill detection. When a single float detects a spill, a fault alarm is displayed. If both float switches detect a spill, a shutdown alarm is displayed. A spill detect shutdown alarm returns all sequences to idle and vents the Process container.

NOTE: The Dual Float Sensors (SUMP SPILL) does not require any calibration, it is recommended to verify the floats move freely by lifting each one up and it should free fall down. Verify no build-up on the Float and Stem which can cause hang-up. Please refer to Chapter 7 for more detail test on the Sump Spill (Dual Float Sensors).

Figure 6-2: Sump Spill (Dual Float Sensors)



6.2 Description of Menus and Operations

6.2.1 Display Screen

Located on the front face of the controller, the display screen is an LCD that contains a graphical display of the Bulk and Process reservoir, shutdown and fault alarm boxes, a controller status box and selection window. The LCD display provides a lighted display, and visual indication of pneumatic valve positions. Open valves are shown in red and closed valves are shown in green. The valve condition colors conform to ISA standards.

Screens that are displayed when the system is powered up are shown below. Figure 6.3 shows a power-up screen of a system with Bulk Refill option. Figure 6.4 depicts a power-up screen of a ChemGuard® Gen II cabinet with a Bulk trickle purge option.

Figure 6-3: ChemGuard GEN II Controller Power Up Screen with Bulk Refill Option

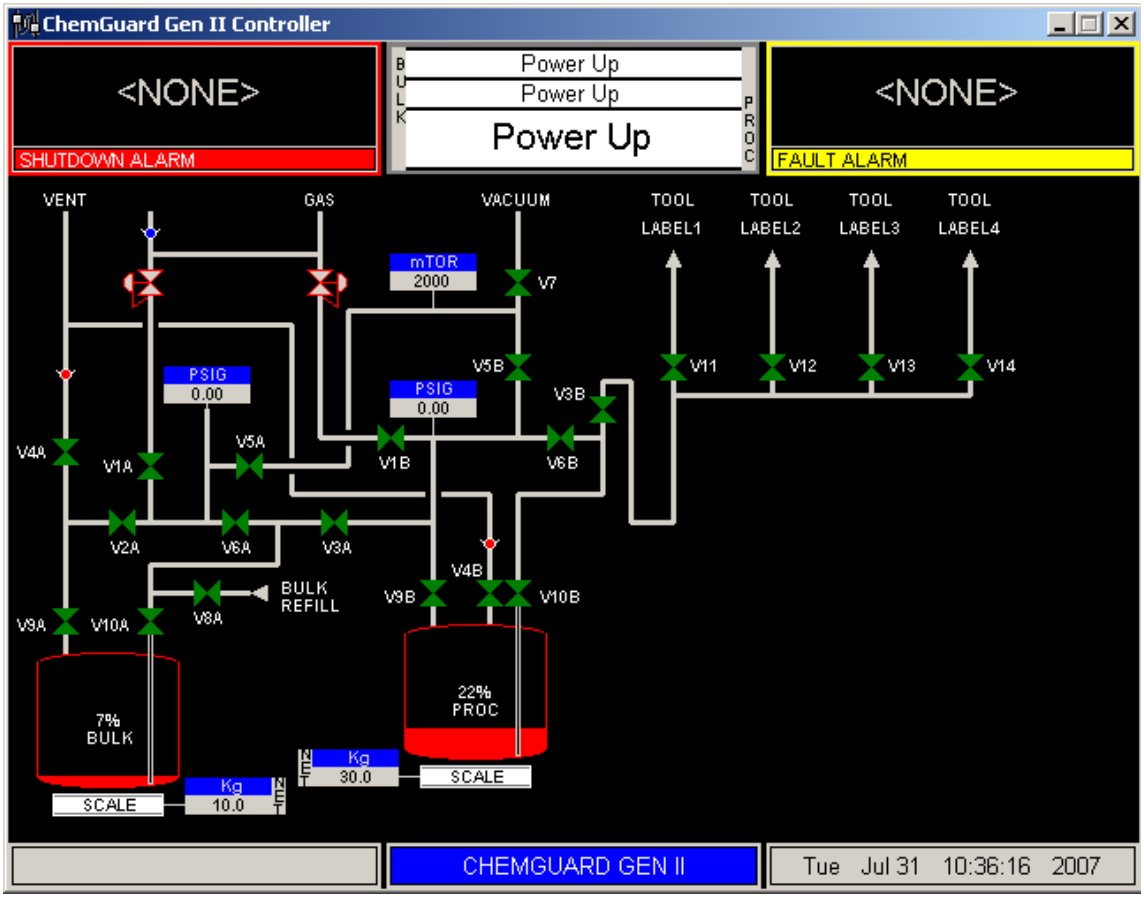
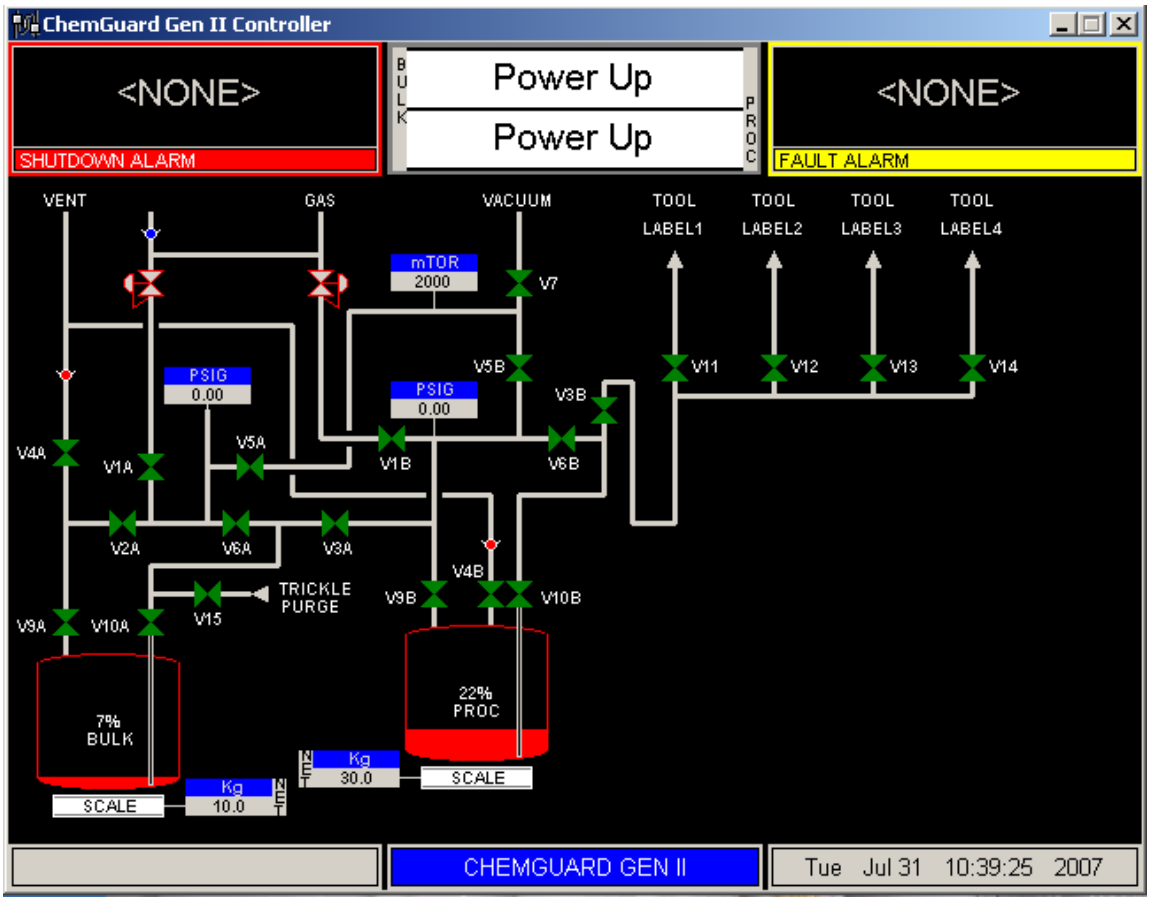


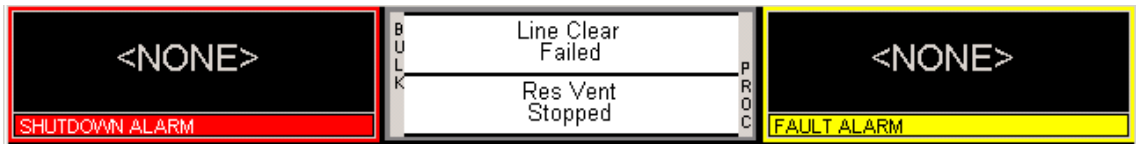
Figure 6-4: ChemGuard GEN II Controller Power Up Screen with Trickle Purge Option



Alarm and Controller Status Boxes

Shutdown alarms in the cabinet appear on the SHUTDOWN ALARM box, located in the top left hand corner of the screen. Fault alarms appear on the FAULT ALARM box, located in the top right hand corner of the screen. If <NONE> is displayed, no alarm conditions are present in the cabinet. A time stamp of when the alarm occurred will be displayed with each alarm. Alarms can be acknowledge and the alarm buzzer can be muted by clicking once anywhere on the alarm box. Double clicking on the alarm text box will clear the alarm.

Figure 6.5: Alarm and Controller Status Boxes



6.2.2 CONTROLLER LED's

Additionally, LEDs that display ChemGuard® functions are located to the right of the LCD display. The table below describes these LEDs and their functions. The fault alarms are indicated by a yellow color and the shutdown alarm is identified by red. These colors are consistent with the optional light bar as well.

LED	FUNCTION
Shutdown Alarm	This LED flashes red on power up and for an un-acknowledged shutdown alarm. Once acknowledged, the LED stops flashing but remains red until it is reset.
Fault Alarm	This LED flashes yellow on power-up and for a fault alarm. Once acknowledged, the LED stops flashing but remains yellow until it is reset.
Chemical Flowing	This LED lights green when chemical process gas is flowing.
Power	This LED indicates that there is +5 VDC power to the unit.

6.2.3 MAIN MENU

Main Menu and Configuration Selection Window

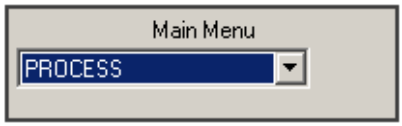
The selection window, which is shown as a Main Menu, is located on the right side of the screen after a password has been successfully entered. This menu will remain displayed for a configurable amount of time or until the "LOGOUT" key is pressed.

The Main Menu

The Main Menu has a pull-down window with two options: Bulk, and Process. (If the cabinet has the Bulk refill option, the Main Menu pull down window will have three options: Bulk, Process and External Fill.) Any operation associated with the Bulk reservoir should be selected by choosing Bulk from the pull-down menu, also referred to as the Bulk Main Menu.

Process reservoir-related operations can be chosen by selecting the Process pull-down menu, also known as the Process Main Menu. If the cabinet is configured for the refill option, then External refill operation can be selected by selecting the External Refill option from the pull-down

menu.



It is possible to resize the Main Menu to get a full view of screen. To resize the Main Menu, touch the label, “Main Menu,” at the top of the window.

The Main Menu will appear like the illustration to the right.

To return the Main Menu to its full size, simply touch the words, “Main Menu,” at the top of the window again.

Screen Saver

The screen saver function becomes active during idle or process on states, after the programmed amount of time has elapsed since the last operator keypad action. The screen saver blanks the screen and displays a randomly-moving mode indicator box.

If the operator presses any key or a new alarm appears while the screen saver is active, the screen saver function will become inactive and the key pressed will be ignored. The screen saver function will not be active while a fault or shutdown alarm is present, an active prompt is displayed, or during any mode/sequence other than idle and process on.

6.2.4 Bulk Main Menu Options

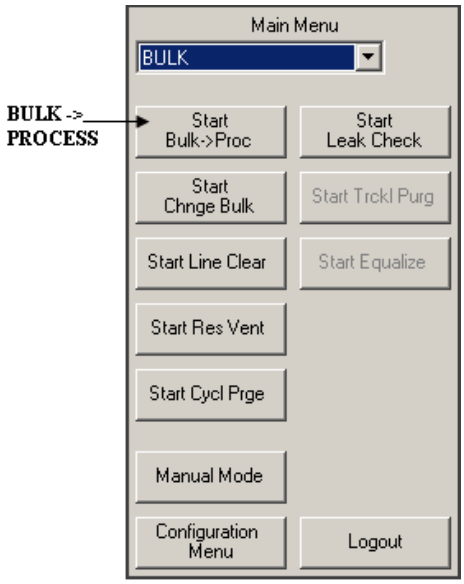
Bulk to Process Fill (START BULK->PROC)

This operation allows chemical to flow from the Bulk reservoir to the Process reservoir. This operation is also called **REFILL** as it refills Process reservoir. From the pull-down menu of the Main Menu, select Bulk (if not selected) to gain access to the Bulk Main Menu. Click **START BULK->PROC** to start chemical flow from the Bulk reservoir to the Process reservoir.

- In this option: Select **START BULK->PROC** to enable the Bulk reservoir to refill the Process reservoir
- Refill operation requires FILL A-To-B input signal on all I/O at A8IOx (x represents IO and may vary from 1 to 4) input pins 16 and 17
- Controller status box for Bulk changes to Bulk->Proc
- Menu option STOP BULK->PROC will be enabled once START BULK->PROC is selected. Clicking on STOP BULK->PROC option stops Bulk reservoir refilling Process

reservoir

- The refill operation commences when chemical level in Process reservoir is less than or equal to PROCESS LOW REFILL set-point, set in USER SETPOINTS of CONFIGURATION MENU. Refill operation stops when Process reservoir level reaches PROCESS HI REFIL set-point, set in USER SETPOINTS of CONFIGURATION MENU
- If multiple I/O connections are used in the cabinet all I/O connections should have jumper installed at A8IOx (x represents IO and may vary from 1 to 4) input pins 16 and 17



The cabinet remains in **Bulk→Proc** status until one of the following conditions occurs:

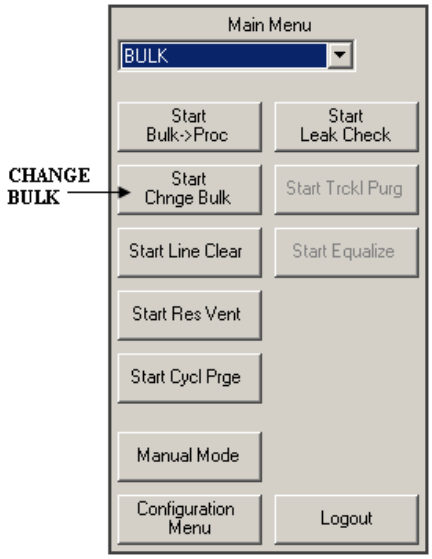
- Chemical level in Process reservoir reaches PROCESS HI REFIL set-point value, set in USER SETPOINTS of CONFIGURATION MENU
- Chemical level in the Bulk reservoir reaches empty
- Operator terminates the operation by selecting **STOP BULK->PROC**
- A shutdown alarm occurs

Change Bulk operation (START CHNGE BULK)

This option guides the operator through steps to remove and replace Bulk reservoir container. Change Bulk operation must be performed any time to remove or install Bulk container.

To start change Bulk operations:

- Press **BULK** button.
- Selecting START CHNGE BULK button will enable STOP CHNGE BULK push button, which can be used to stop change Bulk operation.
- Controller status box for Bulk will display CHNGE BULK STARTED.
- Click on **STOP CHNGE BULK** button to stop change bulk operation.
- Select Bulk from the pull-down menu of Main Menu and press **START CHNGE**.



Change Bulk operation will not proceed if any of the following conditions exists:

- The Vacuum pump is not turned on
- A Shutdown alarm present in the cabinet
- If any automatic operation BULK->PROC or EXTERNAL FILL (if Bulk refill option is available) is enabled. To disable BULK->PROC select STOP BULK->PROC from Bulk Main Menu. If Bulk refill option is available, EXTERNAL FILL operation can be disabled by selecting STOP EXTERNAL FILL from External fill Menu

The change Bulk operation continues to run until one of the following conditions occurs:

- Operator terminates operation by selecting STOP CHNGE BULK from Bulk menu.
- A shutdown alarm occurs.

Refer to Chapter 4 for detail on the Bulk Change operation.

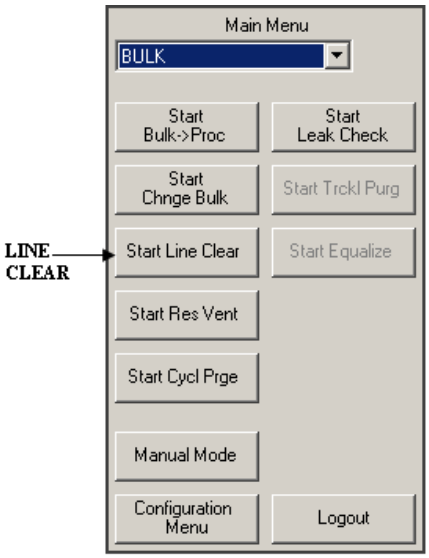
BULK Reservoir Diagnostics

Refer to Chapter 4 for detail on the Bulk Change diagnostics.

Bulk Line Clear Operation (START LINE CLEAR); 'Operation is not available'

Bulk line clear operation removes chemical from internal lines and pushes it back to the Bulk reservoir. This operation is used when the cabinet is to be shut down for an extended period of time or during maintenance operations.

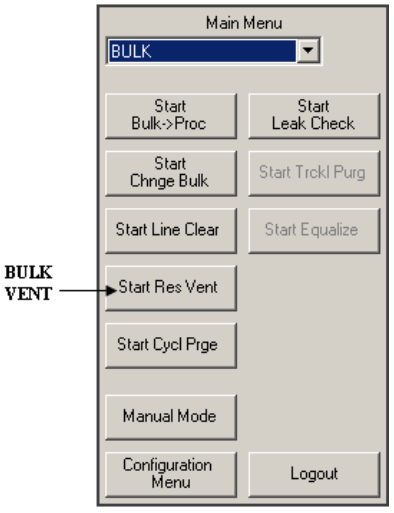
- To start the Bulk line clear operation, click on **START LINE CLEAR** from the Bulk Main Menu
- The Controller status box for Bulk will display "Line Clear" and the STOP LINE CLEAR option will be enabled on the Main Menu.
- Select **STOP LINE CLEAR** to stop line clear operation at any time
- The duration of line clear operation is pre-programmed.
- Bulk line clear operation can be started if there are no shutdown alarms in the cabinet



Bulk Reservoir Vent Operation (START RES VENT); 'Operation is not available'

The Bulk reservoir vent operation removes excess pressure from the Bulk reservoir. It is normally used for cabinet maintenance operations.

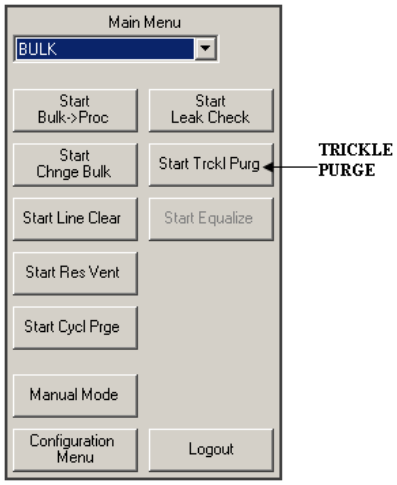
- To start Bulk reservoir vent operation click **START RES VENT** from the Bulk Main Menu
- The Controller status box for Bulk displays RES VENT and the STOP RES VENT option will be enabled on the Bulk Main Menu
- Select the **STOP RES VENT** pushbutton to stop Bulk reservoir vent operation
- The Bulk reservoir vent operates automatically and terminates after a preprogrammed duration of 45 seconds.
- Bulk reservoir vent operation can be started if there are no shutdown alarms in the cabinet



Bulk Trickle Purge Operation (START TRCKL PURG); 'Operation is not available'

Bulk trickle purge operation is an optional feature and not all ChemGuard® will have this option. The START TRCKL PURG option will be enabled if the trickle purge feature is available in this particular ChemGuard®.

- To start the Bulk trickle purge operation, click **START TRCKL PURG** on the Bulk Main Menu and follow prompted information on the screen
- The Controller status box for Bulk displays "Trickl Purg" and the STOP TRCKL PURG option will be enabled on the Bulk Main Menu
- Select **STOP TRCKL PURG** to stop trickle purge operation at any time
- Bulk trickle purge operation can be started if there are no shutdown alarms in the cabinet

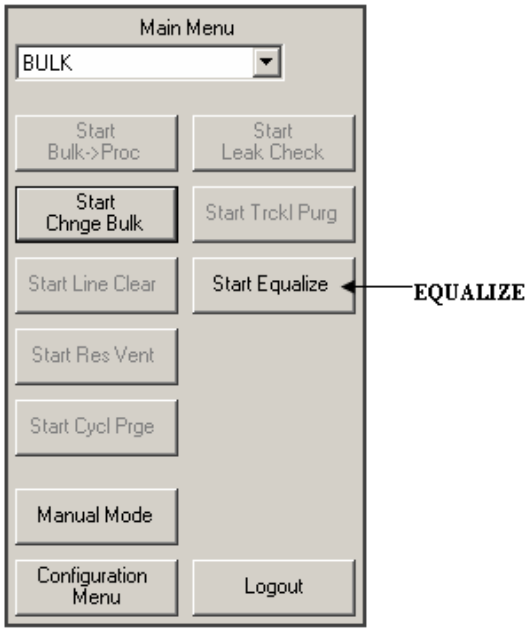


Bulk Equalize Operation (START EQUALIZE); 'Operation is not available'

START EQUALIZE operation should be done at any time that an operation using vacuum has been interrupted. The START EQUALIZE option on the Bulk side will be enabled if the CHANGE BULK routine is interrupted.

- To start the Bulk equalize operation, select **START EQUALIZE** from Bulk Main Menu
- The Controller status box for Bulk will display "Equalize" and STOP EQUALIZE will be enabled on Bulk Main Menu
- Select **STOP EQUALIZE** to stop equalize operation at any time

It is recommended that the Equalize operation be allowed to complete its cycle before starting any other operation



Bulk Manual Mode Operation (START Manual Mode)

The Bulk Manual Mode operation is a function to operate individual valve during startup or maintenance mode as well as for troubleshooting.

- To start Bulk Manual Mode operation, select **MANUAL MODE** from the Bulk Main Menu.
- Select desired valve on touch screen to be actuated and confirm by pressing “OK”.
- For desired valves to remain actuated, then select the “SECURE” box before changing to different screen.
- At anytime all valves can return to normal state by pressing the “CANCEL” box.

6.2.5 Process Main Menu Options

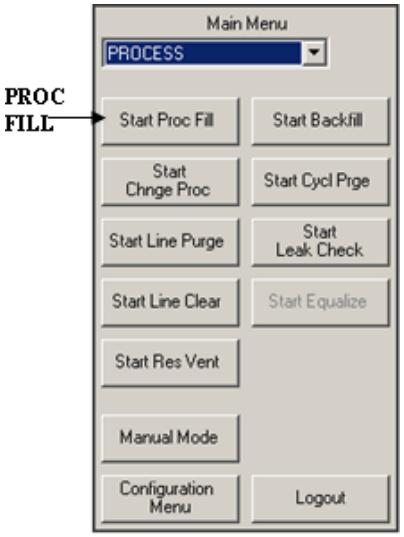
Select Process from the pull-down menu of Main Menu to gain access to the Process Main Menu.

PROC FILL (START PROC FILL)

This option allows chemical to flow from the Process reservoir to the process tool.

In this option:

- Select **START PROC FILL** to enable the Process reservoir to start fill operation to process the tool when requested.
- Process fill operation requires FILL B input signal on any one of the Tool I/Os to be satisfied.
- Once START PROC FILL is clicked, STOP PROC FILL will be enabled. The Controller status box for the Process reservoir will display **PROC FILL**
- The Selection of **STOP PROC FILL** will allow the operator to stop the Process reservoir filling process tool.



The Process fill operation remains enabled until one of the following occurs:

- The chemical level in process reservoir reaches the low level set-point

- The operator terminates the operation by selecting **STOP PROC FILL**
- A shutdown alarm occurs
- FILL B input signal is not available in all IO connections present in the cabinet
- When Process push gas is low, the LOW PUSH PRES PR alarm will be activated
- When Process push gas is high the HIGH PUSH PRES PR alarm will be activated

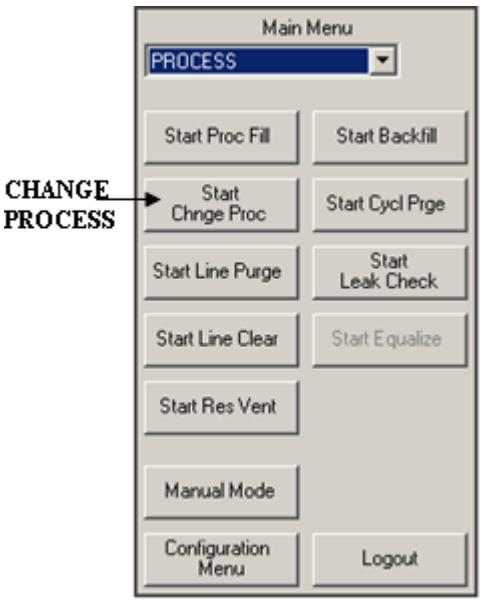
Change Process Reservoir Operation (START CHNGE PROC)

This option guides the operator through steps to remove and replace the Process reservoir. When the Process reservoir is to be removed or installed, the automated change Process reservoir operation must be performed.

NOTE: Change Process operation cannot be started if the vacuum pump is not turned on, a shutdown alarm is present, or all automatic operations are terminated. If, for any reason, the Change Process operation is terminated before its completion, the operator must re-start the change Process reservoir operation to prevent any contamination.

To start Change Process Reservoir operations:

- Stop **Process fill** operation if Process is filling tool, controller status box for Process will display PROC FILL. To stop Process fill, select Process from the pull down menu of Main Menu and choose **STOP PROC FILL** pushbutton
- Stop **Bulk to Process fill** if Bulk reservoir is filling Process reservoir, controller status box for Bulk will display BULK->PROC. To stop Bulk to Process fill select Bulk from the pull-down menu of Main Menu and choose **STOP BULK->PROC** pushbutton



- Stop **Bulk external fill** if an external source is filling Bulk reservoir, controller status box for Bulk (middle one) will indicate EXT FILL. To stop external fill select EXTERNAL FILL from the pull-down menu of Main Menu and choose **STOP EXT FILL** pushbutton. Note: External fill is an option and may not be available in all ChemGuard® products
- Select Process from the pull-down menu of Main Menu. Choose **START CHNGE PROC** pushbutton to start change Process routine

At any time, the operator can terminate the operation by selecting **STOP CHNGE PROC** from the Main Menu.

WARNING

WARNING: Review corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should follow procedures in the Material Safety Data Sheet (MSDS) on chemical being used.

Secondary containment and cleanup material should be available in the event of chemical spill. Proper personal protective equipment must be used.

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 Material-Sicherheitsdatenblättern (MSDS) aufgeführten Verfahren über die jeweils verwendete Chemikalie vertraut sein.

Ein Zweitbehälter und Reinigungsmittel sollten bereitstehen, falls Chemikalien verschüttet werden.

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 suivre les procédés prescrits dans les feuilles de normes pour matières (MSDS) concernant les produits chimiques en usage.Un récipient secondaire et du matériel de nettoyage doivent être disponibles au cas où le produit chimique se renverse.

NOTE: The change Process reservoir operation continues to run until one of the following conditions occurs:

- The Technician/Operator terminates the change Process operation by selecting **STOP CHNGE PROC**
- A shutdown alarm occurs
- Process push pressure is low at the ChemGuard®. (A LOW PUSH PRES, PR will display).

Refer to Chapter 4 for detail on the Process Change operation.

PROCESS Reservoir Diagnostics

Refer to Chapter 4 for detail on the Process Change diagnostics.

Process Line Purge Operation (START LINE PURGE); 'Operation is not available'

The Process line purge operation removes chemical from the internal manifold plumbing of the chemical delivery line (internal from Chemical Output Valves only) and purges it back to the Process Reservoir Container using a pre-programmed timer. Performing this function will not remove all the residual Chemical and/or vapor remaining in the lines.

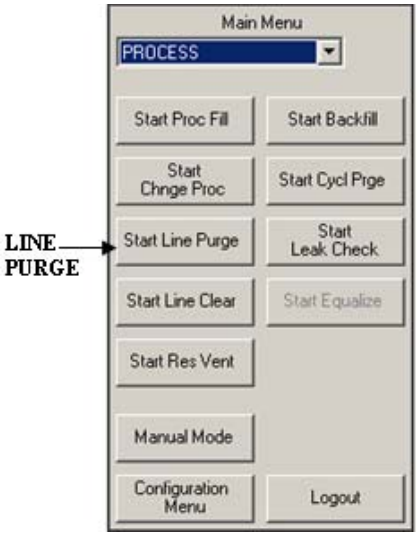
In order to purge the chemical delivery lines completely dry, the operator must perform manual operation with Line Purge by pushing liquid back from the Process Tool(s) into the Process Reservoir with positive pressure and following with Line Clear and Vacuum Cycle Purge.

Before performing the line purge operation, the BACKFILL operation must be performed to prevent overfill condition during line purge.

Process line purge operation must be used when the cabinet is to be shut down for an extended period, if the delivery line is to be expanded to additional Process Tools, or the Process Tool source container is to be removed.

To initiate Process line purge operation perform the following:

- Select Process from the pull-down menu of Main Menu and click **START LINE PURGE** to start Process line purge operation
- The Controller status box for Process displays LINE PURGE and STOP LINE PURGE will be enabled
- Click on **STOP LINE PURGE** at any time to stop line purge operation
- Duration of this operation is embedded in the software

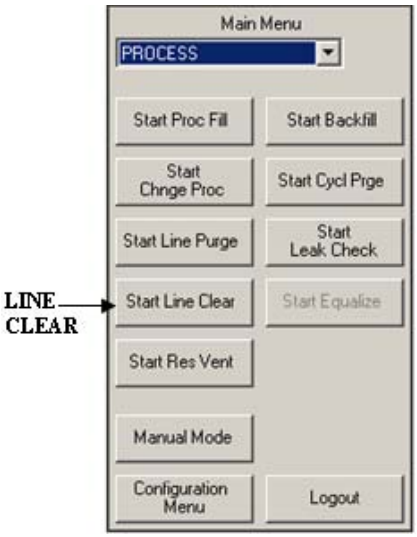


Process Line Clear Operation (START LINE CLEAR); 'Operation is not available'

The Process line clear operation removes chemical from internal lines and pushes it back to Process reservoir. This operation should be used when the cabinet is to be shut down for an extended period or during maintenance operations.

To start Process line clear operation:

1. Select Process from the pull-down menu of Main Menu and click **START LINE CLEAR**. The Controller status box for Process will display LINE CLEAR
2. Once line clear operation is started, the STOP LINE CLEAR button will be enabled on the Process Main Menu. Click on **STOP LINE CLEAR** at any time to stop line clear operation
3. Duration of the line clear operation is embedded in software and cannot be changed
4. Process line clear operation can be started unless there is a shutdown alarm present in the cabinet

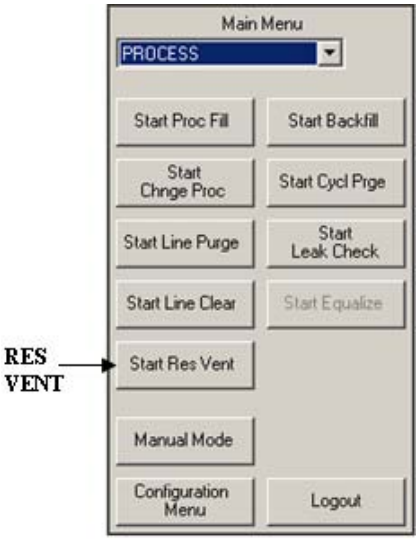


Process Reservoir Vent Operation (START RES VENT); 'Operation is not available'

Process reservoir vent operation removes excess pressure from Process container. It is normally used for cabinet maintenance operations.

To start Process vent operation:

1. Select Process from the pull-down menu of the Main Menu and click START RES VENT. The Controller status box on Process side will display RES VENT
2. Once Process reservoir vent operation is started, the STOP RES VENT button will be enabled on the Process Main Menu. Click on STOP RES VENT at any time to stop reservoir vent operation
3. The Process reservoir vent operation automatically terminates after a preprogrammed duration of 45 seconds
4. Process reservoir vent operation can be started unless there is a shutdown alarm present in the cabinet



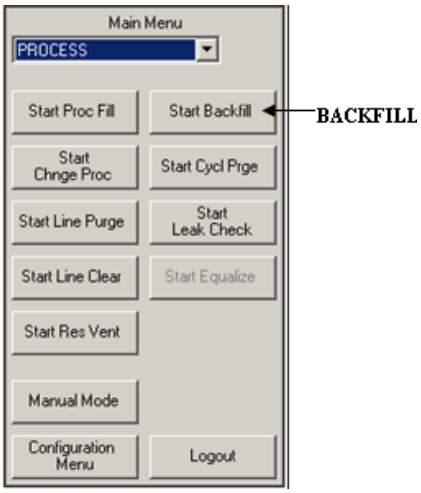
Process Backfill Operation (START BACKFILL); 'Operation is not available'

Process backfill operation removes chemical from the Process reservoir and transfers it to the Bulk reservoir. This operation is primarily used during maintenance operation and should be done before a change Process operation.

Before performing this operation, verify that the Bulk reservoir can hold the amount of chemical from the Process container, (to prevent any OVERFILL condition during the backfill operation.) Otherwise, perform change Bulk operation and install empty Bulk container before proceeding with backfill operation.

To start backfill operation:

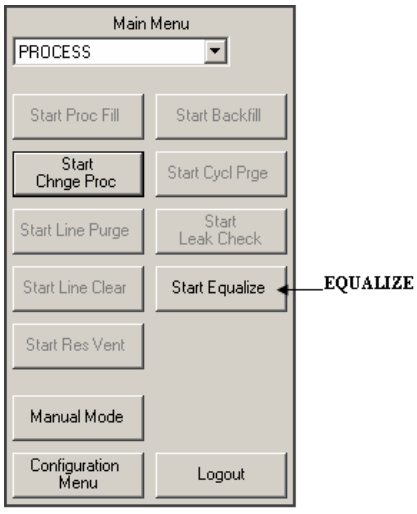
1. Select Process from the pull-down menu of the Main Menu and click START BACKFILL. The Controller status box for Process will appear as Backfill
2. Once Process backfill operation is started, the STOP BACKFILL button will be enabled on the Process Main Menu. Click STOP BACKFILL at any time to stop backfill operation
3. The duration of backfill operation is embedded in software
4. Backfill operation can be started unless there is a shutdown alarm present in the cabinet



Proc Equalize Operation (START EQUALIZE); 'Operation is not available'

START EQUALIZE operation should be done at any time that an operation using vacuum has been interrupted. START EQUALIZE on the Process side will be enabled if the CHANGE PROCESS routine is interrupted before completion.

- To start Process equalize operation, select **START EQUALIZE** from the Process Main Menu
- The Controller status box for Process will display "Equalize" and STOP EQUALIZE will be enabled on the Proc Main Menu
- Select **STOP EQUALIZE** to stop equalize operation at any time



It is recommended that the Equalize operation be allowed to complete its cycle before starting any other operation.

Proc Manual Mode Operation (START Manual Mode)

The Process Manual Mode operation is a function to operate individual valve during startup or maintenance mode as well as for troubleshooting.

- To start Process Manual Mode operation, select **MANUAL MODE** from the Process Main Menu.
- Select desired valve on touch screen to be actuated and confirm by pressing "OK".
- For desired valves to remain actuated, then select the "SECURE" box before changing to different screen.

  At anytime all valves can return to normal state by pressing the "CANCEL" box.

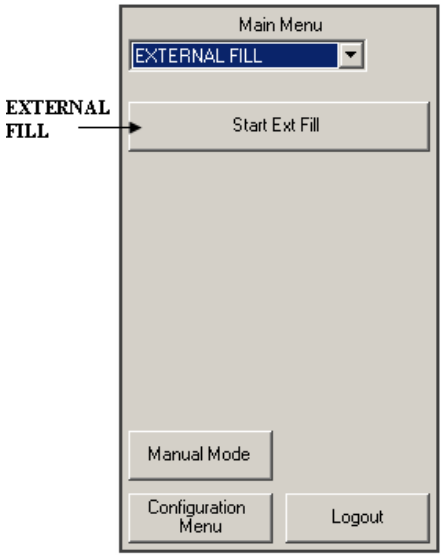
EXTERNAL FILL (Option)

This option allows chemical to flow from an external source to Bulk reservoir. A REFILL manifold is added to the existing BULK reservoir plumbing, allowing connection of the external FILL line, which controls the REFILL of chemical to the Bulk reservoir. External Fill is an optional feature in ChemGuard® product line.

From the pull-down menu of the Main Menu, select EXTERNAL FILL to gain access to this option.

To start external fill operation:

- Select EXTERNAL FILL from the pull-down menu of Main Menu and click **START EXT FILL**. Note: START EXT FILL will be disabled if BULK REFILL LEVEL setpoint percent in User SETPOINTS of Configuration menu is set to zero
- When START EXT FILL is selected, the controller status box for Bulk reservoir (middle box) will display **EXTERNAL FILL ON**
- Also, the menu option STOP EXTERNAL FILL will be enabled. Selecting **STOP EXTERNAL FILL** allows the operator to disable external fill operation.



The external fill operation will start when all of the following conditions are met:

- The XFILL ENABLE input signal is present at T4 pins 1 and 2 on the AP1551 Main I/O PCB.
- Chemical level in the Bulk reservoir falls below the START XFILL LEVEL set-point defined in User Setpoints of Configuration Menu
- The Bulk reservoir is not refilling the Process reservoir
- There are no active alarms that prohibit external fill operation

6.3 Alarm Types

The alarms in the ChemGuard® cabinet can be classified either as SHUTDOWN alarms or FAULT alarms. Shutdown alarms appear on the SHUTDOWN ALARM box, located in the top left hand corner of the screen. Fault alarms appear on the FAULT ALARM box, located in the top right hand corner of the screen. If <NONE> is displayed, no alarm conditions are present. A time stamp of when the alarm occurred will be displayed with each alarm.

Any alarm that occurs in ChemGuard® is displayed along with date and time stamp indicating date and time of alarm occurrence. In addition, independent output signals for shutdown and fault alarm are sent to all the available IO connections in ChemGuard®.

A SHUTDOWN alarms sets off a buzzer, which continues to sound until the alarm has been cleared. A shutdown alarm LED flashes red when an un-acknowledged shutdown alarm is present. The Alarm can be acknowledged by clicking anywhere on the alarm text box. Double-clicking anywhere on the alarm text box will clear the alarm. Once acknowledged, the LED stops flashing, but remains red until it is reset.

A FAULT alarm LED flashes yellow when a fault alarm is present. Once acknowledged, the LED stops flashing, but remains yellow until it is reset. If a light bar tower is available in the system, a red section of light bar flashes when an un-acknowledged shutdown alarm is present. Once acknowledged, the LED stops flashing, but remains red until it is reset. A yellow section of light bar flashes yellow when a fault alarm is present. Once acknowledged, the LED stops flashing, but remains yellow until it is reset.

If multiple alarms are present, alarms will scroll in the alarm box with an index and number of alarms present in the cabinet at that time. The ChemGuard® can be configured so that, when the power at the ChemGuard® is turned off, all alarms are activated at the I/O, which in turn, alerts the process tool of a loss of power on the ChemGuard®.

Unacknowledged alarms are marked with keyword “**NEW**”. Even after an alarm is cleared (by double clicking anywhere on alarm text box), if alarm condition exists in the cabinet, the alarm will come back.

SHUTDOWN Alarms

When a shutdown alarm occurs, all operations are stopped and all valves return to normal stage. In addition, alarm text message will be displayed, shutdown alarm LED will flash and relay output is sent to all active IO connections so that signal can be sent to the process tool. If there is a light bar in the cabinet, a red section of the light bar will flash if shutdown alarm is un-acknowledged and will remain solid red after the alarm is acknowledged.

FAULT Alarms

When a fault alarm occurs, alarm text message will be displayed, fault alarm LED will flash and relay output is sent to all active IO connections so that signal can be sent to the process tool. If there is a light bar in the system, a yellow section of the light bar will flash if the fault alarm is un-acknowledged and will remain solid yellow after the alarm is acknowledged.

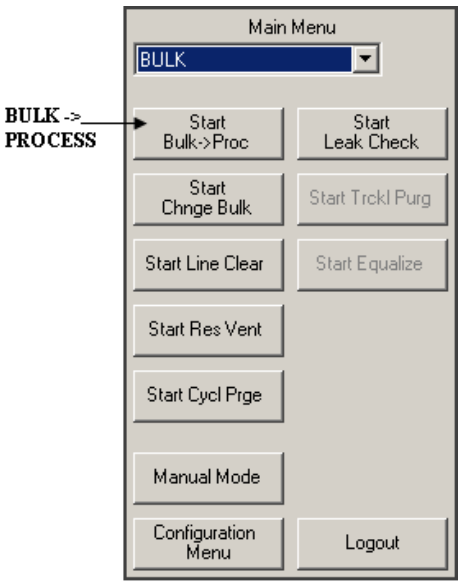
6.4 Ready-Reference Procedures for ChemGuard® Operation

INITIATE FILL OPERATION: BULK TO PROCESS

This operation allows chemical to flow from the Bulk reservoir to the Process reservoir. This operation is also called **REFILL**, as it refills the Process reservoir. From the pull-down menu of the Main Menu, select Bulk (if not selected) to get access to the Bulk Main Menu. Click on **START BULK->PROC** to start chemical flow from the Bulk reservoir to the Process reservoir.

In this option:

- Select **START BULK->PROC** to enable the Bulk reservoir to refill the Process reservoir
- Refill operation requires FILL A-To-B input signal on all I/O to be present
- The Controller status box for Bulk changes to Bulk->Proc
- Menu option STOP BULK->PROC will be enabled once START BULK->PROC is selected. Clicking on STOP BULK->PROC option stops Bulk reservoir refilling Process reservoir
- The refill operation starts when chemical level in Process reservoir is less than or equal to PROCESS LOW REFILL set-point, set in USER SETPOINTS of CONFIGURATION MENU. Refill operation stops when Process reservoir level reaches PROCESS HI REFIL set-point, set in USER SETPOINTS of CONFIGURATION MENU



The cabinet remains in **Bulk→Proc** status until one of the following conditions occurs:

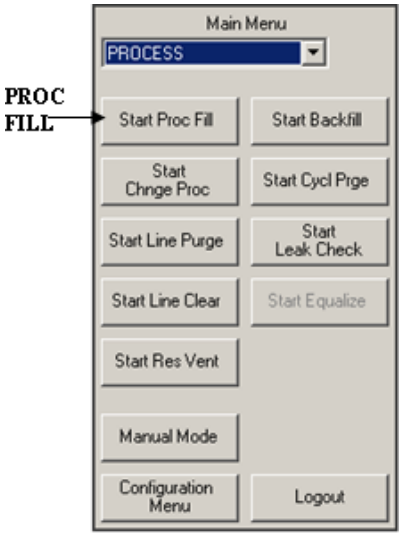
- The chemical level in the Process reservoir reaches the PROCESS HI REFIL set-point value, set in USER SETPOINTS of the CONFIGURATION MENU
- The chemical level in the Bulk reservoir reaches empty
- The Operator terminates the operation by selecting **STOP BULK->PROC**
- A shutdown alarm occurs

INITIATE CHEMICAL FILL OPERATION: PROCESS TO PROCESS TOOL(S)

This option allows chemical to flow from the Process reservoir to the process tool

In this option:

- Select **START PROC FILL** to enable Process reservoir to start fill operation to process tool whenever tool requests
- Process fill operation requires FILL B input signal to be present
- Once START PROC FILL is clicked, STOP PROC FILL will be enabled. Controller status box for Process reservoir displays **PROC FILL**
- Selection of **STOP PROC FILL** allows the operator to stop Process reservoir filling process tool



The Process fill operation remains enabled until one of the following occurs:

- The chemical level in process reservoir reaches the low level set-point
- The operator terminates the operation by selecting **STOP PROC FILL**
- A shutdown alarm occurs
- FILL B input signal is not available in all IO connections present in the cabinet

When Process push gas is low fault alarm LOW PUSH PRES PR alarm will be activated.

Table 6-1: Digital Alarms (ALM-CHM1010, Rev 4)

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

DIGITAL ALARM #	Change Alarm Conditions/Type	ALARM LABEL	ALARM STATE	Hardwire Shutdown J4-13	ALARM RESPONSE	DEFAULT DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
													Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
1	N	Emergency Stop	SHUTD		Opens V4A and V4B, energizes Internal Flag alarm #39 (Shutdown)	0	Open				APCI			Deenergize		Deenergize	X	X	X
2	N	Cabinet Exhaust	FAULT			30	Open	X	X	X	APCI	Fault or Shutdown only. Cannot be made inactive	Deenergize						
3	Y	Z Purge	FAULT			0	Open				APCI		Deenergize						
4	Y	Low Pneumatics	SC, MC		Sequence Controlled, Re-run response on Mode change. Fault in Process Fill or Bulk>Process Fill, Shutdown in all others	30	Open				APCI	Deenergizes the Fault Relay in Process Modes, (Process Fill, Bulk>Process Fill). Deenergizes Shutdown Relay in Idle/Purge modes	Deenergize Process or B>P Fill ON	Deenergize in all others					
5		Supervisory Open	N/A								APCI								
6		Life Safety	N/A								APCI								
7		Supervisory Open R	N/A								APCI								
8		Life Safety R	N/A								APCI								
9	N	Spill Detected 1 (Optical)	NL, MC		Opens V4A/V9A and V4B, energizes Internal Flag alarm #39 (Shutdown)	1	Open				APCI			Deenergize		Deenergize	X	X	X
9	Y	Spill Detected 1 (Dual Float)	NL, MC		Shutdown in Bulk and External Fill Modes, Fault in Process, when combined with Spill Detect 2 alarm, Process shuts down. V4A/V9A and V4B open.	1	Open	X		X	APCI	Fault Alarm in Idle, when placed in Bulk or External fill modes, shuts down modes. Fault in Process Fill mode only.	Deenergize	Deenergize			X		X
10	Y	Spill Detected 2 (Dual Float)	NL, MC		Shutdown in Bulk and External Fill Modes, Fault in Process, when combined with Spill Detect 1 alarm, Process shuts down. V4A/V9A and V4B open.	1	Open	X		X	APCI	Fault Alarm in Idle, when placed in Bulk or External fill modes, shuts down modes. Fault in Process Fill mode only.	Deenergize	Deenergize			X		X
9 & 10	Y	Spill Detected 1 and 2 (Dual Float)	NL, MC		Shutdown in all Modes, All modes shut down. V4A/V9A and V4B open.	1	Open	X	X	X	APCI	Deenergizes Chem On Relay if both float spill detects occur.	Deenergize	Deenergize		Deenergize	X	X	X
11	Y	Door Open	FAULT			0	Open				APCI		Deenergize						
12	N	Liq in Vac Line - ULS3 (Usonic Sensor on Vac Line)	FAULT		Shutdown in Change Bulk and Process Modes.	0	Open	X	X	X	APCI		Deenergize						
13	N	Res Overfull - ULS2 (Usonic Sensor on Vent)	SHUTD		Bulk to Proc, External Fill and Back Fill will go into stand-by mode, all valves will shut until condition is cleared.	3	Open	X		X	APCI			Deenergize			X		X
13	N	Res Overfull (Usonic Sensor installed in Process Container)	SHUTD		Bulk to Proc, External Fill and Back Fill will go into stand-by mode, all valves will shut until condition is cleared.	3	Open	X		X	APCI	CG325 only		Deenergize			X		X
14	Y	Ultrasonic Module 1 Fail (Cabinet Usonic Detector Module)	SC, MC	X	Sequence Controlled, Re-Run Response after Mode Change. Shutdown in Idle, Fault in all other modes.	2	Open				APCI	Energize Shutdown Relay in idle, Energize Fault Relay in all other modes.	Deenergize Process or B>P Fill ON	Deenergize in all others					
15	Y	Bulk Empty - ULS1 (Usonic Sensor on Bulk Outlet Pigtail)	SHUTD		Enabled in Bulk to Process	0	Closed				APCI	Refer to Relay Config Options sheet for Relay Output conditions					X		

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

DIGITAL ALARM #	Change Alarm Conditions/Type	ALARM LABEL	ALARM STATE	Hardwire Shutdown J4-13	ALARM RESPONSE	DEFAULT DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
													Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
16	Y	UVIR Fault	FAULT		Alarms if UVIR detector fails or there is internal trouble.	0	Open				APCI		Deenergize						
17	Y	Usonic Module 2 Fail (Hi Flow Degasser Usonic Detector Module)	SC, MC		Sequence Controlled, Re-Run Response after Mode Change. Shutdown in Idle, Fault in all other modes.	2	Open				APCI	Deenergizes the Fault Relay in Process Modes, (Process Fill, Bulk>Process Fill). Deenergizes Shutdown Relay in Idle/Purge modes	Deenergize Process or B>P Fill ON	Deenergize in all others					
18	N	Degasser Leak 1 - ULS6 (Hi Flow Degasser)	F, MC		Fault in all modes. Any combination of two or more alarms, Degasser Leak 1, 2 or 3 will result in the closing of V8 (degasser valve) and switching to Bypass flow path.	0	Open				APCI	Does not alarm at Digital Output 4 - Degasser Out	Deenergize						
19	N	Degasser Leak 2 - ULS5 (Hi Flow Degasser)	F, MC	X	Fault in all modes. Any combination of two or more alarms, Degasser Leak 1, 2 or 3 will result in the closing of V8 (degasser valve) and switching to Bypass flow path.	0	Open				APCI	Does not alarm at Digital Output 4 - Degasser Out	Deenergize						
20	N	Degasser Leak 3 - ULS4 (Hi Flow Degasser)	F, MC	X	Fault in all modes. Any combination of two or more alarms, Degasser Leak 1, 2 or 3 will result in the closing of V8 (degasser valve) and switching to Bypass flow path.	0	Open				APCI	Does not alarm at Digital Output 4 - Degasser Out	Deenergize						
21	NA	Test Toggle	NL (Fault)		See note for Internal Alarm #28 (I/O Loopback error)	0	Open				APCI	See Note for Internal Alarm #28							
22	NA	V11 Control	NL, MC		Input controls process out valve.	0	Closed				APCI								
23	NA	V12 Control	NL, MC		Input controls process out valve.	0	Closed				APCI								
24	NA	V13 Control	NL, MC		Input controls process out valve.	0	Closed				APCI								
25	NA	V14 Control	NL, MC		Input controls process out valve.	0	Closed				APCI								
26	N	Bulk Code Cable (Option)	FAULT (prompt)	X	Operator prompt - "RECHECK CODE CABLE CONNECTION"	0	Open				APCI	Bulk container code connector must match CG code cable during Change Bulk - "Replace Can" step. If code cable not connected or matches Bulk Container, will not proceed with Change Bulk operation	Deenergize				X		
27	N	UVIR Detect	NL		Opens V4A/V9A and V4B/V9B. DO11 relay at 1551 board, T8-4/5/6 deenergizes when Fire Detect Alarm occurs, from either Fire RofR sensor or UVIR detector.	1	Open				APCI			Deenergize		Deenergize	X	X	X
28		Spare	N/A																
29	NA	X-Fill is OFF (Option)	Fault		Alarm will display an info prompt 'X-Fill Input Not Active' when input is not satisfied.	0	Open			X	APCI								X

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

DIGITAL ALARM #	Change Alarm Conditions/Type	ALARM LABEL	ALARM STATE	Hardwire Shutdown J4-13	ALARM RESPONSE	DEFAULT DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
													Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
29	Y	Low Vent Purge (Option)	SHUTD			0	Open	X			APCI	Shutdown alarm (option) for CG300 and CG325s. When selected customer will supply low flow switch input to DI29 and connect at T4, 1&2 on the Main System IO board.		Deenergize			X		
30	N	Vac Pump is Off	NL (Fault)		Input must be closed or a prompt will appear "Vacuum Pump Not Available" and a Fault alarm will be activated. Activated in Change Bulk	0	Open				APCI	"Vacuum Pump Not Available" prompt displayed	Deenergize						
31	N	Vacuum Interlock	NL, MC	X	Input must be open or a prompt will appear "Vacuum Pump In Use" and a Fault alarm will be activated. Activated in Change Bulk	0	Open				APCI	"Vacuum Pump In Use" prompt displayed. Vacuum Interlock interfaced used when multiple CGs sharing single vacuum pump	Deenergize						
32	N	Degasser Leak - Optical Spill (AMAT Degasser)	FAULT	X	Fault alarm in all mode. Will result in the closing of V8 (degasser valve) and switching to Bypass flow path.	0	Open				APCI	Alamrs at Digital Output 4 - Degasser Out	Deenergize						
32	Y	Low Coax Flow (Option)	Fault			0	Open				APCI	Fault alarm (option) for CG300 and CG325s. When selected customer will supply low coaxial flow switch input to DI32 and connect at T4, 7&8 on the Main System IO board.	Deenergize						
33	Y	Fire Detected (Option)	NL	X	Opens V4A/V9A and V4B. DO11 relay at 1551 board, T8-4/5/6 deenergizes when Fire Detect Alarm occurs, from either Fire RofR sensor or UVIR detector.	2	Closed				APCI			Deenergize		Deenergize	X	X	X
34	N	Degasser Vacuum Switch Fail (Degasser Option)	FAULT	X	Fault alarm in all mode. Will result in the closing of V8 (degasser valve) and switching to Bypass flow path.	0	Open	X	X		APCI	Alamrs at Digital Output 4 - Degasser Out	Deenergize						
35	Y	Combustible Vap Det (Option)	NL	X	Opens V4A/V9A and V4B, energizes Internal Flag alarm #12 (Shutdown)	30	Open				APCI			Deenergize		Deenergize	X	X	X
36	Y	Life Safety Shutdown	NL SHUTD	X	Opens V4A/V9A and V4B, energizes Internal Flag alarm #57 (Shutdown)	0	Open				APCI			Deenergize		Deenergize	X	X	X
37	NA	Process - Fill B (Tool 1)	NL (prompt)		At least one of the Process Fill Tool inputs must be satisfied for Proc Fill to operate.	0	Open				APCI	No Tools Active Fault alarm displayed on alarm	Deenergize			Deenergize			
38	NA	Bulk - Fill A->B (Tool 1)	NL (prompt)		If input required, enter a value of 1 for Variable 77, if not, leave it defaulted at zero, then the software will ignore checking that input.	0	Open	X			APCI	Action Required Fault alarm displayed when Variable 77 selected for 1.00	Deenergize if Variable set for 1.00						
39	NA	Process - Fill B (Tool 2)	NL (prompt)		At least one of the Process Fill Tool inputs must be satisfied for Proc Fill to operate.	0	Open				APCI	No Tools Active Fault alarm displayed on alarm	Deenergize			Deenergize			

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

DIGITAL ALARM #	Change Alarm Conditions/Type	ALARM LABEL	ALARM STATE	Hardwire Shutdown J4-13	ALARM RESPONSE	DEFAULT DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
													Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
40	NA	Bulk - Fill A->B (Tool 2)	NL (prompt)		If input required, enter a value of 1 for Variable 78, if not, leave it defaulted at zero, then the software will ignore checking that input.	0	Open	X			APCI	Action Required Fault alarm displayed when Variable 78 selected for 1.00	Deenergize if Variable set for 1.00						
41	NA	Process - Fill B (Tool 3)	NL (prompt)		At least one of the Process Fill Tool inputs must be satisfied for Proc Fill to operate.	0	Open				APCI	No Tools Active Fault alarm displayed on alarm	Deenergize			Deenergize			
42	NA	Bulk - Fill A->B (Tool 3)	NL (prompt)		If input required, enter a value of 1 for Variable 79, if not, leave it defaulted at zero, then the software will ignore checking that input.	0	Open	X			APCI	Action Required Fault alarm displayed when Variable 79 selected for 1.00	Deenergize if Variable set for 1.00						
43	NA	Process - Fill B (Tool 4)	NL (prompt)		At least one of the Process Fill Tool inputs must be satisfied for Proc Fill to operate.	0	Open				APCI	No Tools Active Fault alarm displayed on alarm	Deenergize			Deenergize			
44	NA	Bulk - Fill A->B (Tool 4)	NL (prompt)		If input required, enter a value of 1 for Variable 80, if not, leave it defaulted at zero, then the software will ignore checking that input.	0	Open	X			APCI	Action Required Fault alarm displayed when Variable 80 selected for 1.00	Deenergize if Variable set for 1.00						
45	NA	Power Supply 1	Fault		Alarms when output drops to 0vdc	0	Open				APCI	Used for Dual Power Supply Option Only	Deenergize						
46	NA	Power Supply 2	Fault		Alarms when output drops to 0vdc	0	Open				APCI	Used for Dual Power Supply Option Only	Deenergize						
47																			
48																			
49	NA	Invalid Tool #1	FAULT		This alarm is enabled when Analog 10 does not detect a valid LTO520 Tool OEM.	0	Open				APCI		Deenergize						
50	NA	Invalid Tool #2	FAULT		This alarm is enabled when Analog 11 does not detect a valid LTO520 Tool OEM.	0	Open				APCI		Deenergize						
51	NA	Invalid Tool #3	FAULT		This alarm is enabled when Analog 12 does not detect a valid LTO520 Tool OEM.	0	Open				APCI		Deenergize						
52	NA	Invalid Tool #4	FAULT		This alarm is enabled when Analog 13 does not detect a valid LTO520 Tool OEM.	0	Open				APCI		Deenergize						

Table 6-2: Analog Alarms

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

ANALOG ALARM #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
AI#1 Process Scale																	
1	Proc Res Overfull	SHUTD	Bulk to Proc Refill stops when Proc Res Overfull alarm activated	3	High	X			User	Alarm active only when in Bulk>Process Fill operation (Bulk>Process fill is enabled)		Deenergize			X		
2	Proc Res Low	FAULT		10	Low				User		Deenergize						
3	Proc Res Empty	FAULT		10	Low				User		Deenergize						
4	Proc Hi Refill	NL	Bulk to Proc Refill stops when Proc can reaches its high stop % level, it has a 2 sec delay to compensate for analog drift or scale bumping, if it is a true % reading after 2 sec, Blk to Prc. Fill will stop.	2	High	X			User						X	X	X
7	Proc Low Refill	NL	Bulk to Proc Refill starts when Proc can reaches its low refill % level, it has a 2 sec delay to compensate for analog drift or scale bumping, if it is a true % reading after 2 sec, Blk to Prc. Fill will start.	2	Low				User								
AI#2 Bulk Scale																	
11	Bulk Res Overfull	SHUTD	Active in BackFill operation, valves will close when condition is present.	3	High				User			Deenergize			X		X
12	Bulk Res Low	FAULT		10	Low				User	Refer to Relay Config Options sheet for Relay Output conditions							
12	Bulk Res Low	FAULT		10	Low				User	User select via Variable 165 set for 1			Deenergize				
13	Bulk Res Empty	FAULT		3	Low				User	Refer to Relay Config Options sheet for Relay Output conditions							
13	Bulk Res Empty	FAULT		3	Low	X			User	User select via Variable 165 set for 1							
13	Bulk Res Empty	SHUTD		3	Low	X			User	Bulk Res Empty set for Shutdown		Deenergize			X		
14	Bulk Refill Level	NL	Refilling from external source stops when it reaches the % setpoint.	2	Low	X			User								
15	Start X-Fill Level	NL	Refilling from external source starts when chemical drops below % setpoint.	0	Low				User								

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

ANALOG ALARM #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
AI#3 Process Push																	
21	Low Push Pres PR (Process)	FAULT	Once pressure is above Low Push Pres PR setpoint, (when already in Process Fill) and pressure decreases below setpoint, alarm will be generated	45	Low				User	User can select for Shutdown	Deenergize						
22	High Push Pres PR (Process)	FAULT		45	High				User	User can select for Shutdown	Deenergize						
23	Low Push Pres PR (Process)	NL	When Process is in idle and is placed in fill, alarm will occur if pressure does not increase above Low Push Pres PR setpoint. NL means non-latching, if in alarm condition and pressure increases above setpoint, alarm clears and Process fill valves will turn on	10	High		X		User	Alarm condition prevents Process Fill to activate, until Process Push Pressure above Low Push Press Process Setpoint	Deenergize			Deenergize			
24	Proc Vent Failed	NL	Time based alarm with a 5 minute limit, a fault alarm will appear if setpoint isn't satisfied after 5 minutes.	20	Low				APCI		Deenergize						
25	Proc Pulse Vent	NL	Valve 4B (venting) will pulse when it reaches setpoint.	0	High				User	User select via Variable 163 & 164. Default is 400 & 400.							
28	Gross Leak PT2	FAULT	Leak Test Process Pigtails in Change Process operation. Pressure Decay Process Pressure (PT2) must satisfy DECAY TEST DELTA and DURATION in LEAK TEST PARAMETERS	2	Low				APCI	This is used in Change Process operation only	Deenergize						
	Initial Purge Delay	*NL*	*This alarm is actually a delay in process purge modes and is subsequence #8 (Line Clear). The operator has the ability to change the wait times after V1B, V6B and V10B open. The default is set to 15 sec. Operator can adjust time delay in the configuration menu under Alarm Delays.*	*15*	*High*				*APCI*								
AI#4 Bulk Push																	
31	Low Push Pres BLK	FAULT	Once pressure is above Low Push Pres BLK setpoint, (when already in Bulk Fill) and pressure decreases below setpoint, alarm will be generated	45	Low						Deenergize						
32	High Push Pres BLK	SHUTD	Shutdown in Bulk to Process Fill	45	High				User			Deenergize			X		X

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

ANALOG ALARM #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
33	Low Push Pres BLK	FAULT	When Bulk is in idle and is placed in fill, alarm will occur if pressure does not increase above Low Push Pres BLK setpoint. NL means non-latching, if in alarm condition and pressure increases above setpoint, alarm clears and Bulk fill valves will turn on	5	High	X			User	Alarm condition prevents Bulk>Process Fill to start, until Bulk Push Pressure is above Low Push Press Bulk Setpoint	Deenergize				X		X
34	Bulk Vent Failed	NL	Time based alarm with a 5 minute limit, a fault alarm will appear if setpoint isn't satisfied after 5 minutes.	10	Low				User		Deenergize						
35	N2 Vent Fail	NL	Time based alarm with a 60 second limit, a fault alarm will appear if setpoint isn't satisfied after 1 minutes. This alarm is only active in the Trickle Purge Sequence.	5	High					This is used with the Pigtail Trickle Purge Option and only during Change Bulk Operation	Deenergize						
6	Pgtl Pres PT1 Fail	NL	This alarm setpoint is used in Change Bulk Sequence. After the Bulk canister is replaced, a leak test is performed. If the Bulk pressure is lower than what is set for this setpoint, a Gross Leak PT1 alarm will appear along with a message "Leak check failure. Alarm must be reset to complete mode"	0	Low				User								
36	Gross Leak PT1	FAULT	Leak Test Bulk Pigtails in Change Bulk operation, refer to step 18 of Bulk Change Valve table	2	Low				APCI	This is used in Change Bulk operation only	Deenergize						
	Initial Purge Delay	*NL*	*This alarm is actually a delay in bulk purge modes and is subsequence #8 (Line Clear). The operator has the ability to change the wait times after V1A, V6A and V10A open. The default is set to 30 sec. Operator can adjust time delay in the configuration menu under Alarm Delays.*	*30*	*High*				*APCI*								
AI#5 Vacuum																	
41	Vac Gauge Fail	SHUTD	Vacuum pressure must increase above VAC GAUGE FAIL value set in USER SETPOINTS-Vacuum, in Change Bulk operation, refer to step 7 of Bulk Change Valve table	0	Low				APCI	This is used in Change Bulk/Process operations only		Deenergize					

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

ANALOG ALARM #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
42	Base Vac Timeout	NL	This alarm used in vacuum sequences and has a 5 minute timeout, a fault alarm occurs if proper vacuum is not reached during the 5 minute wait period. Vacuum pressure must decrease below BASE VAC TIMEOUT in USER SETPOINTS-Vacuum	10	Low				User	This is used in Change Bulk/Process operations only	Deenergize						
43	Pumpdown Timeout	NL	This alarm used in vacuum sequences and has a 5 minute timeout, a fault alarm occurs if proper vacuum is not reached during the 5 minute wait period. Vacuum pressure must decrease below PMPDWN TIMEOUT in USER SETPOINTS-Vacuum	10	Low				User	This is used in Change Bulk/Process operations only	Deenergize						
61	Low Deg Vacuum (Degasser Vacuum Sensor Option)	FAULT	Alarms if vacuum pressure increases above LOW DEG VACUUM value set in USER SETPOINTS-DG VACUUM	2	High				User	Vacuum Sensor monitors health of Degasser Vacuum Pump and will alarm when vacuum pressure of degasser increases above setpoint. Replaces 75Torr Atmospheric Switch	Deenergize						
AI#10 Tool #1																	
91	T1 Sig Low	NL	Prevents V11 from opening	0	Low					CG300T-LTO520 PLC Option	Deenergize						
92	T1 Sig High	NL	Prevents V11 from opening	0	High					CG300T-LTO520 PLC Option	Deenergize						
AI#11 Tool #2																	
101	T2 Sig Low	NL	Prevents V12 from opening	0	Low					CG300T-LTO520 PLC Option	Deenergize						
102	T2 Sig High	NL	Prevents V12 from opening	0	High					CG300T-LTO520 PLC Option	Deenergize						
AI#12 Tool #3																	
111	T3 Sig Low	NL	Prevents V13 from opening	0	Low					CG300T-LTO520 PLC Option	Deenergize						
112	T3 Sig High	NL	Prevents V13 from opening	0	High					CG300T-LTO520 PLC Option	Deenergize						

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

ANALOG ALARM #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
AI#13 Tool #4																	
121	T4 Sig Low	NL	Prevents V14 from opening	0	Low					CG300T-LTO520 PLC Option	Deenergize						
122	T4 Sig High	NL	Prevents V14 from opening	0	High					CG300T-LTO520 PLC Option	Deenergize						
151	PS Output Low	FAULT	Tests the +5vdc output from power supply. Alarm setpoint found in APCI Setpoints, power Supply	2	Low				APCI		Deenergize						
151	PS Output Low	SHUTD	Tests the +5vdc output from power supply. Alarm setpoint found in APCI Setpoints, power Supply	2	Low	X		X	APCI	PS Output Low alarm required to be set for Shutdown when configured for External Fill		Deenergize			X		X
152	PS Output High	FAULT	Tests the +5vdc output from power supply. Alarm setpoint found in APCI Setpoints, power Supply	2	High				APCI		Deenergize						

Table 6-3: Internal Flags

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

INTERNAL FLAG #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
2	*Liq in Vac Line*	*S*	*Alarm occurs in Purge Modes*	*0*	*Energized*	*X*						*Deenergize*			*X*		
6	*Spill Detected*	*SC, MC*	*Alarm occurs when 1 spill float trips. Fault in Bulk to Process and External Fill and Shutdown in Process.*	*0*	*Energized*						*Deenergize*	*Deenergize*				*X*	
12	*Combustible Vap Det*	*S*	*Alarm occurs when Vapor is detected.*	*0*	*Energized*							*Deenergize*			*X*	*X*	
13	*Fire Detected*	*S*	*Alarm occurs when Fire is detected.*	*0*	*Energized*							*Deenergize*			*X*	*X*	
14	CHG Bulk Not Done	SC, MC	Alarm occurs if change bulk is stopped before completion, Blk to Prc will not be able to start until this alarm is cleared.	0	Energized	X					Deenergize				X		
15	Vacuum Pump is Off	SC, MC	Alarm occurs if Jumper not installed or Customer Supplied Dry Contact Input not present at T4 3&4 of Main System IO PCA, AP1551, DI30, when Starting Change Bulk Operation	0	*Deenergized*					"Vacuum Pump Not Available" prompt displayed	Deenergize						
16	*Low Vacuum Timeout*	*S*	*Alarm occurs when Vacuum is not reached after two sets of subcycles are finished and setpoint is still not satisfied.*	*0*	*Deenergized*		*X*					*Deenergize*				*X*	
20	Vacuum Interlock	SC, MC	Alarm occurs if input is closed at T4 5&6 of Main System IO PCA, AP1551, DI31, when Starting Change Bulk Operation.	0	Energized					"Vacuum Pump In Use" prompt displayed. Vacuum Interlock interfaced used when multiple CGs sharing single vacuum pump	Deenergize						
25	N2 Purge Fail	SC, MC	Sequence Controlled, Re-Run response on mode change, enabled in Proc Res Vent, only a Fault in Idle.	0	Energized					Used with Pigtail Trickle Purge Option. Not used at Samsung Austin	Deenergize						
27	*Base Vac Timeout*	*Fault*	*Alarm occurs during Change bulk mode when it fails Base Vac timeout after the sub cycles are complete.*	*0*	*Energized*						*Deenergize*						
32	No Tools Active	FAULT	Alarm occurs if no process tool inputs are satisfied.	0	Energized		X				Deenergize			Deenergize		X	
34	Action Required	FAULT	Alarm occurs when all the Fill A ->B Tool inputs aren't satisfied along with a specific Bulk to Proc info prompt.	0	*Deenergized*						Deenergize				X		

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

INTERNAL FLAG #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
37	Scale Fault (Process)	FAULT	Alarm occurs when scale jumps + or - 5 Kg's anytime during a 12 second window.	1	Energized	X				Bulk to Process returns to idle mode and will not fill the Process container until an operator restarts Bulk to Process.	Deenergize				X		
	Scale Fault (Bulk)	FAULT	Alarm occurs when scale jumps + or - 5 Kg's anytime during a 12 second window.	1	Energized			X		X-Fill to Bulk returns to idle mode and will not fill the Bulk container until an operator restarts X-Fill.	Deenergize						X
38	PT2 Failure	FAULT	Process Push Press transducer does not change ± 0.5 psig after V3A closes during the completion of a Bulk to Process Fill.	0	Energized				User	2 snapshots taken, 1 when Valves 1, 2 and 9 open and the other, 1 sec before V3 closes. The 2 snapshots are compared and they must be identical for PT2 alarm to appear. PT2 alarm can be enabled or disabled from the controller face. Variable 57 (PT2 Failure) can be configured as 0 for Enable and1 fordisable. Default is 0.	Deenergize				X		
	Scale Fault (Bulk)	FAULT	Alarm occurs when scale jumps + or - 5 Kg's anytime during a 12 second window.	1	Energized			X		X-Fill to Bulk returns to idle mode and will not fill the Bulk container until an operator restarts X-Fill.	Deenergize						X
39	Emergency Stop	SHUTD	Alarm occurs when E-Stop is pushed.		Energized							Deenergize			X	X	X
40	Deg Spill Det 1 & 2 (Option)	S, MC	Response after Mode Change, alarm occurs when Deg Leak inputs 1 & 2 trip.	0	Energized							Deenergize		Deenergize		X	
44	Deg Spill Det 1 & 3 (Option)	S, MC	Response after Mode Change, alarm occurs when Deg Leak inputs 1 & 3 trip.	0	Energized							Deenergize		Deenergize		X	
45	Deg Spill Det 2 & 3 (Option)	S, MC	Response after Mode Change, alarm occurs when Deg Leak inputs 2 & 3 trip.	0	Energized							Deenergize		Deenergize		X	

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

INTERNAL FLAG #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
46	Pigtail Not Empty	FAULT	Alarm occurs if Bulk Empty Usonic Sensor sees wet condition during Change Bulk Line Clear Step	1	Energized						Deenergize						
49	DualSpillDetect (Option)	SHUTD	Alarm occurs when both Spill floats trip simultaneously while in Proc Fill mode.	0	Energized							Deenergize		Deenergize		X	
50	*Leak Test Failure*	*SHUTD*	*Alarm occurs if the leak test fails. If the leak test fails befaor a can change, it comes as a shutdown alarm*	*0*	*Energized*							*Deenergize*			X		
51	*Gross Leak PT1*	*Fault*	*Alarm occurs when the Leak test fails during a change Bulk operation. This is the leak test that is performed after the canister has been replaced*	*0*	*Deenergized*						*Deenergize*						
57	*Life Safety Shutdown*	*SHUTD*	*Alarm occurs when E-Stop is pushed.*	*0*	*Energized*					*Alarm occurs when Life Safety Input is triggered.*		*Deenergize*			X	X	X

Table 6-4: Internal Alarms

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

INTERNAL ALARM #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
1	Power Up	SHUTD	When Controller is initally powered up, this alarm will appear.	0	Not Used					Monitored during initialization. Not currently used in ChemGuard		Deenergize					
3	Operator Input Timeout	SHUTD	This alarm will be generated if a WAIT FOR ENTER sequence command is executed and the time-out period for the response has elapsed.	0	Prc Line Only					All timeouts are currently configured as wait forever. This alarm will not occur in this release.		Deenergize		Deenergize			
4	Leak Check Failure	FAULT	Alarm occurs when Leak test fails during pre or post leak check during changing of bulk or prc cans .	0	Prc Line Only						Deenergize						
5	I/O Error	SHUTD	I/O ERROR {ERROR TYPE}, {I/O ERROR TYPE SPECIFIC CODE} I/O ERROR TYPE - 0 is the only I/O error type currently defined. "0" indicates analog input read errors (10 consecutive read errors for the board) I/O ERROR TYPE SPECIFIC CODE - For I/O Error Type 0, this code epresents the analog input number that had the read error	0	All Process Lines					Monitored continuously.		Deenergize		Deenergize		X	
8	INVALID COMMAND	SHUTD	If an unrecognized sequence command is encountered, this alarm will appear.	0	Prc Line Only					Monitored continuously. Will deenergize the Chem On Relay if the invalid command is in the Process Fill Sequence.		Deenergize		see note		X	
9	*TEST GLOBAL SHUTDOWN*	SHUTD	*This is a test alarm used solely in the AP10 simulator. Pressing the 'Shutdown Alarm Test' Button on the System Information Window on the PC AP10 simulator will generate this alarm.*	*0*	*All Process Lines*					*Simulator Only*							
10	*TEST GLOBAL FAULT*	*FAULT*	*This is a test alarm used solely in the AP10 simulator. Pressing the 'Fault Alarm Test' on the System Information Window on the PC AP10 Simulator will generate this alarm.*	*0*	*All Process Lines*					*Simulator Only*							
14	IGNORED: VALVE LOCKOUT	FAULT	This alarm will be generated if an attempt is made via a sequence command to open a valve which is currently closed and locked.	0	Prc Line Only					Monitored continuously	Deenergize						

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

INTERNAL ALARM #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
15	IGNORED: V AND VLR	FAULT	This alarm will be generated if an attempt is made to open a valve which violates one of the configured valve lockout rules. This can occur via either a sequence command or manual mode.	0	Prc Line Only					Monitored continuously	Deenergize						
17	WDT TRIPPED	FAULT	This alarm will be generated on controller power-up if the last power loss was due to the watchdog being tripped.	0	Display Only					When CG in a Process Fill and controller reboots due to a WDT, controller will come back into Process Fill mode if option is selected.							
20	WAIT FOR ALARM TIME OUT	FAULT	This alarm will be generated if a WAIT FOR ALARM sequence command is executed and the time-out period for the alarm has elapsed.	0	Prc Line Only						Deenergize						
21	CONFIG FILE NOT APPROVED	FAULT	This alarm will be generated if the controller detects that the configuration file has not been approved to run on a controller. It will occur during controller startup and when a user attempts to start a main menu sequence.	0	Display Only					Monitored during initialization, and at start of any Main Menu Sequence.							
22	PEER-TO-PEER COMM ERROR	FAULT	This alarm will be generated if Peer-to-Peer communications is utilized and loss of communications to another controller occurred for longer than the configurable comm down error timeout, typically 5 minutes.	0	Not Used												
23	PEER-TO-PEER SHUTDOWN TIMEOUT	FAULT	This alarm will be generated if Peer-to-Peer communications is utilized and loss of communications to another controller occurred for longer than the configurable comm down shutdown timeout, typically 24 hours.	0	Not Used												
24	INVALID PRODUCT CODE	SHUTD	This alarm is used with the Product Verify and Barcode option. This alarm is generated when an incorrect product code is entered.	0	Prc Line Only					Monitored during Bulk Change only when Barcode option is used.		Deenergize					

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

INTERNAL ALARM #	ALARM LABEL	ALARM STATE	ALARM RESPONSE	DELAY	ALARM CONDITION	BULK TO PROCESS INHIBIT	PROCESS FILL INHIBIT	EXTERNAL INHIBIT	DEFINED BY	NOTES	RELAY OUTPUT De-energized when Bulk>Process Fill and Process Fill Enabled				BULK TO PROCESS FAILED	PROCESS FILL FAILED	X-FILL FAILED
											Fault DO30 / Relay 22	Shutdown DO29 / Relay 21	Bulk Empty DO32 / Relay 24	Chem On DO31 / Relay 23			
	Check pneumatic connections, valve operation, and ULS sensor placement	S, MC	Prompt accompanying the PIGTAIL NOT EMPTY alarm that states "Check pneumatic connections, valve operation, and ULS sensor placement". The technician must then select "OK" or "Terminate Container Change"	0													
25	Bulk Fill Timeout	FAULT	Alarm occurs when Prc Fill Setpoint is not reached in the allotted amout of time entered in the Fill Timer menu.	0	Prc Line Only						Deenergize				X		
26	*External Fill Timeout*	*FAULT*	*Alarm occurs when the Bulk Refill Level is not reached in the alloted amount of time entered for Ext Fill parameter in Fill Timers*	*0*	*Prc Line Only*						*Deenergize*						***X***
27	*Process Fill Timeout*	*SHUTD*	*Alarm occurs when the alloted amount of time entered for Proc Fill parameter in Fill Timers has reached during a Process fill operation.*	*0*	*Prc Line Only*							*Deenergize*				***X***	
28	I/O LoopBack Error	FAULT	Alarm occurs when when the digital output #5 state on the Micronix Board does not match the input state on DI #21 (Test Toggle). The check is designed to verify the operation of the Micronix I/O and Arcom relay boards, and the PC/104 bus in general.	0	Prc Line Only						Deenergize						

Table 6-5: Relay Outputs

ChemGuard Gen IIB Alarm Matrix - Config File 11.0

DIGITAL OUTPUT #	OUTPUT LABEL	NOTES
1	Shutdown LED	Internal to Controller
2	Fault LED	Internal to Controller
3	Chem on LED	Internal to Controller
4	Degasser Out	NO / NC contacts available on PLIS Cable, PN 143991, Pin 7/8. Indicates when degasser V8 is closed and in Bypass flow mode.
5	Test Toggle	Internal to Controller
6	Alarm Horn	Internal to Controller
7	Mast Sol Permissive	Internal to Controller
8	Hrdw Mast Rst	Internal to Controller
9 (relay 1)	Exhaust	NO / NC contacts available on 1551 board, T8-10/11/12. Relay deenergizes when Low Exhaust Alarm occurs.
10 (relay 2)	Spill	NO / NC contacts available on 1551 board, T8-7/8/9. Relay deenergizes when both dual sump spill sensors detect liquid.
11 (relay 3)	Fire	NO / NC contacts available on 1551 board, T8-4/5/6. Relay deenergizes when Fire Detect Alarm occurs, from Fire RofR sensor or UVIR detector.
12 (relay 4)	Door Open	NO / NC contacts available on 1551 board, T8-1/2/3. Relay deenergizes when Door Open Alarm occurs.
13 (relay 5)	UVIR Fault	NO / NC contacts available on 1551 board, T10-10/11/12. Relay deenergizes when UVIR fault alarm occurs (health status of UVIR device).
14 (relay 6)	Z-purge	NO / NC contacts available on 1551 board, T10-7/8/9. Relay deenergizes when Z-Purge Alarm occurs.
15 (relay 7)	Liq in Vac	NO / NC contacts available on 1551 board, T10-4/5/6. Relay deenergizes when Liquid in Vac Line Alarm occurs.
16 (relay 8)	Vapor	NO / NC contacts available on 1551 board, T10-1/2/3. Relay deenergizes when Vapor Detect Alarm occurs.
17 (relay 9)	Fill Active	NO / NC contacts available on 1551 board, T9-10/11/12. Not programmed in this release.
18 (relay 10)	Xfill Request	NO / NC contacts available on 1551 board, T9-10/11/12. Relay energizes when system requires fill from the BCD.
19 (relay 11)	Vac Status 1	NO / NC contacts available on 1551 board, T9-4/5/6. Relay energizes when system starts a Bulk and Process Change.
20 (relay 12)	Vac Status 2	NO / NC contacts available on 1551 board, T9-1/2/3. Relay energizes when system starts a Bulk and Process Change.
21 (relay 13)	V11 Chem On	NO / NC contacts available on 1551 board, T11-10/11/12. Relay energizes when V11 Chem On valve is opened/activated.
22 (relay 14)	V12 Chem On	NO / NC contacts available on 1551 board, T11-7/8/9. Relay energizes when V12 Chem On valve is opened/activated.
23 (relay 15)	V13 Chem On	NO / NC contacts available on 1551 board, T11-4/5/6. Relay energizes when V13 Chem On valve is opened/activated.
24 (relay 16)	V14 Chem On	NO / NC contacts available on 1551 board, T11-1/2/3. Relay energizes when V14 Chem On valve is opened/activated.
25 (relay 17)	*Alarm Ex*	*Future expansion for Light Tower*
26 (relay 18)	*Shutdown Ex*	*Future expansion for Light Tower*
27 (relay 19)	*Fault Ex*	*Future expansion for Light Tower*
28 (relay 20)	*Chem On Ex*	*Future expansion for Light Tower*
29 (relay 21)	Shutdown Alarm	NO/NC contacts available on db25 connectors or 1555 board, T1-T4, 2/3. Relay deenergizes when any Shutdown alarm is present (Refer to Relay Config Option sheet).
30 (relay 22)	Fault Alarm	NO/NC contacts available on db25 connectors or 1555 board, T1-T4, 4/5. Relay deenergizes when any Fault alarm is present (Refer to Relay Config Option sheet).
31 (relay 23)	Chem ON	NO/NC contacts available on db25 connectors or 1555 board, T1-T4, 6/7. Relay deenergizes when system not in a Process Fill mode. V11, 12, 13, and 14 do not need to be open.
32 (relay 24)	Bulk Empty	NO/NC contacts available on db25 connectors or 1555 board, T1-T4, 8/9. Relay deenergizes when Bulk Empty is detected at either the Bulk Scale or the Bulk Pigtail Ultra-Sonic Sensor (Refer to Relay Config Option sheet).

Table 6-6: AP10/ChemGuard® Internal Diagnostic Alarm Supplements

***E**lectronics **E**quipment **S**olutions*

AP10 Internal Diagnostic Alarms Supplement

Document No.: BAP001 TCHMAN 0002
Revision: 3
Revision Date: 6-Nov-09
Sheet: 1 of 1

				Distribution System (VMB)		Source System (Cabinet)		High Flow System (HFS)		HPCM (Bulk System)		Universal Pigtail		ChemGuard	
Alarm	*Alarm Number*	*Description*	*Monitored During*	*Alarm Type*	*Condition*	*Alarm Type*	*Condition*	*Alarm Type*	*Condition*	*Alarm Type*	*Condition*	*Alarm Type*	*Condition*	*Alarm Type*	*Condition*
POWER UP	1	When controller is initially powered-up, this alarm will appear.	Initialization	N/A	Not Used	Shutdown	Display Only	Shutdown	Display Only	Fault	Display Only	Shutdown	Display Only	Shutdown	Not Used
V3 INOP DURING RBS	2	This alarm will apply if the system is configured with RBS and will be generated if the operator attempts to run a purge sequence that contains a command to open V3.	Continuously	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only
OPERATOR INPUT TIMEOUT	3	This alarm will be generated if a WAIT FOR ENTER sequence command is executed and the time-out period for the response has elapsed.	Continuously	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only
LEAK CHECK FAILURE	4	This alarm will be generated if a leak check test fails.	Continuously	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Fault	Proc Line Only
I/O ERROR	5	I/O ERROR {ERROR TYPE}, {I/O ERROR TYPE SPECIFIC CODE} I/O ERROR TYPE - 0 is the only I/O error type currently defined. "0" indicates analog input read errors (10 consecutive read errors for the board) I/O ERROR TYPE SPECIFIC CODE - For I/O Error Type 0, this code represents the analog input number that had the read error.	Continuously	Shutdown	All Proc Lines	Shutdown	All Proc Lines	Shutdown	All Proc Lines	Shutdown	All Proc Lines	Shutdown	All Proc Lines	Shutdown	All Proc Lines
INVALID COMMAND	8	If an unrecognized sequence command is encountered, this alarm will appear.	Continuously	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only
TEST GLOBAL SHUTDOWN	9	This is a test alarm used solely in the AP10 simulator. Pressing the 'Shutdown Alarm Test' Button on the System Information Window on the PC AP10 simulator will generate this alarm.	Continuously	Shutdown	All Proc Lines	Shutdown	All Proc Lines	Shutdown	All Proc Lines	Shutdown	All Proc Lines	Shutdown	All Proc Lines	Shutdown	All Proc Lines
TEST GLOBAL FAULT	10	This is a test alarm used solely in the AP10 simulator. Pressing the 'Fault Alarm Test' on the System Information Window on the PC AP10 Simulator will generate this alarm.	Continuously	Fault	All Proc Lines	Fault	All Proc Lines	Fault	All Proc Lines	Fault	All Proc Lines	Fault	All Proc Lines	Fault	All Proc Lines
SC COMM ERROR	13	This internal alarm only applies to ChemGuard systems with a network of Source Controllers (ChemGuard 1000/2000 and FACS), and is used to indicate communication interface errors with the network of Source Controllers. The internal alarm will show two arguments - error type and SCE number. The error types are as follows: 0 - Communication Down (Shutdown if interacting with the SCE (operation request in progress), or Fault otherwise) 1 - Duplicate IP Parameters (Fault) 2 - Timeout Waiting for SCE Operation Request (Shutdown) 3 - Control Disabled for Interacting SCE (Shutdown) Error Type 2 occurs if 60 seconds has passed since a refill has completed and the auto line purge request hasn't been requested by the SCE (if Auto Line Purge is Enabled) or a new/idle request doesn't occur within 60 seconds after the completed status is set by the ChemGuard Controller for the line purge request. Error Type 3 occurs when control is disabled for an interacting SCE.	Continuously	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	Fault/Shutdown	All Proc Lines
IGNORED: VALVE LOCKOUT	14	This alarm will be generated if an attempt is made via a sequence command to open a valve which is currently closed and locked.	Continuously	Fault	Proc Line Only	Fault	Proc Line Only	Fault	Proc Line Only	Fault	Proc Line Only	Fault	Proc Line Only	Fault	Proc Line Only
IGNORED: V AND VLR	15	This alarm will be generated if an attempt is made to open a valve which violates one of the configured valve lockout rules. This can occur via either a sequence command or manual mode.	Continuously	Fault	Proc Line Only	Fault	Proc Line Only	Fault	Proc Line Only	Fault	Proc Line Only	Fault	Proc Line Only	Fault	Proc Line Only
ZERO VERIFY COMND	16	This alarm will be generated when a ZERO VERIFY command occurs in a sequence and the auto zero processing fails.	Continuously	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only
WDT TRIPPED	17	This alarm will be generated on controller power-up if the last power loss was due to the watchdog being tripped.	Initialization	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only
WAIT FOR ALARM TIME OUT	20	This alarm will be generated if a WAIT FOR ALARM sequence command is executed and the time-out period for the alarm has elapsed.	Continuously	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Shutdown	Proc Line Only	Fault	Proc Line Only
CONFIG FILE NOT APPROVED	21	This alarm will be generated if the controller detects that the configuration file has not been approved to run on a controller. It will occur during controller startup and when a user attempts to start a main menu sequence.	Power-up and start of any main menu sequence.	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only
PEER-TO-PEER COMM ERROR	22	This alarm will be generated if Peer-to-Peer communications is utilized and loss of communications to another controller occurred for longer than the configurable comm down error timeout, typically 5 minutes.	Continuously	N/A	Not Used	N/A	Not Used	Fault	All Proc Lines	Fault	All Proc Lines	Fault	All Proc Lines	N/A	Not Used
PEER-TO-PEER SHUTDOWN TIMEOUT	23	This alarm will be generated if Peer-to-Peer communications is utilized and loss of communications to another controller occurred for longer than the configurable comm down shutdown timeout, typically 24 hours.	Continuously	N/A	Not Used	N/A	Not Used	Shutdown	All Proc Lines	Shutdown	All Proc Lines	Shutdown	All Proc Lines	N/A	Not Used
INVALID PRODUCT CODE	24	This alarm is used with the Product Verify and Barcode option. This alarm is generated when an incorrect product code is entered.	Continuously	N/A	Not Used	Shutdown	Proc Line Only	N/A	Not Used	N/A	Not Used	N/A	Not Used	Shutdown	Proc Line Only
CHEMGUARD BULK FILL TIMEOUT	25	This alarm will occur if all of the bulk flow path valves are open longer than the duration of the fill timer, if the fill timer is enabled.	Continuously	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	Fault	Proc Line Only
CHEMGUARD EXTERNAL FILL TIMEOUT	26	This alarm will occur if all of the external flow path valves are open longer than the duration of the fill timer, if the fill timer is enabled.	Continuously	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	Fault	Proc Line Only
CHEMGUARD PROCESS FILL TIMEOUT	27	This alarm will occur if all of the process flow path valves are open longer than the duration of the fill timer, if the fill timer is enabled.	Continuously	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	Shutdown	Proc Line Only
I/O LOOPBACK ERROR	28	This alarm will occur if the state of digital output #5 of the Micronix board does not match the state of digital input #21 on the first Arcom relay board. This check is designed to verify the operation of the Micronix board, the Arcom relay boards, and PC/104 bus. This alarm is only enabled for use in ChemGuard Gen IIB. This error check can not be utilized in ChemGuard Gen IIA.	Continuously	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	N/A	Not Used	Fault	All Proc Lines
FIRMWARE EVENT MESSAGE *F file L:line# T:taskname S:severity M:message*	33	See separate sheet in this document that describes Firmware Event Messages	Continuously	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only	Fault	Display Only

Internal Firmware Event Messages

To provide as much firmware robustness as possible, the firmware must check for hundreds of internal events, most of which should never occur and will never be seen by the controller operators.

The format of the internal firmware event messages will be as follows:

Date	Time	File	Line	Task	Severity	Message
10/29/09	16:12:05.000	F:TskWdg.cpp	L:223	T:TskWdg(1)	S:Warn	M:NetOvrld

- Date – Date string being Month, Day and Year (two or four character)
- Time – Time string being Hour (00 to 23), Minute and Second (and optional Milliseconds)
- File – Source File origin
- Line – Line number in the source file
- Task – Task name and identification number
- Severity – Severity
- Message – Message

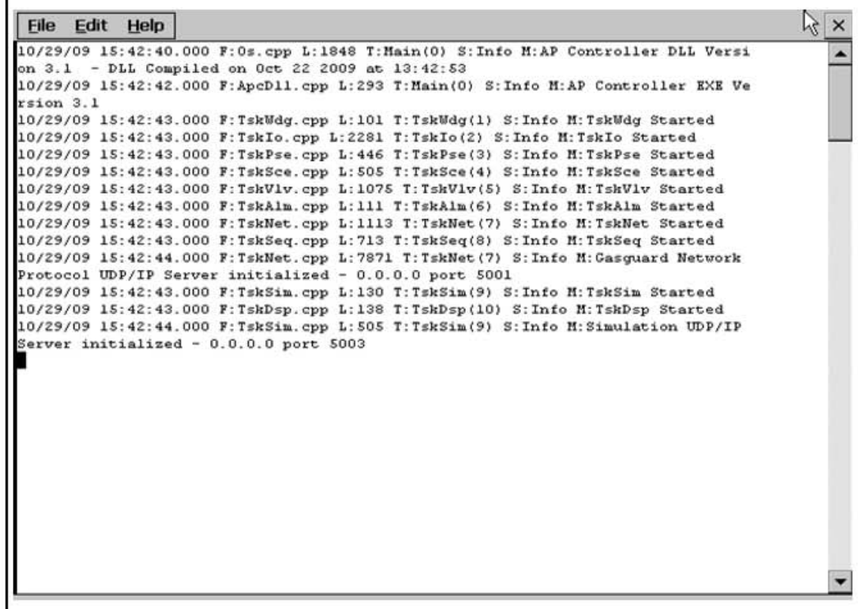
Internal firmware event messages have the following severity level:

- **Info** – Informational event messages usually reserved for controller startup messages or other informational events.
- **Warn**– Warning event messages are used for critical events that aren't severe enough to be errors.
- **Err** – Error event messages that are serious error events that aren't severe enough to be fatal errors. The controller will try to overcome such error events.
- **Fatal** – Fatal event messages that are very severe error events that the controller cannot overcome. These fatal events will result in a reboot of the controller, and may or may not appear in the alarm history event log due to the severity of the event.

The internal firmware event messages will have the following output destination:

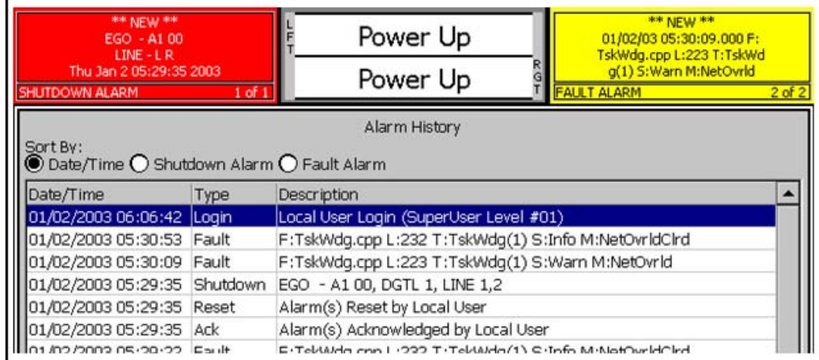
- **StdOutWndw** – Standard Output Window destination being the log window that appears during controller startup and remains in the background of the controller's user interface. This output destination is reserved for controller startup messages or informational events during controller operation. These messages will not appear in the alarm history log.
- **DspWndw** – Display Window destination being the fault alarm box. Regardless of the severity of these messages, they will always appear in the fault alarm box. Display Window destination event messages will also go to the Standard Output Window and to the alarm history log.

Standard Output Window destination event message will appear as follows:



Display Window destination event message will appear as follows:

Display Window destination event messages will appear in the alarm history log as follows:



Recommended Action for the Occurrence of an Internal Firmware Event Message:

Since almost all internal firmware event messages are very rare, all occurrences should be reported to Air Products as soon as possible. With the report, please include the alarm history log and as much detail as possible that is known about the problem.

Some detail is worth noting on the following internal firmware event messages:

- **NetOvrld** – This Network Overload event message results from an Ethernet Network Storm. In addition to reporting this message to Air Products, investigate the occurrence of a Network Storm at the equipment's site. Did other controllers or pieces of equipment report the same problem? If so, the problem is not with the controller, but is with the network somewhere. Contact the IT staff at the equipment's site. If no other networked devices reported this event message, the problem may be with the specific controller. The recommended action is to report and monitor closely.
- **NetOvrldClrd** – This Network Overload Cleared event message indicates the end of an Ethernet Network Storm. See NetOvrld for details.
- **Low Memory** – This Low Memory event message indicates that 91% or more memory is used. In addition to reporting this message to Air Products, the controller should be rebooted as soon as downtime is available. It is unknown what would cause this high level of memory usage, and therefore, no estimate of time available until all memory is exhausted.

Chapter 7: Maintenance & Calibration Procedures

NOTE: Maintenance personnel shall make use of a step stool or small ladder to safely access the ChemGuard® GEN II controller. Operating personnel shall make use of a step stool to access the touch screen monitor as required.

7.1 Introduction

The ChemGuard® is designed to have minimal maintenance activity associated with its electronics. Proper Lockout-Tagout procedures should be followed to ensure that power is disconnected from the electronic enclosure before any work is performed on this equipment.

A recommended spare-parts list provides part numbers for the appropriate number of PCA's required for the cabinet.

7.2 Calibration and Testing

Calibration and testing, and any resulting maintenance, should be performed at regular intervals. Refer to table below.

Table 7-1: Inspections Schedule

Periodic Inspection	Frequency
Spill Sensor Calibration	12 Months
Vapor Detector Verify/Calibration	3 Months
Vacuum Thermal Couple / Vacuum Transducer	24 Months or When replaced
Scales Verify/Calibration	24 Months or When replaced
Ultrasonic clamp-on sensors Verify	12 Months
Fire Detect "Rate Of Rise" sensor Verify	12 Months
Fire Suppression System & ROR sensor	12 Months
UVIR (Ultraviolet / Infrared) Detector Verify	12 Months
*Degasser Vacuum Pump	3 Months

NOTE: Refer to Vacuum Pump Operating Manual for scheduled maintenance recommended by the manufacturer and/or if the pump oil shows sign of discoloration.

7.2.1 Sump Spill Optical Sensor Verification (Optional)

The Optical Sensor verification is used to ensure proper operation of the fiber optic spill detect probe. Not performing this test may result in a sensor that does not provide an alarm in the event of an actual chemical leak inside the cabinet.

This procedure should be performed during a CHANGE BULK RESERVOIR Operation, as the Bulk Reservoir must be removed to perform the optic sensor verification.

During the Optical Sensor verification, the ChemGuard® should be in an idle condition, it will not deliver chemical to the OEM tools.

1. Connect a voltmeter to AP1552 PCA at TP4 with respect to TP6 common (analog ground). Verify the reading is 14.7Vdc – 15.8Vdc.
2. Power off cabinet. Temporally remove jumper J21 at position A on AP1552 PCA. Connect current meter.
3. Power on cabinet. Verify the reading is 4.0 +/- 0.5 mAmp.
4. Apply liquid isopropyl alcohol (IPA) to the probe tip. The angled end must be covered with liquid. The test should result in cabinet power OFF or SPILL DETECTED shutdown alarm.
5. Carefully remove liquid from the probe tip. Verify that the cabinet can be powered ON or SPILL DETECTED alarm can be cleared.
6. Remove test equipment and re-install jumper J21.

NOTE: If the test fails, repeat procedure. If continues to fail, troubleshoot and repair or contact Versum Materials, Inc. EES Technical Support group.

7.2.2 Sump Spill Dual Float Sensors Verification

The Dual Float Sensor(s) consist of hermetically sealed reed switches actuated by magnetic floats. As the floats rise and fall with the liquid level, the magnetic field passing the switch causes the switch to either open or close.

The ChemGuard® uses Dual Float Sensors which are closed in the normally dry condition and open when wet to generate Fault and/or Shutdown alarms depending on the operation mode.

This procedure should be performed during a CHANGE BULK RESERVOIR Operation, as the Bulk Reservoir must be removed to perform sensor verification.

During the Dual Float Sensors verification, the ChemGuard® should be in an idle condition, it will not deliver chemical to the OEM tools.

NOTE: The Dual Float Sensors do not require calibration. It is recommended to verify the floats move freely by lifting each one up and it should freely fall down. Verify there is no build-up of debris on the float and stem which could cause hang-up. The assembly can be cleaned using isopropyl alcohol.

1. Ensure the Dual Float Sensors assembly is properly mounted.
2. Gently lift up one float at a time. The test result should be a SPILL DETECTED or SPILL DETECTED 2 fault alarm.
3. Clear alarm and test other float.
4. Verify each float sensor movement several times to ensure the floats are free falling.
5. Gently lift up both floats at once. The test result should be a DUAL SPILL DETECT shutdown alarm.
6. Verify that the DUAL SPILL DETECT alarm can be cleared.

NOTE: If the test fails, repeat procedure. If continues to fail, troubleshoot and repair or contact Versum Materials, Inc. EES Technical Support group.

7.2.3 Vapor Detector Verify / Calibration (Device Option)

This procedure is used to verify/calibrate the detection limit of the optional Vapor Detector. Failure to perform this calibration may fail to detect sensor drift over time, resulting in inaccurate response of the Vapor Detector. This inaccuracy can manifest itself as over-sensitivity (causing the alarm to be triggered when no vapors are present), or as insensitivity (causing no alarm when vapors are present). Drift is not predictable and may vary in direction and magnitude from system to system and may change as the Vapor Detectors age.

The optional Vapor Detector should be verified / calibrated every three (3) months, or when exhaust flow over an interval changes. The user should be familiar with the operation and calibration of the Vapor Detector prior to servicing the detector.

NOTE: Before starting the verify/calibrate procedure, any Remote Alarm interface must be disconnected to a avoid fault alarm to the site.

The vapor detector used in ChemGuard® is the Sierra Monitor Corporation Gas Sensor Module, Model 2001-00. Refer to Appendix F this manual.

The following tools and equipment are required for Vapor Detector calibration:

- Jeweler's screwdriver or equivalent
- Calibration gas (1000 ppm CH4)
- Calibration gas delivery system

For accurate calibration, use a gas mixture at the required concentration mixed in an air balance, rather than with an inert gas, such as nitrogen. This gas and the required delivery equipment are available from the Sierra Monitor Corporation.

1. The calibration gas must be applied directly to the sensor opening of the vapor detector housing.

2. Apply 50 cc/min. of calibration gas. A low gas flow is desired to prevent cooling of the sensor element. However, a flow greater than 250 cc/min. may be necessary in order to get the gas to the sensor because exhaust flow rates will affect calibration gas dilution rates.
3. If the detector alarm activates, the detector is calibrated and requires no further adjustment.
4. If the monitor alarm does not activate, do the following:
   a) Apply 50 cc/min. of calibration gas for 1.0 minute to the detector and adjust the potentiometer until the detector alarm activates with a constant tone from the detector alarm. Refer to Appendix F for potentiometer rotation.

NOTE: If the alarm from the detector is oscillating, the detector is disabled.

   b) Remove the calibration gas and allow the alarm to clear.
   c) Re-apply 50 cc/min. of calibration gas for 1.0 minute.
   d) If the detector alarm activates within one minute and stops within one minute of the removal of the calibration gas, the detector is calibrated and requires no further adjustment. If not, repeat sub step a).

7.2.4 Thermocouple Gauge Setup

Verify that J7 on the AP1552 PCB is configured for thermocouple (A and C). Calibration is not required.

1. Shut the cabinet power off.
2. Verify J7 on the AP1552 is configured for thermocouple (A and C).
3. Connect a calibrated vacuum reference to the vacuum pump.
4. Apply vacuum to the vacuum port on the ChemGuard®.
5. Manually open V7. Wait for the vacuum reading on the “Analog Test In” display of the ChemGuard® to stabilize.
6. The cabinet vacuum base pressure is approximately between 10-50 mTorr. This may be higher than the calibrated vacuum reference.
7. Thermocouple verification is complete.

Reference Model via Vacuum Gauge:

Vacuum Gauge	CG100--200	CG300—325, CG400NT

Thermocouple	yes	n/a
Baratron	n/a	yes

7.2.5 Vacuum Transducer Calibration (Baratron model 626A)

This procedure is used to set the accuracy of the Vacuum Transducer. Failure to perform this calibration may permit a build up of “sensor drift”, resulting in inaccurate reading and may prevent the removal of chemical from the container/pigtail interface or vacuum source not being able to reach vacuum set points. The first condition may expose the technician to chemical vapor and/or liquid. The second condition may cause the ChemGuard® to abort the “Change Container Function” due to vacuum pump failure. Sensor drift is not predictable and may vary in direction and magnitude from system to system.

1. Shut the cabinet power off.
2. Verify J7 on the AP1552 is configured for Baratron (B and D)
3. Connect a calibrated vacuum reference to the vacuum pump.
4. Apply vacuum to the vacuum port on the ChemGuard®.
5. Enter Manual Mode and open V7. Wait for the vacuum reading on the “Analog Test In” display of the ChemGuard® to stabilize.
6. Verify / Adjust the Zero potentiometer on the vacuum transducer until the vacuum reading on the display matches the calibrated vacuum reference on the vacuum source.
7. Switch V7 off and remove the vacuum reference.
8. Calibration is now complete.

7.2.6 Scale Calibration

This procedure is used to set the accuracy of the Scale. Failure to perform this calibration may permit a build up of “strain gage drift” resulting in inaccurate reading. If the PROCESS scale were to read the container weight lower than real weight, the PROCESS container could potentially be overfilled, causing a Major Alarm and shutdown of the cabinet, which may result in scrapping wafers. Similarly, the minimum weight of <30% may be reached, resulting in additional Helium to be trained in the chemical, causing shift on the chemical deposition thickness, which will result in scrapping wafers. Scale drift may vary in direction and magnitude from system to system.

BULK scale:

If the unit is operational, the BULK container must be removed to perform this calibration. Turn the bottom scale assembly upside down to verify the BULK scale option was installed. If the scale option is present, leave the cover plate assembly attached and upside down. If the scale is **not** installed, ensure that the shorting plug for the panel mount connector under the shelf is installed. The calibration requires the use of weight standards weighing approximately 18Kg (~40lbs) each. It is recommended that this calibration be coordinated with a normal Bulk change out event.

1. Notify the Process Engineer that the ChemGuard® will not deliver chemical for approximately four (4) hours.
2. Disable the BULK TO PROCESS ON functions.
3. Document both fields of the NET and CURRENT weight of the BULK can, then perform CHANGE BULK operation.
4. Start the CHANGE BULK function.
5. When the software prompts with a text message stating “CHANGE CAN?” the technician/operator should remove the BULK container. After the removal of the container, the pigtails should be capped.

NOTE: The new scale design is no longer require turn over as it bolted.

6. Turn the Bulk scale assembly upside down (the scale is now right side-up and the adaptor plate is under the scale).
7. From the Configuration screen, select Net Product, Select BULK from the pull down menu and change the BULK NET field weight to “100” and a CURRENT weight of “0.1”.
8. Verify the weight on the main graphics is 0%.
9. Place both calibrated weights on the scale and verify that the Bulk weight displayed in the “Analog Test In” screen equals the actual grams value of both calibrated weights (within ±150 grams with 300 Lbs scale).
10. Adjust the Span pot (right side when scale is upright) as required.

11. Remove calibrated weights and verify that the scale returns to 0.1 gram (±150 grams with 300 Lbs scale).
12. Adjust the zero pot. (Left side) on front edge of scale as required.
13. Repeat steps 9 - 12 until no adjustments are required.
14. Place one calibrated weight on the scale and verify that the Bulk weight displayed in the “Analog Test In” screen equals the actual grams value of calibrated weight (within ±150 grams with 300 Lbs scale).
15. Remove the weight and turn the Bulk scale assembly right side-up (the scale is now upside down and the adaptor plate is on top of the scale).
16. Check BULK Pigtails are to be capped or old/empty the BULK container is still connected at pigtails.
17. Start the CHANGE BULK function.
18. When the software prompts with a text message stating “CHANGE CAN?” the technician/operator should remove the caps from the pigtails on the old BULK container.
19. Install the new BULK container with new VCR gaskets.
20. Press ENTER to allow the software to continue with the change function. Then follow software prompts to complete the BULK CHANGE RESERVOIR Operation. Refer to Chapter 4 for detail.
21. The Bulk scale calibration is completed.

PROCESS scale:

If the unit is operational, the PROCESS container must be removed to perform this calibration.

The following steps apply with the PROCESS container not installed. If the can is not empty, BACKFILL the chemical to the BULK can if ample space is available. Perform CHANGE PROCESS to remove the can.

1. Notify the Process Engineer that the ChemGuard® will not deliver chemical for approximately four (4) hours.
2. Disable the PROCESS ON and BULK TO PROCESS ON functions.
3. Document both fields of the NET and CURRENT weight of the PROCESS can, then perform CHANGE PROCESS operation.
4. Start the CHANGE PROCESS function.
5. When the software prompts with a text message stating “CHANGE CAN?” the technician/operator should remove the PROCESS container. After the removal of the container, the Pigtails should be capped.
6. From the Configuration screen, click Net Product, Select PROCESS from the pull down menu and change the PROCESS NET field weight to “100” and a CURRENT weight of “0.1”.
7. Verify that the weight on the main graphics is 0%.

8. Place both calibrated weights on the scale and verify that the weight displayed in the “Analog Test In” screen equals the actual grams value of the both calibrated weights (within ±150 grams with 300 Lbs scale).
9. Adjust the Span pot (right side) as required.
10. Remove the calibrated weights and verify that the scale returns to 0.1 gram (±150 grams with 300 Lbs scale).
11. Adjust the zero pot. (Left side) on front edge of scale as required.
12. Repeat steps 9 - 12 until no adjustments are required.
13. Place one calibrated weight on the scale and verify that the Bulk weight displayed in the “Analog Test In” screen equals the actual grams value of calibrated weight (within ±150 grams with 300 Lbs scale).
14. Remove the weight.
15. Check PROCESS Pigtails are to be capped or old the PROCESS container is still connected at pigtails.
16. Start the CHANGE PROCESS function.
17. When the software prompts with a text message stating “CHANGE CAN?” the technician/operator should remove the caps from the pigtails on the old PROCESS container.
18. Re-install/install the PROCESS container with new VCR gaskets.
19. Press ENTER to allow the software to continue with the change function. Then follow software prompts to complete the PROCESS CHANGE RESERVOIR Operation. Refer to Chapter 4 for detail.
20. The Process scale calibration is completed.

7.2.7 Ultrasonic Clamp-On Sensor

This procedure is used to verify that the Ultrasonic clamp-on sensors operate at the appropriate alarm conditions. The clamps are removed one at a time and then monitored at the System Test menu under Digital Input.

“LIQUID IN VACUUM” Sensor Test

1. Loosen or remove the clamp on the sensor at the vacuum line. This should generate the “LIQUID IN VAC LINE” and an “USONIC SENSOR FAIL” alarm messages on the Main Menu.
2. Use the Digital Input Test screen to verify the logic change for the “LIQUID IN VAC LINE” alarm and “USONIC SENSOR FAIL” alarm
3. If applicable, apply Dow Corning vacuum grease or gel tape (SAP pn 164016) to the clamp on the sensor and reinstall. This should remove the “USONIC SENSOR FAIL” alarm messages.
4. Select ALARM CLEAR to clear the alarm from the cabinet.

"ULTRASONIC OVERFULL" Sensor Test

1. Loosen or remove the clamp on the sensor at the vent line. (The clamp should be located ~2" below the VCR gland). This should generate the "ULTRASONIC OVERFULL" and "USONIC SENSOR FAIL" alarm messages on the Main Menu.
2. Use the Digital Input Test screen to verify the logic change for the "ULTRASONIC OVERFULL alarm and "USONIC SENSOR FAIL" alarm
3. If applicable, apply Dow Corning vacuum grease or gel tape (SAP pn 164016) to the clamp on the sensor and reinstall. It should slide freely between the vent line and edge of back panel. Loosen pipe strap and carefully pull vent line out slightly. If needed, place additional spacers/washers on pipe strap to allow the sensor to freely slide between the line and panel. This should remove the "ULTRASONIC OVERFULL" and "USONIC SENSOR FAIL" alarm messages.
4. Use the Digital Input Test screen to verify the logic change for the "ULTRASONIC OVERFULL alarm and "USONIC SENSOR FAIL" alarm
5. Select ALARM CLEAR to clear the alarm from the cabinet.

"ULTRASONIC EMPTY" Sensor Test

NOTE: This digital input must be satisfied for BULK to PROCESS Fill operation.

1. Loosen or remove the clamp on the sensor at the BULK Reservoir Outlet line. This should generate the "USONIC SENSOR FAIL" alarm messages on the Main Menu.
2. Use the Digital Input Test screen to verify the logic change for the "BULK RES EMPTY" alarm and "USONIC SENSOR FAIL" alarm
3. If applicable, apply Dow Corning vacuum grease or gel tape (SAP pn 164016) to the clamp on the sensor and reinstall. This should remove the "USONIC SENSOR FAIL" alarm messages.
4. Select ALARM CLEAR to clear the alarm from the cabinet.

7.2.8 Other Tests

Other tests that should be performed on a periodic basis include:

- Triggering the EMO to verify all electrical connections.
- Triggering the UVIR to verify sensor operation. Refer to the device operation manual.
- Triggering the Smoke Detector to verify sensor operation. Refer to the device operation manual.

- Comparing pressures and flows between the external regulators and the internal pressure gauges.
- Verification of cabinet exhaust.
- Verification of all system parameters.

7.2.9 "Rate of Rise" Fire Detection (Device option)

NOTE: Do not point the heat gun at anything other than the ROR sensor.

1. Apply the heat gun directly to the sensor at 0.5" distance with 45 degree angle to the tip of fire detect sensor for more than 1 minute but less than 5 minutes.
2. An alarm message "Fire Detected" will display within 1-2 minutes.
3. Remove the heat gun and wait until the fire detector sensor cools down.
4. Verify that the alarm message self-clears from display.

7.2.10 Fire Suppression System (Device Option)

NOTE: Versum Materials, Inc. recommends consulting the manufacturer's manual provided with the ChemGuard® for detailed information about the operation, calibration, and maintenance of the Fire Suppression System.

NOTE: Do not point the heat gun at anything other than the ROR sensor.

Review and understand the AUTOPULSE 542R Operation Manual before energizing the unit.

CAUTION
High voltage will be present on the terminals and leads to the equipment during testing.

CAUTION
Failure to disconnect the CV-98 Electric Actuator from CO2 cylinder could result in discharging of the CO2 cylinder during testing.

WARNING
Before activating alarm, warn others in the testing area of loud noise and flashing strobe light. Hearing protection is recommended.

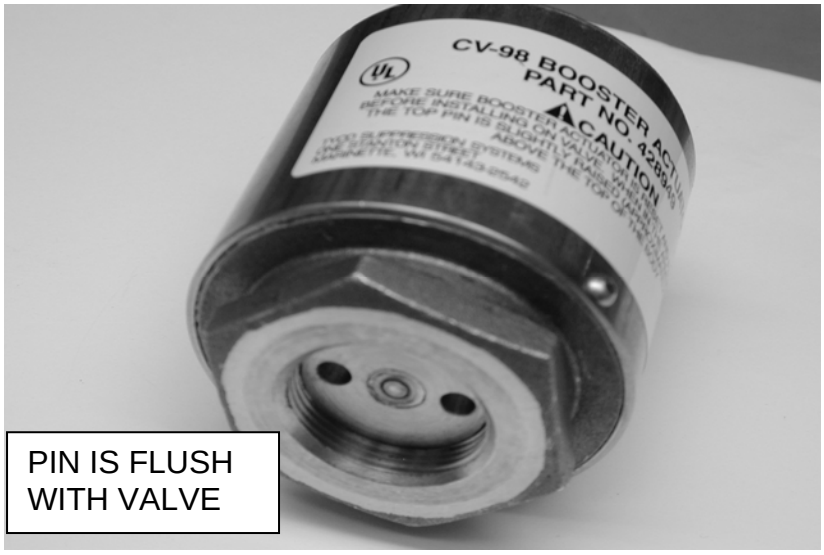
Test the Fire Suppression System with HF Electric Actuator / CV-98 Booster Actuator:

1. Verify all plumbing and cables are connected.
2. Disconnect the CV-98 Electric Actuator from the CO2 cylinder bottle.
3. Verify the HF Electric Actuator / CV-98 Booster Actuator pin is not activated.
4. Apply the heat gun directly to the sensor at 0.5” distance with 45 degree angle to the tip of fire detect sensor for more than 1 minute but less than 5 minutes.
5. The AUTOPULSE 542R strobe light and audio alarm will sound.
6. The ChemGuard® audio alarm will sound while the panel screen displays an alarm message “Fire Detected”.
7. Remove the heat gun and wait for the Fire Detect sensor to cool down. This will occur within a few minutes.
8. Reset the fire alarm on the Fire-Suppression (Extinguishing) system (AUTOPULSE 542R).
9. The alarm “Fire Detected” will disappear and the DMM should display between 0 to 1 Vdc.
10. Unthread the boost valve from the actuator valve.

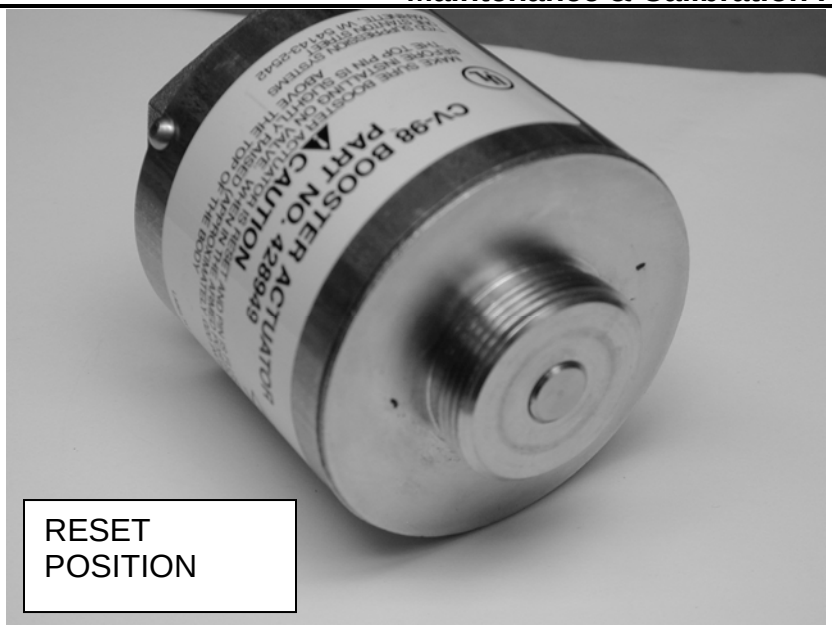
11. Obtain the boost valve reset tool. Before threading the tool into boost valve, back the screw out until approximately .250” TO .375”.

12. Hand-tighten the reset tool into the boost valve. Use an adjustable wrench to hold the boost valve while turning the screw clockwise with a box wrench until it contacts the valve. Continue to turn the screw until a CLICK/SNAP is heard. **Do not over-tighten the screw or damage may occur to the boost valve.**

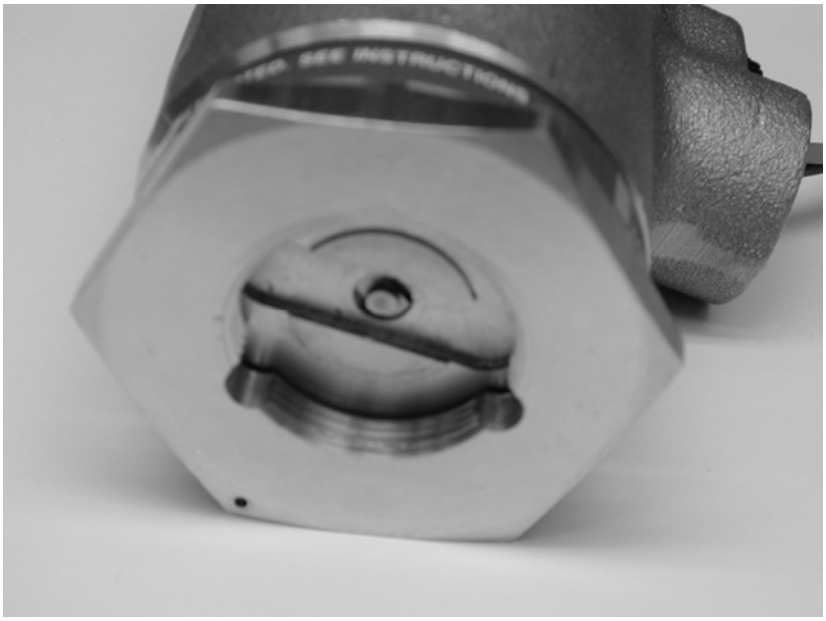
13. Remove the reset tool from the boost valve. Inspect the boost valve pin, when the pin is reset properly it should be flush with the bottom of the boost valve.



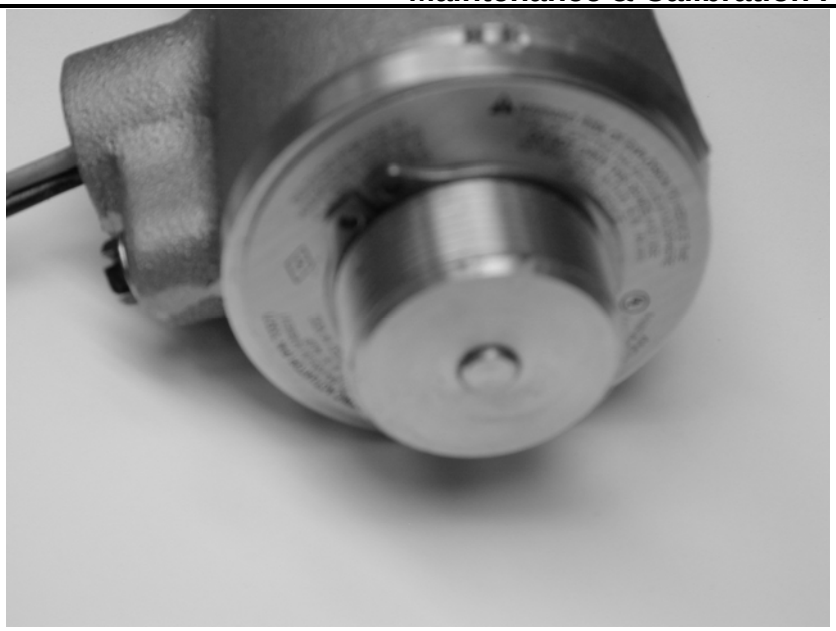
14. The pin at the top of the valve should extend slightly beyond flush and have a small spring tension applied to it.



15. To reset the actuator valve place the valve in a vise or on a work surface bottom side up. **Do not tighten the vise against the actuator valve.** Using a suitable brass punch, firmly press down on the pin until it locks into place. The bottom pin should be near flush to the groove.



16. The pin at the top of the valve should be slightly above flush and have a small spring tension applied to it.



17. Reassemble the boost valve into the actuator valve to complete the reset procedure.
18. Test the pull station switch by pulling on the handle. The AUTOPULSE 542R control system should respond the same way as a Rate of Rise for “fire detected” alarm.
19. Reset the Fire-Suppression (Extinguishing) system (AUTOPULSE 542R).
20. Follow the above steps 10-17 to reset the HF Electric Actuator / CV-98 Booster Actuator.
21. Reinstall the HF Electric Actuator / CV-98 Booster Actuator onto the CO2 cylinder bottle.

7.3 Troubleshooting

7.3.1 Overview

This section describes troubleshooting:

- A description of mechanical problems and suggested solutions
- A description of electrical problems and suggested solutions

Problems and alarms on the ChemGuard® are either mechanical or electrical in origin.

Refer to Chapter 6 Alarm Table for basic troubleshooting guide. Contact Versum Materials, Inc. EES Group for further assistance.

MECHANICAL PROBLEMS

The cause of a mechanical failure can be narrowed down to:

- Loose plumbing connections
- Broken plumbing connections
- Pneumatic failure
- Valve failure
- Vacuum pump failure

Inspect each of these items to isolate the mechanical failure(s)

CAUSES OF ELECTRICAL PROBLEMS

The electronic components have been placed on the stack of microprocessor boards: If there is an electrical problem, it can be narrowed down to one of these boards. For part number and description refer to Chapter 5 and Appendix C for details.

RESOLVING ELECTRICAL PROBLEMS

All electrical troubleshooting performed on ChemGuard® is Type 2.

1. Examine any current, activated alarm (Refer to Chapter 6). If you are unable to silence the alarm, and the problem persists, try troubleshooting each board.
2. If system solenoids do not activate, check the 24VDC power supply. Refer to ChemGuard® System Interconnect diagram.
3. If there is no power, check incoming AC power source.

POWER SUPPLY MODULE

If the power supply module is not properly operating, an alarm output will be generated and displayed on the Touch Screen.

7.3.2 Main Power

Test points are available for monitoring potentials/signals on the AP1551, AP1552, AP1553 / AP1555, and AP1554 controller PCAs.

The system was designed so that all user interface connections (field connections) can be made directly on the Phoenix connectors of the AP1553 / AP1555 controller PCAs.

The main AC power is wired through this circuit and will apply power to the main DC power supply when certain conditions are met. The following paragraphs describe these conditions.

Table 7-2: Electrical Troubleshooting Guide

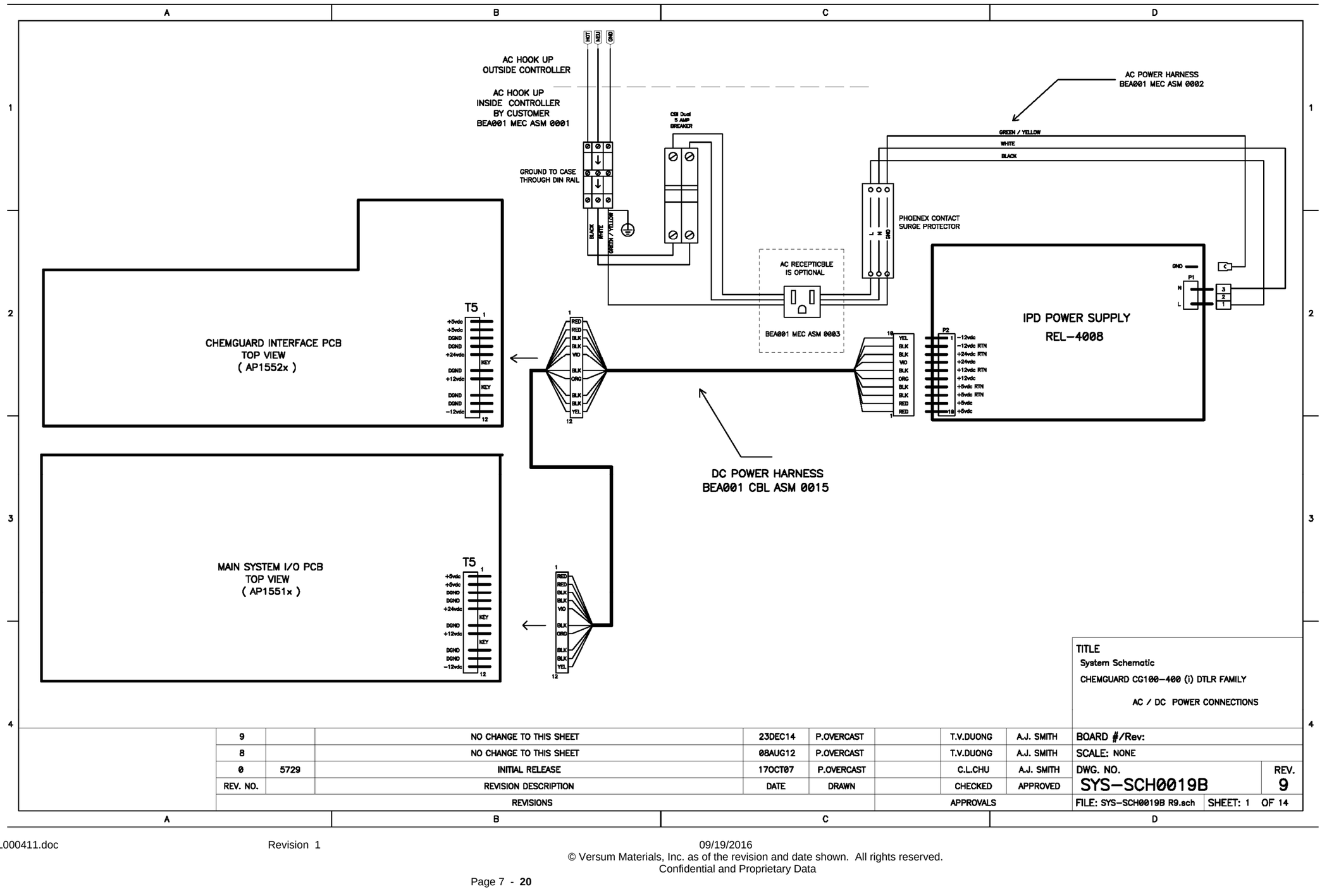
PROBLEM	SOLUTION
NO AC TO THE SYSTEM	If GFI is installed, verify the reset button has been pressed. Measure AC input wires at the Power Supply PCA. Check circuit breaker on the controller and/or PLC Electronic Box (option).
AC PRESENT AT POWER SUPPLY PCA BUT NO DC OUT	Checks power supply fuse. Verify cables connected at power supply.
DC POWER SUPPLY IS NOT CORRECT	Check cable between power supply and AP1551 PCA. Check power supply voltage adjusted correctly.
NO TOUCH-SCREEN OPERATION	Checks display cables. Check Display Touch Screen. Check power supplies to the Touch Screen.
EXCESSIVE CURRENT DRAW	Check all cables in ChemGuard GEN II cabinet for wiring errors.
EXHAUST ALARM CAN'T BE REMOVED	Check wiring for error. Check cable for damage. Check / replace Digital Input / Output PCA.
DOOR ALARM CAN'T BE REMOVED	Check wiring for error. Check cable for damage. Check / replace Digital Input / Output PCA.

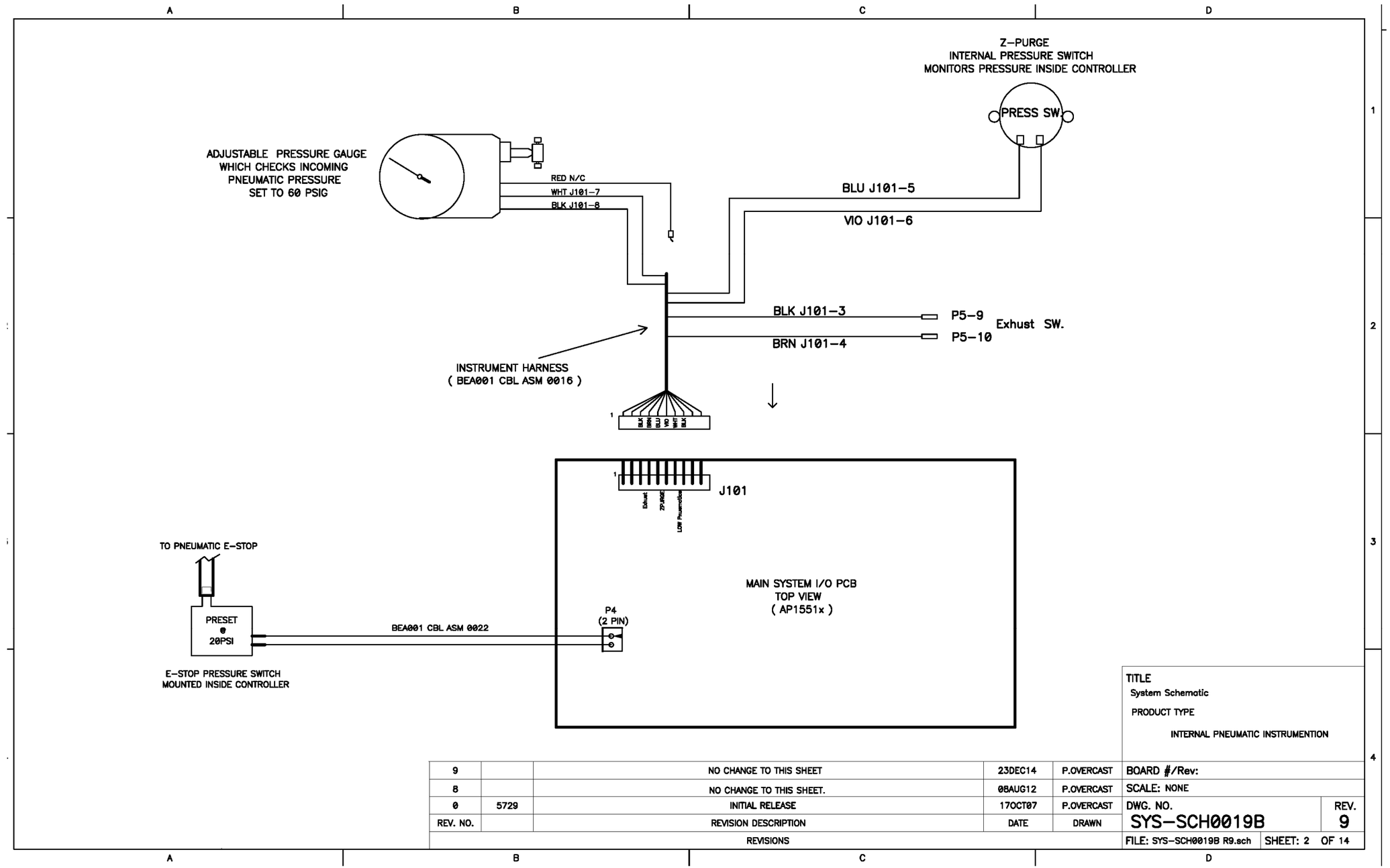
USONIC ALARM STATUS CAN NOT BE REMOVED/CHANGED	Apply high vacuum grease to inside surface of probe on cable side of inner diameter. Rotate sensor on tubing before tightening. Move sensor up or down on tubing and retighten (hand tight, 1/4 turn past snug). Reapply high vacuum grease to sensor when move location. Check all P1.wiring for error. Check cable for damage. Check / replace Digital Input / Output PCA.
BUZZER IS NOT AUDIBLE	Check connections to AP1551 PCA. Check buzzer assembly for damage.
LIQUID SPILL DOESN'T SHUT DOWN SYSTEM	Check cable connections at P1. Check Float sensors and stem are not binding or sticky. Check cable for damage. Check / replace Digital Input / Output PCA.
COMBUSTABLE VAPOR ALARM CAN'T BE REMOVED	Check cable connections at P5. Check gas mixture. Refer to combustible vapor calibration (Appendix F). Replace combustible vapor detector. Check / replace Digital Input / Output PCA.
BULK/PROCESS SCALE WILL NOT CALIBRATE	Refer to Scale calibration in this chapter. Check cable connections. Check / replace Analog PCA.
NO SIGNAL FROM BULK/PROCESS PRESSURE TRANSDUCER	Check wiring at P1/P2. Check valve status. Check the push gas supply sources are present. Check regulator adjustment. Check sensor will produce output voltage.

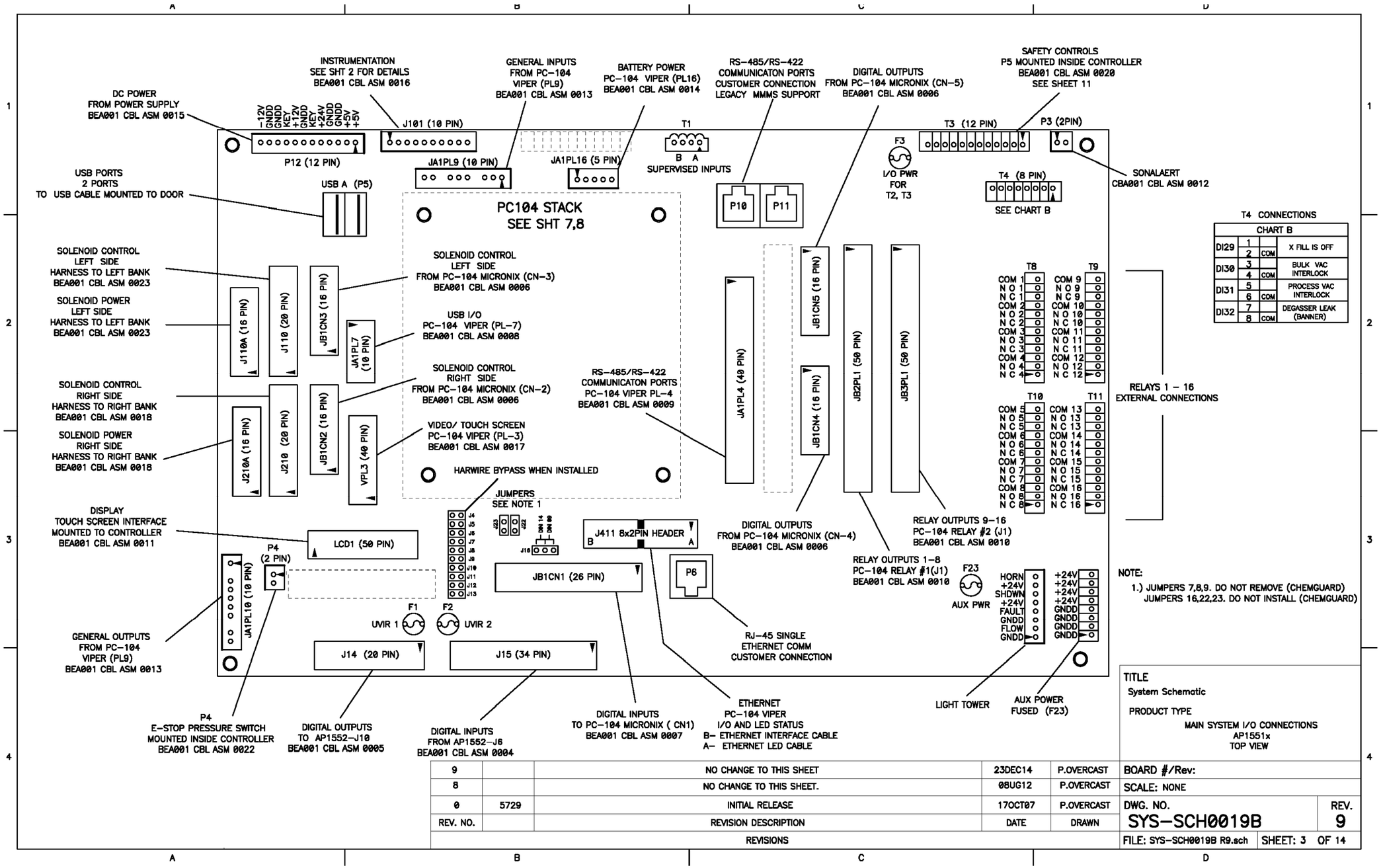
VACUUM MKS UNIT	
NO OR SMALL SIGNAL CHANGE ON DISPLAY	Verify jumpers installed at J7 on AP 1552. See Chapter 7 Calibration section for detail jumper location. Check voltage to vacuum transducer. Check vacuum pump is on and have vacuum. Check vacuum transducer adjustment.
READING NOT STABLE	Check sensor output signal or connections on P1. **NOTE**: At atmosphere, the output of this device is 10Vdc which the display shows 408 mT.
SENSOR NOT IN CALIBRATION	Refer to Vacuum Transducer calibration in this chapter.
VACUUM THERMOCOUPLE	
NO OR SMALL SIGNAL CHANGE ON DISPLAY	Verify jumpers installed at J7 on AP 1552. See Chapter 7 Calibration section for detail jumper location. Check 163 milli-Amperes current source to vacuum thermocouple. Check vacuum pump is on and have vacuum.
READING NOT STABLE	Check sensor output signal or connections on P1. **NOTE**: At atmosphere, the display shows 1000 mT.
SENSOR NOT IN CALIBRATION	No Calibration.

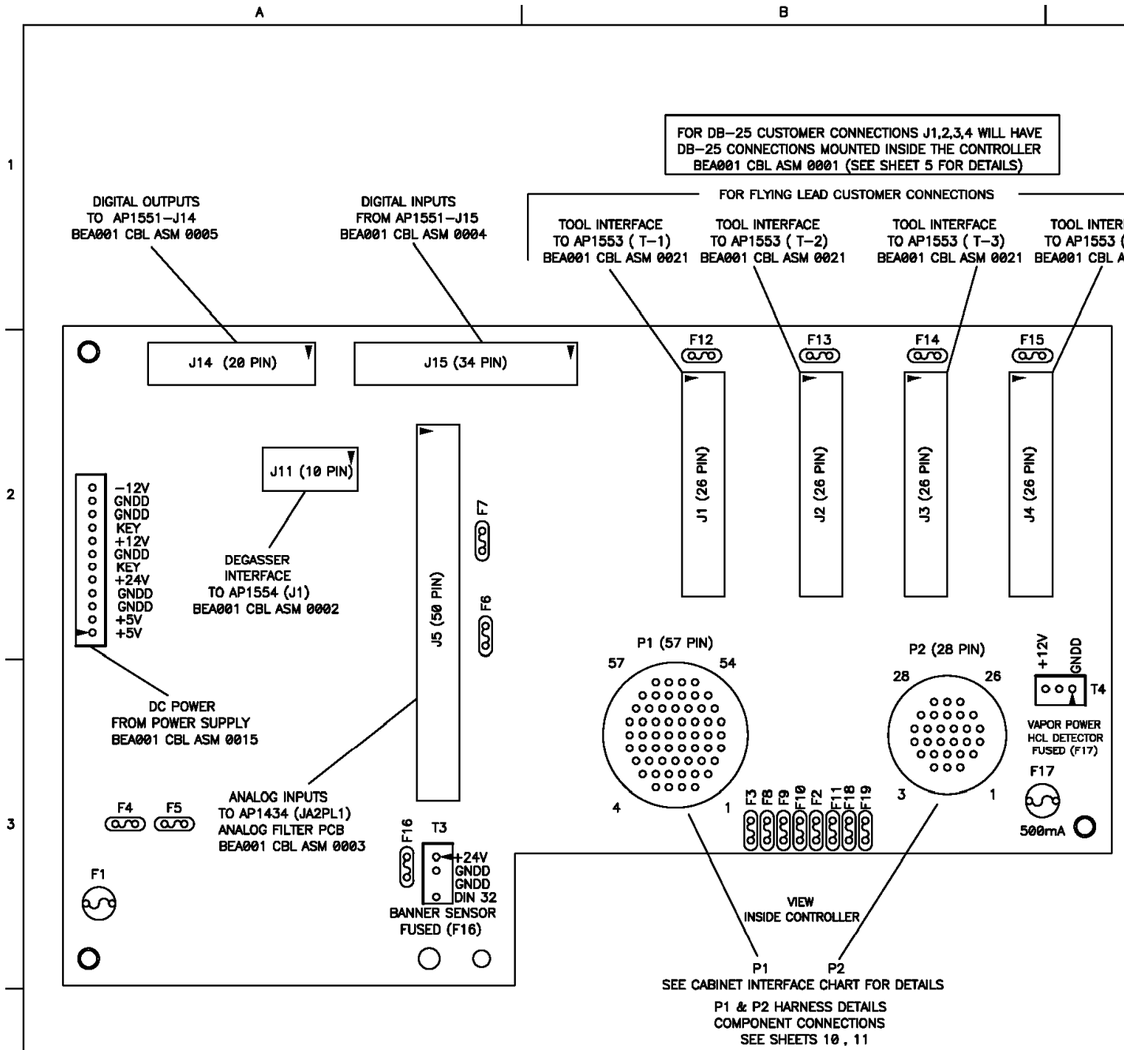
This page intentionally left blank.

Figure 7-1: SYSTEM INTERCONNECT DIAGRAM SYS-SCH0019B Cross-Reference









CABINET INTERFACE CHART P1
CG100-CG400

P1	SIGNAL	SIGNAL NAME	FUSE AP1552	
1	+15V	OPTO SPILL PWR		
2	DIN 9	SPILL DETECT (OPTO/FLOAT)		
3	LED CURRENT	OPTO SPILL RTN		
4	AIN 6 PWR	SPARE	F8	
5	GNDD	SPILL DETECTED 2 RTN		
6	DIN 11	DOOR OPEN		
7	GNDD	DOOR OPEN RTN		
8	AIN 6	SPARE		
9	GNDA	SPILL DETECTED RTN		
10	DIN 10	SPILL DETECTED 2		
11	DIN 12	LIQUID IN VAC LINE		
12	DIN 13	RES OVERFULL		
13	DIN 14	ULTRASONIC FAIL 1		
14	DIN 15	BULK EMPTY		
15	GNDD	BULK EMPTY RTN		
16	GNDD	ULTRASONIC FAIL RTN		
17	AIN 2	BULK SCALE SIGNAL		
18	GNDA	SPARE		
19	BLK SCL PWR	BULK SCALE POWER	F4	
20	DIG PWR +24V	SPARE	F1	
21	GNDA	SPARE		
22	GNDA	SPARE		
23	AIN 7 PWR	SPARE	F9	
24	AIN 7	SPARE		
25	AIN 4	BULK PUSH PRESS SIG		
26	GNDA	SPARE		
27	AIN 4 PWR	BULK PUSH PRESS PWR	F3	
28	DIG PWR +24V	SPARE	F1	
29	GNDA	SPARE		
30	GNDA	SPARE		
31	AIN 8 PWR	SPARE	F10	
32	AIN 8	SPARE		
33	DIN 16	SMOKE DETECT		(CG400 ONLY)
34	VAC DRV 163 mA	VAC DRIVE		
35	VAC SIG IN	VAC SIGNAL		
36	VAC REF	VAC REF		
37	+12V	ULTRASONIC 1 PWR	F18	
38	DIG PWR +24V	SPARE	F1	
39	GNDD	ULTRASONIC 1 GND		
40	GNDA	VAC GND		
41	N/C	NOT USED		
42	-15V	BARATRON PWR -	F7	
43	N/C	NOT USED		
44	+15V	BARATRON PWR +	F6	
45	N/C	NOT USED		
46	N/C	NOT USED		
47	DIN 27	SPARE (NOTE 1)		
48	GNDD	SMOKE DETECT RTN		(CG400 ONLY)
49	DIN 28	SPARE (NOTE 1)		
50	GNDD	SPARE		
51	N/C	NOT USED		
52	N/C	NOT USED		
53	UVIR 1	SMOKE RELAY(+24VDC)(NOTE 2)	F2	(CG400 ONLY)
54	N/C	NOT USED		
55	GNDD	RES OVERFULL RTN		
56	GNDD	LIQUID IN VAC LINE RTN		
57	GNDD	SMOKE GND		(CG400 ONLY)

NOTES :
1. DI26, DI27, AND DI28 SWITCH TP +24VDC. ALL OTHER INPUTS SWITCH TO GNDD
2. THESE (F2) FUSES ARE LOCATED ON THE AP1551 PCB.

9

CABINET INTERFACE CHART P2
CG100-CG325, CG400NT

P2	SIGNAL	SIGNAL NAME	FUSE AP1552
1	DIN 17	ULTRASONIC FAIL 2	
2	DIN 18	DEGASSER LEAK 1	
3	DIN 19	DEGASSER LEAK 2	
4	DIN 26	BULK CODE CABLE(NOTE 1)	
5	DIN 20	DEGASSER LEAK 3	
6	GNDD	ULTRASONIC FAIL 2 RTN	
7	N/C	NOT USED	
8	N/C	NOT USED	
9	AIN 1	PROCESS SCALE SIG	
10	GNDA	SPARE	
11	PRC SCL PWR	PROCESS SCALE PWR	F5
12	GNDA	SPARE	
13	N/C	NOT USED	
14	N/C	NOT USED	
15	GNDD	DEGASSER LEAK 1 RTN	
16	GNDD	DEGASSER LEAK 2 RTN	
17	AIN 3	PROCESS PUSH PRESS SIG	
18	GNDA	SPARE	
19	AIN 3 PWR	PROCESS PUSH PRESS PWR	F2
20	GNDA	SPARE	
21	GNDD	SPARE	
22	UVIR 3	UVIR OUT 3 (NOTE 2)	F2
23	N/C	NOT USED	
24	AIN 9 PWR	BULK CODE CABLE RTN	F11
25	AIN 9	SPARE	
26	GNDD	DEGASSER LEAK 3 RTN	
27	+12V	ULTRASONIC 2 PWR	F19
28	GNDD	ULTRASONIC 2 GND	

9

CABINET INTERFACE CHART P2
CG400 ONLY

P2	SIGNAL	SIGNAL NAME	FUSE AP1552
1	DIN 17	UVIR FAULT	
2	DIN 18	DI18	
3	DIN 19	DI19	
4	DIN 26	UVIR DETECT	
5	DIN 20	DI20	
6	GNDD	UVIR FAULT RTN	
7	N/C	NOT USED	
8	N/C	NOT USED	
9	AIN 1	PROCESS SCALE SIG	
10	GNDA	SPARE	
11	PRC SCL PWR	PROCESS SCALE PWR	F5
12	GNDA	SPARE	
13	N/C	NOT USED	
14	N/C	NOT USED	
15	GNDD	DI18 RTN	
16	GNDD	DI19 RTN	
17	AIN 3	PROCESS PUSH PRESS SIG	
18	GNDA	SPARE	
19	AIN 3 PWR	PROCESS PUSH PRESS PWR	F2
20	GNDA	SPARE	
21	GNDD	SPARE	
22	UVIR 3	UVIR RELAY(+24VDC)(NOTE 2	F2
23	N/C	NOT USED	
24	AIN 9 PWR	SPARE	F11
25	AIN 9	SPARE	
26	GNDD	DI20 RTN	
27	+12V	ULTRASONIC 2 PWR	F19
28	GNDD	UVIR GND	

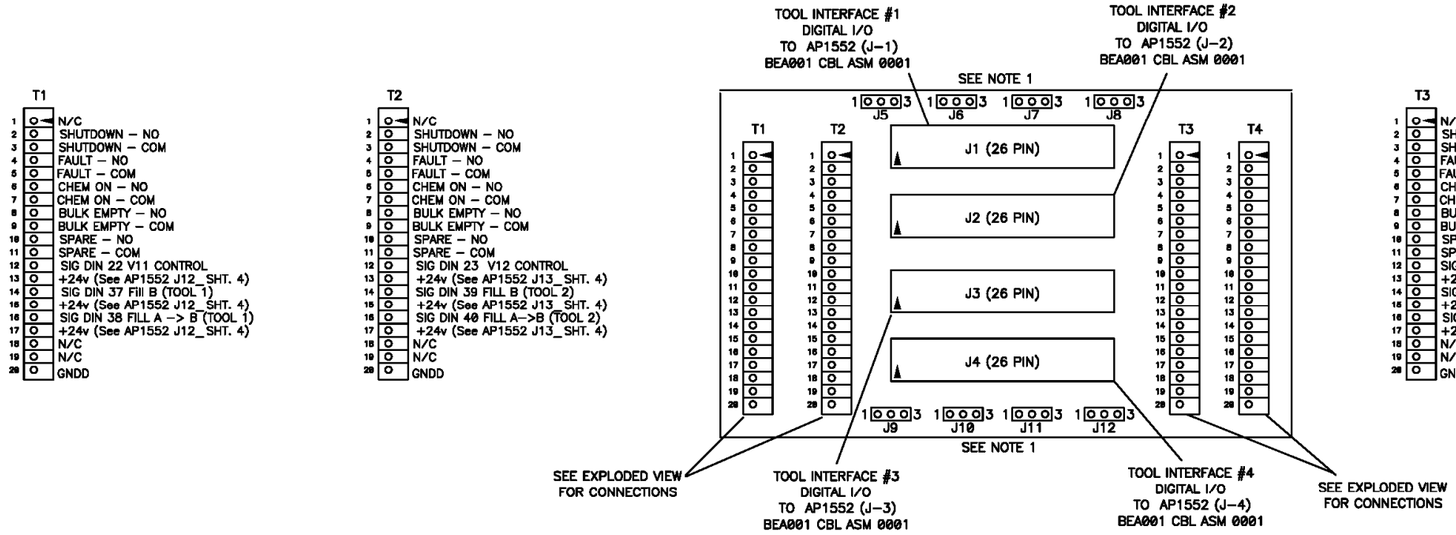
TITLE
System Schematic
PRODUCT TYPE
CHEMGUARD INTEFACE I/O CONNECTIONS
AP1552x
TOP VIEW

REV. NO.		REVISION DESCRIPTION	DATE	DRAWN
9		CHANGED TEXT AS PER MOC (ELC-01062346)	23DEC14	P.OVERCAST
8		NO CHANGE TO THIS SHEET.	08AUG12	P.OVERCAST
0	5729	INITIAL RELEASE	17OCT07	P.OVERCAST

REVISIONS

BOARD #/Rev:
SCALE: NONE
DWG. NO. SYS-SCH0019B REV. 9
FILE: SYS-SCH0019B R9.sch SHEET: 4 OF 14

FLYING LEAD CUSTOMER CONNECTIONS



T1

1	N/C
2	SHUTDOWN – NO
3	SHUTDOWN – COM
4	FAULT – NO
5	FAULT – COM
6	CHEM ON – NO
7	CHEM ON – COM
8	BULK EMPTY – NO
9	BULK EMPTY – COM
10	SPARE – NO
11	SPARE – COM
12	SIG DIN 22 V11 CONTROL
13	+24v (See AP1552 J12_SHT. 4)
14	SIG DIN 37 Fill B (TOOL 1)
15	+24v (See AP1552 J12_SHT. 4)
16	SIG DIN 38 FILL A –> B (TOOL 1)
17	+24v (See AP1552 J12_SHT. 4)
18	N/C
19	N/C
20	GNDD

T2

1	N/C
2	SHUTDOWN – NO
3	SHUTDOWN – COM
4	FAULT – NO
5	FAULT – COM
6	CHEM ON – NO
7	CHEM ON – COM
8	BULK EMPTY – NO
9	BULK EMPTY – COM
10	SPARE – NO
11	SPARE – COM
12	SIG DIN 23 V12 CONTROL
13	+24v (See AP1552 J13_SHT. 4)
14	SIG DIN 39 FILL B (TOOL 2)
15	+24v (See AP1552 J13_SHT. 4)
16	SIG DIN 40 FILL A–>B (TOOL 2)
17	+24v (See AP1552 J13_SHT. 4)
18	N/C
19	N/C
20	GNDD

T3

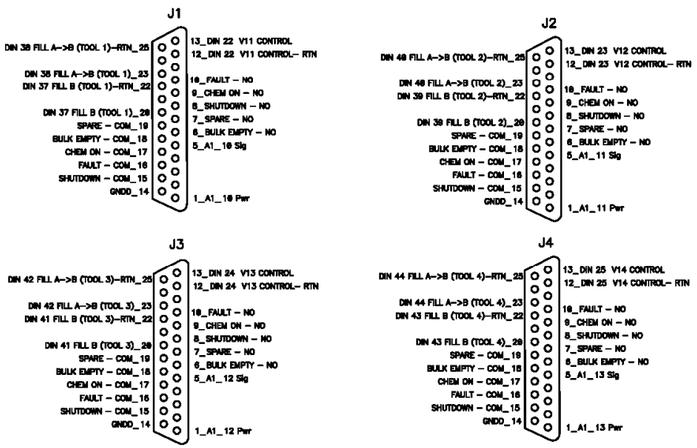
1	N/C
2	SHUTDOWN – NO
3	SHUTDOWN – COM
4	FAULT – NO
5	FAULT – COM
6	CHEM ON – NO
7	CHEM ON – COM
8	BULK EMPTY – NO
9	BULK EMPTY – COM
10	SPARE – NO
11	SPARE – COM
12	SIG DIN 24 V13 CONTROL
13	+24v (See AP1552 J14_SHT. 4)
14	SIG DIN 41 FILL B (TOOL 3)
15	+24v (See AP1552 J14_SHT. 4)
16	SIG DIN 42 FILL A –> B (TOOL 3)
17	+24v (See AP1552 J14_SHT. 4)
18	N/C
19	N/C
20	GNDD

T4

1	N/C
2	SHUTDOWN – NO
3	SHUTDOWN – COM
4	FAULT – NO
5	FAULT – COM
6	CHEM ON – NO
7	CHEM ON – COM
8	BULK EMPTY – NO
9	BULK EMPTY – COM
10	SPARE – NO
11	SPARE – COM
12	SIG DIN 25 V14 CONTROL
13	+24v (See AP1552 J15_SHT. 4)
14	SIG DIN 43 FILL B (TOOL 4)
15	+24v (See AP1552 J15_SHT. 4)
16	SIG DIN 44 FILL A–>B (TOOL 4)
17	+24v (See AP1552 J15_SHT. 4)
18	N/C
19	N/C
20	GNDD

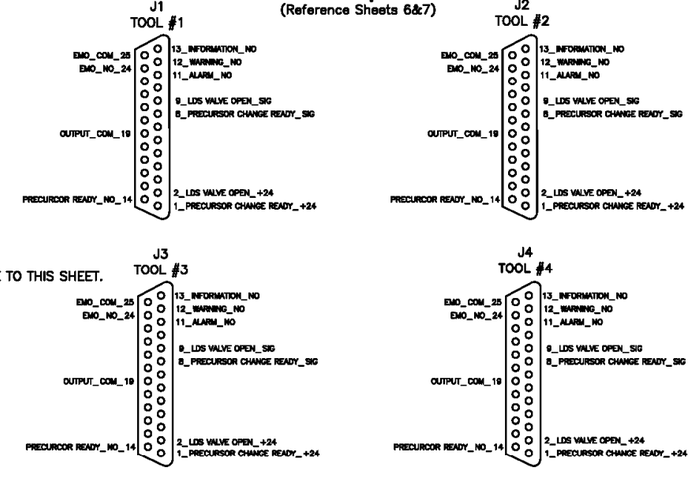
DB–25 CUSTOMER CONNECTIONS

Standard

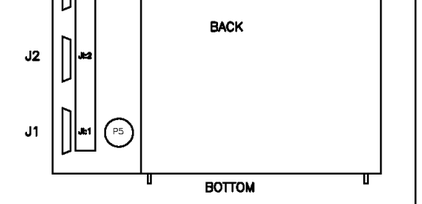


PLC Option

(Reference Sheets 6&7)



NO CHANGE TO THIS SHEET.



DB25 LOCATIONS ON THE CHEMGUARD GENII B CONTROLLER

NOTES :

1. INSTALL JUMPERS ON J5–12 PINS 1,2 FOR PLC.
   INSTALL JUMPERS ON J5–12 PINS 2,3 FOR NO PLC.

1 2 3

REV. NO.		REVISION DESCRIPTION	DATE	DRAWN
		REVISIONS		
9		NO CHANGE TO THIS SHEET	23DEC14	P.OVERCAST
8		NO CHANGE TO THIS SHEET.	08AUG12	P.OVERCAST
0	5729	INITIAL RELEASE	17OCT07	P.OVERCAST

TITLE
System Schematic

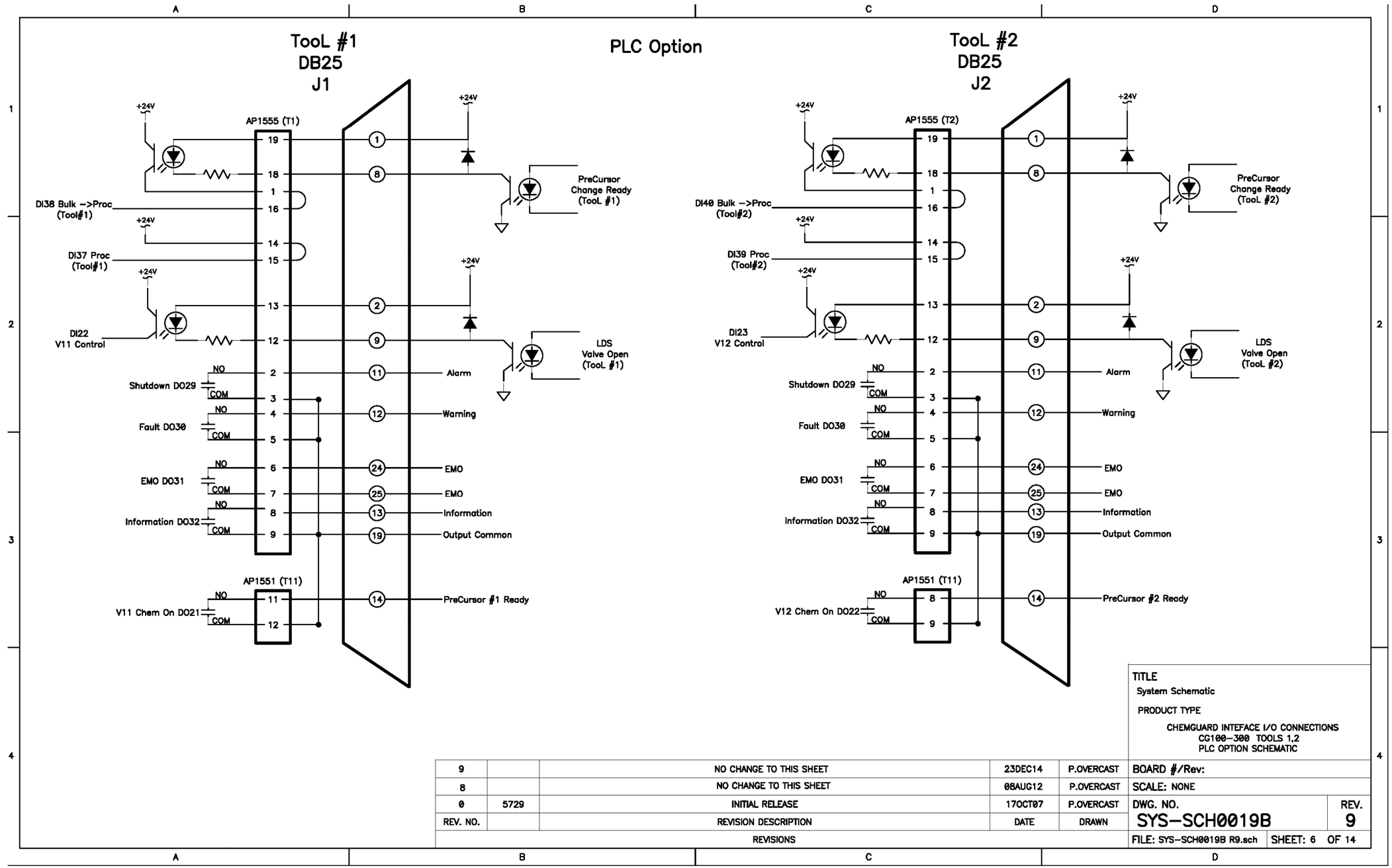
PRODUCT TYPE
CHEMGUARD INTEFACE I/O CONNECTIONS
AP1555x
TOP VIEW

BOARD #/Rev:

SCALE: NONE

DWG. NO. SYS–SCH0019B REV. 9

FILE: SYS–SCH0019B R9.sch SHEET: 5 OF 14



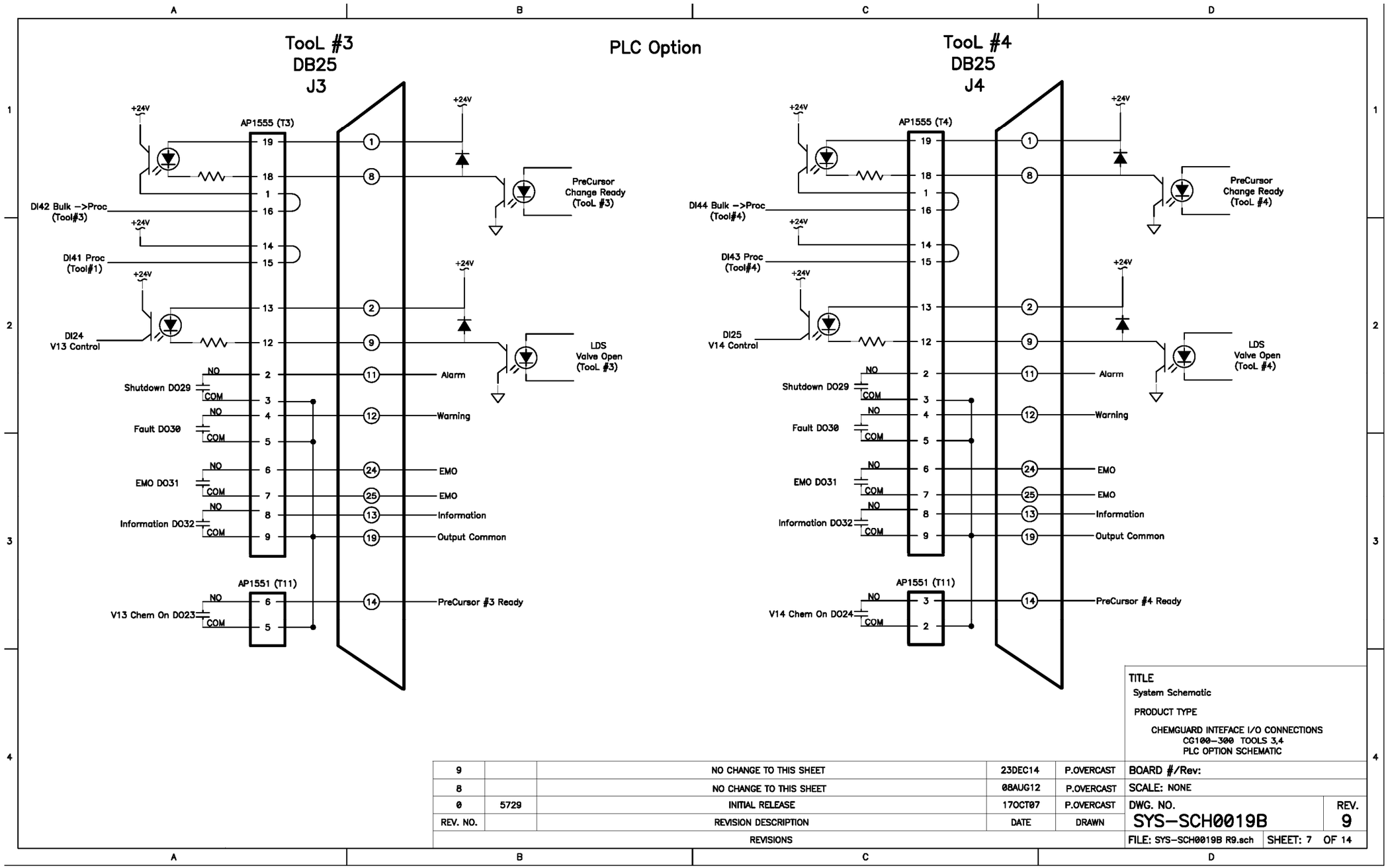
REV. NO.		REVISION DESCRIPTION	DATE	DRAWN
9		NO CHANGE TO THIS SHEET	23DEC14	P.OVERCAST
8		NO CHANGE TO THIS SHEET	08AUG12	P.OVERCAST
0	5729	INITIAL RELEASE	17OCT07	P.OVERCAST

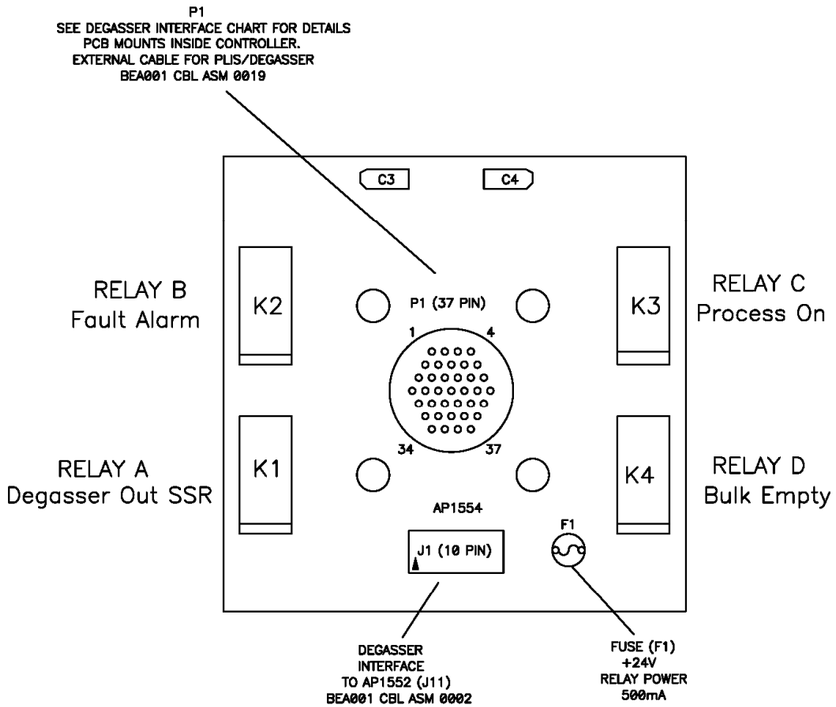
REVISIONS

TITLE
System Schematic

PRODUCT TYPE
CHEMGUARD INTEFACE I/O CONNECTIONS
CG100–300 TOOLS 1,2
PLC OPTION SCHEMATIC

BOARD #/Rev:
SCALE: NONE
DWG. NO. SYS–SCH0019B
REV. 9
FILE: SYS–SCH0019B R9.sch
SHEET: 6 OF 14





VIEW
INSIDE CONTROLLER

PLIS/DEGASSER INTERFACE CHART

P1	CON	SIGNAL	RELAY	PLIS #
1	NO	CHEM ON	K3	PLIS 1
2	COM			
3	COM	FAULT	K2	PLIS 1
4	NO			
5	NO	CHEM ON	K3	PLIS 2
6	COM			
7				
8	NO	FAULT	K2	PLIS 2
9	COM			
10	COM	CHEM ON	K3	PLIS 3
11	NO	CHEM ON	K3	PLIS 4
12	COM			
13	NO	FAULT	K2	PLIS 4
14	COM			
15	NO	FAULT	K2	PLIS 3
16	NO	CHEM ON	K3	PLIS 3
17	COM	BULK EMPTY	K4	PLIS 4
18				
19				
20				
21	NO	DEGASSER OUT	K1	PLIS 4
22	COM	FAULT	K2	PLIS 3
23	COM	BULK EMPTY	K4	PLIS 3
24	NO			
25	NO	BULK EMPTY	K4	PLIS 4
26	COM	DEGASSER OUT	K1	PLIS 4
27	NO	DEGASSER OUT	K1	PLIS 3
28	COM			
29	COM	BULK EMPTY	K4	PLIS 2
30	NO			
31				
32	COM	DEGASSER OUT	K1	PLIS 2
33	NO			
34	NO	BULK EMPTY	K4	PLIS 1
35	COM			
36	COM	DEGASSER OUT	K1	PLIS 1
37	NO			

PINOUT OF 9 POS CONNECTORS
FOUND ON BEA001 CBLO ASM 0019

PLIS1/PLIS2/PLIS3/PLIS4	
PIN	OUTPUT(DRY CONTACT)
1	CHEM ON
2	
3	FAULT
4	
5	BULK EMPTY
6	
7	DEGASSER OUT
8	
9	NOT USED

REV. NO.		REVISION DESCRIPTION	DATE	DRAWN
9		NO CHANGE TO THIS SHEET	23DEC14	P.OVERCAST
8		NO CHANGE TO THIS SHEET.	08AUG12	P.OVERCAST
0	5729	INITIAL RELEASE	17OCT07	P.OVERCAST

REVISIONS

TITLE
System Schematic

PRODUCT TYPE
DEGASSER INTERFACE PCB
AP1554x
TOP VIEW

BOARD #/Rev:

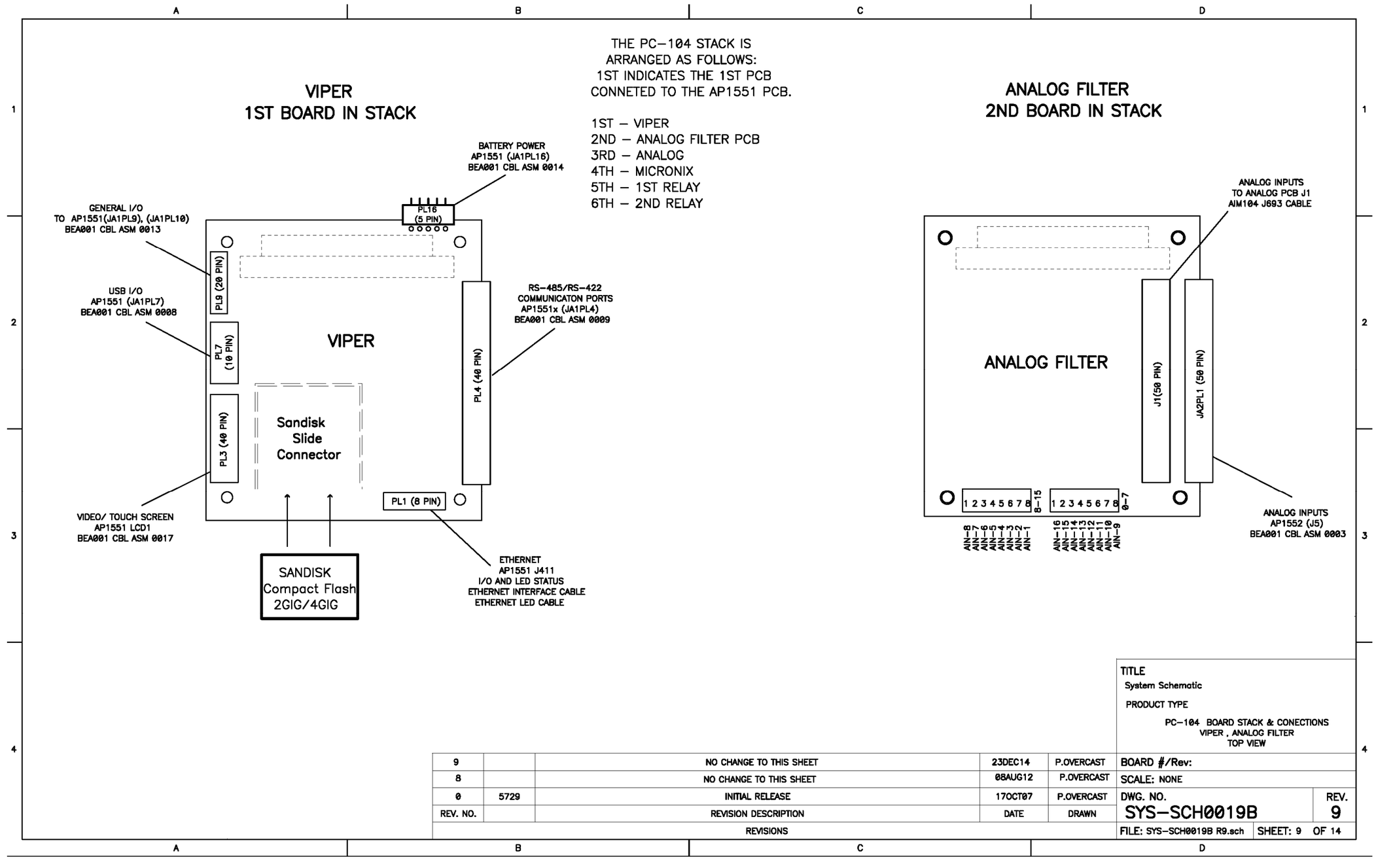
SCALE: NONE

DWG. NO. SYS-SCH0019B

REV. 9

FILE: SYS-SCH0019B R9.sch

SHEET: 8 OF 14



THE PC–104 STACK IS
ARRANGED AS FOLLOWS:
1ST INDICATES THE 1ST PCB
CONNETED TO THE AP1551 PCB.

1ST – VIPER
2ND – ANALOG FILTER PCB
3RD – ANALOG
4TH – MICRONIX
5TH – 1ST RELAY
6TH – 2ND RELAY

ANALOG
3RD BOARD IN STACK

ANALOG
INPUT

JA2PL1 (50 PIN)

ANALOG INPUTS
AP1434 (J1)
ANALOG FILTER PCB
BEA001 CBL ASM 0003

MICRONIX
4TH BOARD IN STACK

SOLENOID CONTROL
LEFT SIDE
TO AP1551 (JB1CN3)
BEA001 CBL ASM 0006

DIGITAL OUTPUTS
TO AP1551 (JB1CN5))
BEA001 CBL ASM 0006

CN3
(16 PIN)

CN5
(16 PIN)

MICRONIX

CN2
(16 PIN)

CN4
(16 PIN)

SOLENOID CONTROL
RIGHT SIDE
TO AP1551 (JB1CN2)
BEA001 CBL ASM 0006

DIGITAL OUTPUTS
TO AP1551 (JB1CN4))
BEA001 CBL ASM 0006

CN1 (26 PIN)

DIGITAL INPUTS
TO AP1551 (JB1CN1))
BEA001 CBL ASM 0007

REV. NO.		REVISION DESCRIPTION	DATE	DRAWN
		REVISIONS		
9		NO CHANGE TO THIS SHEET	23DEC14	P.OVERCAST
8		NO CHANGE TO THIS SHEET	08AUG12	P.OVERCAST
0	5729	INITIAL RELEASE	17OCT07	P.OVERCAST

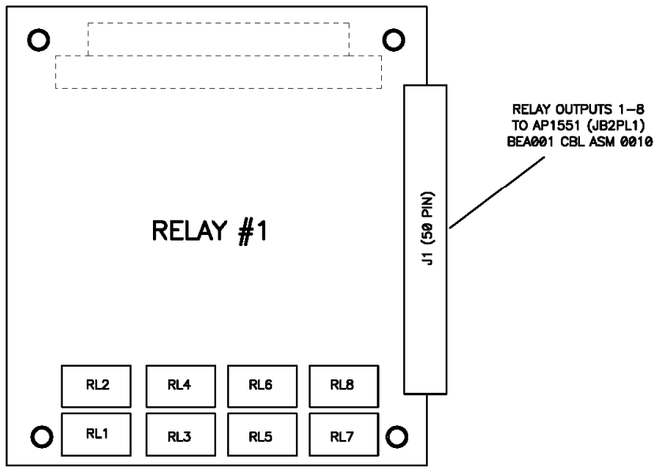
TITLE
System Schematic
PRODUCT TYPE
PC–104 BOARD STACK & CONECTIONS
ANALOG , MICRONIX
TOP VIEW

BOARD #/Rev:
SCALE: NONE
DWG. NO. SYS–SCH0019B
REV. 9
FILE: SYS–SCH0019B R9.sch
SHEET: 10 OF 14

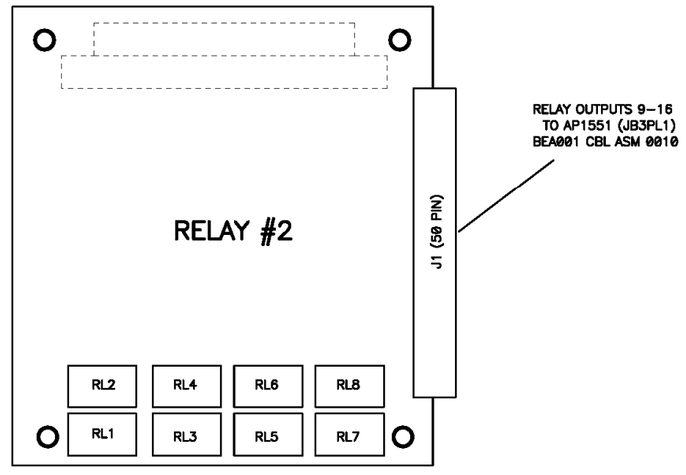
THE PC–104 STACK IS
ARRANGED AS FOLLOWS:
1ST INDICATES THE 1ST PCB
CONNETED TO THE AP1551 PCB.

1ST – VIPER
2ND – ANALOG FILTER PCB
3RD – ANALOG
4TH – MICRONIX
5TH – 1ST RELAY
6TH – 2ND RELAY

RELAY #1
5TH BOARD IN STACK



RELAY #2
6TH BOARD IN STACK



REV. NO.		REVISION DESCRIPTION	DATE	DRAWN
9		NO CHANGE TO THIS SHEET	23DEC14	P.OVERCAST
8		NO CHANGE TO THIS SHEET	08AUG12	P.OVERCAST
0	5729	INITIAL RELEASE	17OCT07	P.OVERCAST

REVISIONS

TITLE
System Schematic

PRODUCT TYPE

PC–104 BOARD STACK & CONECTIONS
RELAY #1, RELAY #2
TOP VIEW

BOARD #/Rev:

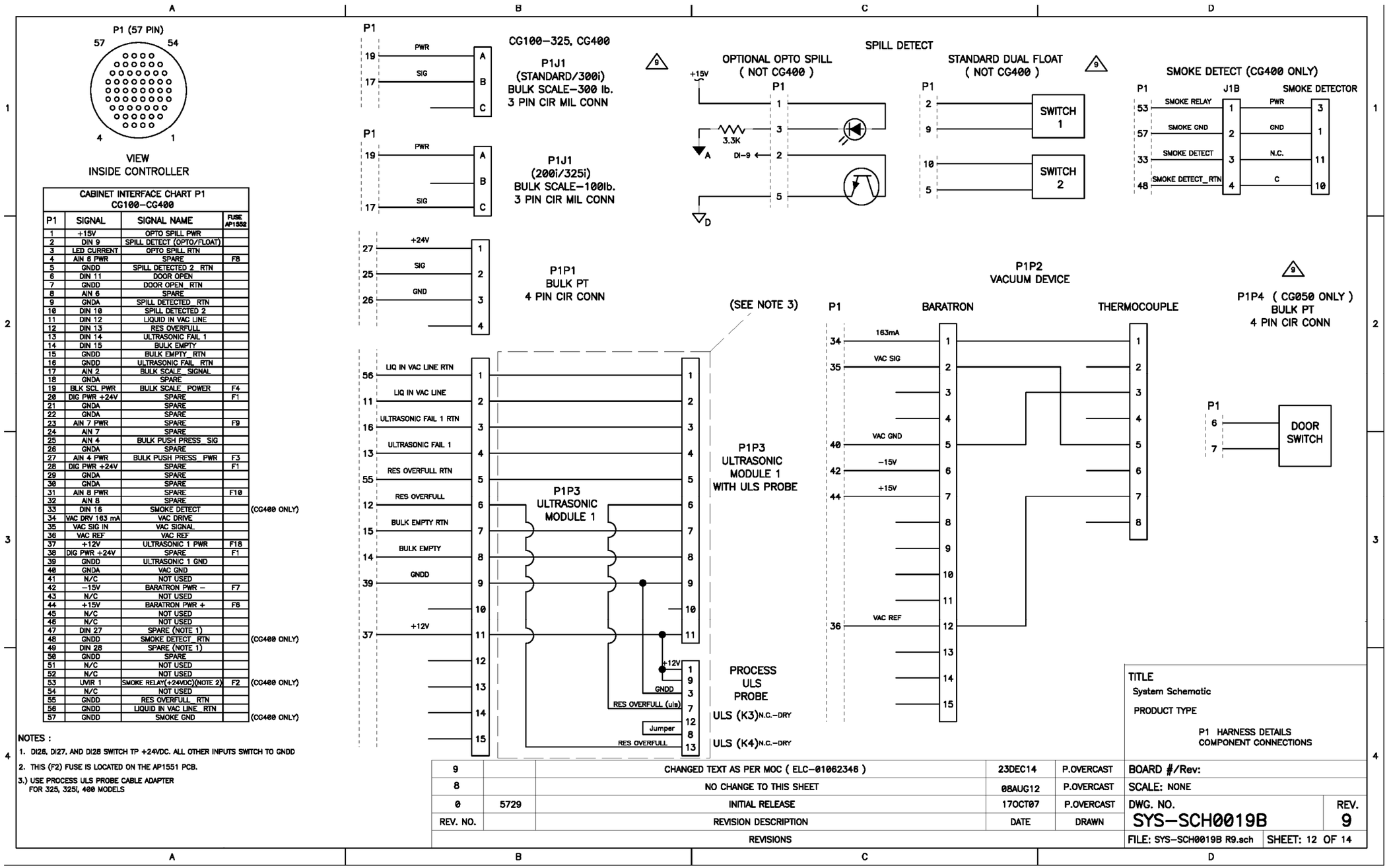
SCALE: NONE

DWG. NO. SYS–SCH0019B

REV. 9

FILE: SYS–SCH0019B R9.sch

SHEET: 11 OF 14



CABINET INTERFACE CHART P1
CG100–CG400

P1	SIGNAL	SIGNAL NAME	FUSE AP1552	
1	+15V	OPTO SPILL PWR		
2	DIN 9	SPILL DETECT (OPTO/FLOAT)		
3	LED CURRENT	OPTO SPILL RTN		
4	AIN 6 PWR	SPARE	F8	
5	GNDD	SPILL DETECTED 2 RTN		
6	DIN 11	DOOR OPEN		
7	GNDD	DOOR OPEN RTN		
8	AIN 6	SPARE		
9	GNDA	SPILL DETECTED RTN		
10	DIN 10	SPILL DETECTED 2		
11	DIN 12	LIQUID IN VAC LINE		
12	DIN 13	RES OVERFULL		
13	DIN 14	ULTRASONIC FAIL 1		
14	DIN 15	BULK EMPTY		
15	GNDD	BULK EMPTY RTN		
16	GNDD	ULTRASONIC FAIL RTN		
17	AIN 2	BULK SCALE SIGNAL		
18	GNDA	SPARE		
19	BLK SCL PWR	BULK SCALE POWER	F4	
20	DIG PWR +24V	SPARE	F1	
21	GNDA	SPARE		
22	GNDA	SPARE		
23	AIN 7 PWR	SPARE	F9	
24	AIN 7	SPARE		
25	AIN 4	BULK PUSH PRESS SIG		
26	GNDA	SPARE		
27	AIN 4 PWR	BULK PUSH PRESS PWR	F3	
28	DIG PWR +24V	SPARE	F1	
29	GNDA	SPARE		
30	GNDA	SPARE		
31	AIN 8 PWR	SPARE	F10	
32	AIN 8	SPARE		
33	DIN 16	SMOKE DETECT		(CG400 ONLY)
34	VAC DRV 163 mA	VAC DRIVE		
35	VAC SIG IN	VAC SIGNAL		
36	VAC REF	VAC REF		
37	+12V	ULTRASONIC 1 PWR	F18	
38	DIG PWR +24V	SPARE	F1	
39	GNDD	ULTRASONIC 1 GND		
40	GNDA	VAC GND		
41	N/C	NOT USED		
42	–15V	BARATRON PWR –	F7	
43	N/C	NOT USED		
44	+15V	BARATRON PWR +	F6	
45	N/C	NOT USED		
46	N/C	NOT USED		
47	DIN 27	SPARE (NOTE 1)		
48	GNDD	SMOKE DETECT RTN		(CG400 ONLY)
49	DIN 28	SPARE (NOTE 1)		
50	GNDD	SPARE		
51	N/C	NOT USED		
52	N/C	NOT USED		
53	UVIR 1	SMOKE RELAY(+24VDC)(NOTE 2)	F2	(CG400 ONLY)
54	N/C	NOT USED		
55	GNDD	RES OVERFULL RTN		
56	GNDD	LIQUID IN VAC LINE RTN		
57	GNDD	SMOKE GND		(CG400 ONLY)

NOTES :
1. DI26, DI27, AND DI28 SWITCH TP +24VDC. ALL OTHER INPUTS SWITCH TO GNDD
2. THIS (F2) FUSE IS LOCATED ON THE AP1551 PCB.
3.) USE PROCESS ULS PROBE CABLE ADAPTER FOR 325, 325i, 400 MODELS

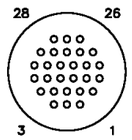
REV. NO.		REVISION DESCRIPTION	DATE	DRAWN
9		CHANGED TEXT AS PER MOC (ELC–01062346)	23DEC14	P.OVERCAST
8		NO CHANGE TO THIS SHEET	08AUG12	P.OVERCAST
0	5729	INITIAL RELEASE	17OCT07	P.OVERCAST

REVISIONS

TITLE
System Schematic
PRODUCT TYPE
P1 HARNESS DETAILS
COMPONENT CONNECTIONS

BOARD #/Rev:
SCALE: NONE
DWG. NO. SYS–SCH0019B
REV. 9
FILE: SYS–SCH0019B R9.sch
SHEET: 12 OF 14

P2 (28 PIN)



VIEW
INSIDE CONTOLLER

CABINET INTERFACE CHART P2
CG100–CG300

P2	SIGNAL	SIGNAL NAME	FUSE AP1552
1	DIN 17	ULTRASONIC FAIL 2	
2	DIN 18	DEGASSER LEAK 1	
3	DIN 19	DEGASSER LEAK 2	
4	DIN 26	BULK CODE CABLE (NOTE 1)	
5	DIN 20	DEGASSER LEAK 3	
6	GNDD	ULTRASONIC FAIL 2 RTN	
7	N/C	NOT USED	
8	N/C	NOT USED	
9	AIN 1	PROCESS SCALE SIG	
10	GNDA	SPARE	
11	PRC SCL PWR	PROCESS SCALE PWR	F5
12	GNDA	SPARE	
13	N/C	NOT USED	
14	N/C	NOT USED	
15	GNDD	DEGASSER LEAK 1 RTN	
16	GNDD	DEGASSER LEAK 2 RTN	
17	AIN 3	PROCESS PUSH PRESS SIG	
18	GNDA	SPARE	
19	AIN 3 PWR	PROCESS PUSH PRESS PWR	F2
20	GNDA	SPARE	
21	GNDD	SPARE	
22	UVIR 3	UVIR OUT 3 (NOTE 2)	F2
23	N/C	NOT USED	
24	AIN 9 PWR	BULK CODE CABLE RTN	F11
25	AIN 9	SPARE	
26	GNDD	DEGASSER LEAK 3 RTN	
27	+12V	ULTRASONIC 2 PWR	F19
28	GNDD	ULTRASONIC 2 GND	

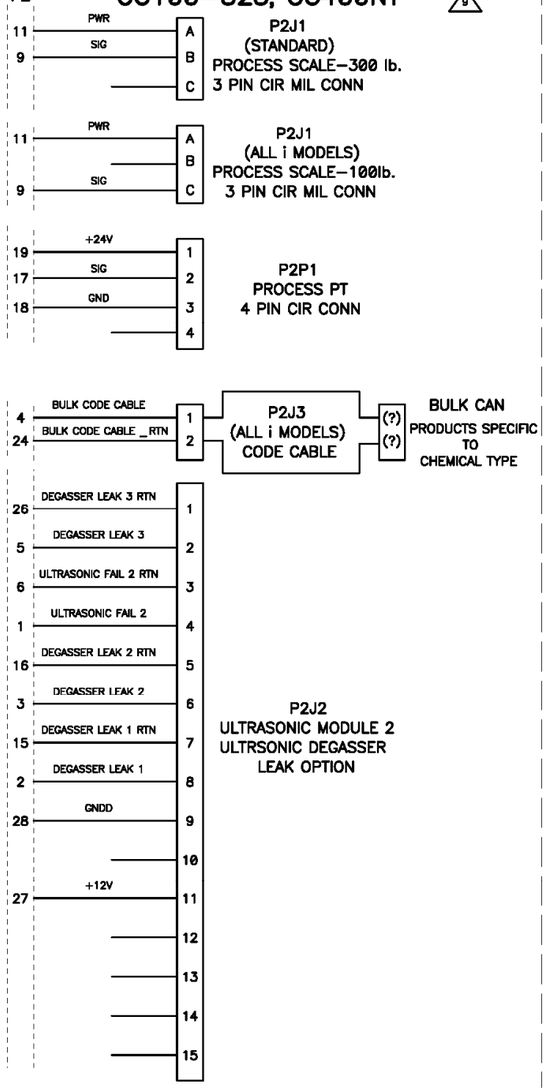
CABINET INTERFACE CHART P2
CG400 ONLY

P2	SIGNAL	SIGNAL NAME	FUSE AP1552
1	DIN 17	UVIR FAULT	
2	DIN 18	DI18	
3	DIN 19	DI19	
4	DIN 26	UVIR DETECT	
5	DIN 20	DI20	
6	GNDD	UVIR FAULT RTN	
7	N/C	NOT USED	
8	N/C	NOT USED	
9	AIN 1	PROCESS SCALE SIG	
10	GNDA	SPARE	
11	PRC SCL PWR	PROCESS SCALE PWR	F5
12	GNDA	SPARE	
13	N/C	NOT USED	
14	N/C	NOT USED	
15	GNDD	DI18 RTN	
16	GNDD	DI19 RTN	
17	AIN 3	PROCESS PUSH PRESS SIG	
18	GNDA	SPARE	
19	AIN 3 PWR	PROCESS PUSH PRESS PWR	F2
20	GNDA	SPARE	
21	GNDD	SPARE	
22	UVIR 3	UVIR RELAY(+24VDC)(NOTE 2)	F2
23	N/C	NOT USED	
24	AIN 9 PWR	SPARE	F11
25	AIN 9	SPARE	
26	GNDD	DI20 RTN	
27	+12V	ULTRASONIC 2 PWR	F19
28	GNDD	UVIR GND	

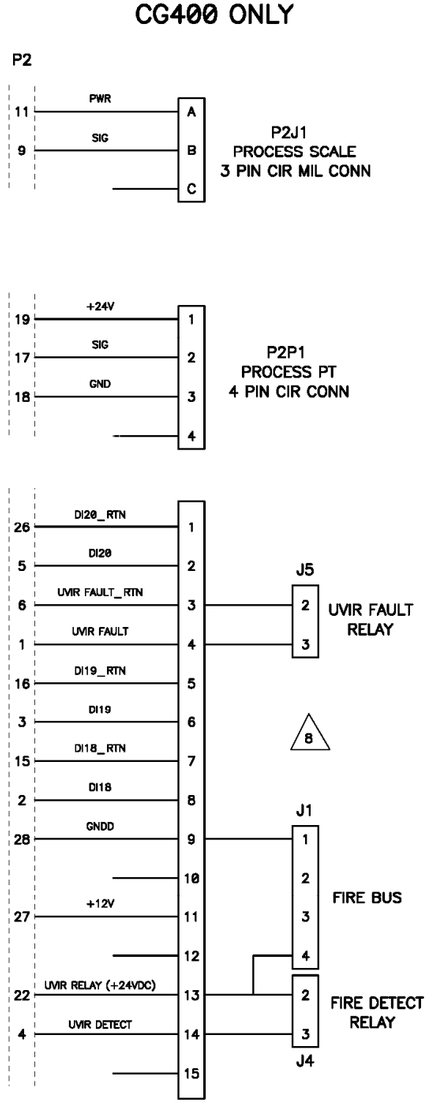
NOTES :

1. DI26, DI27, AND DI28 SWITCH TP +24VDC. ALL OTHER INPUTS SWITCH TO GNDD
2. THESE (F2) FUSES ARE LOCATED ON THE AP1551 PCB.

CG100–325, CG400NT ⚠9

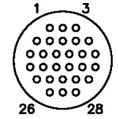


CG400 ONLY



⚠9 CG100–CG325, CG400, CG400NT

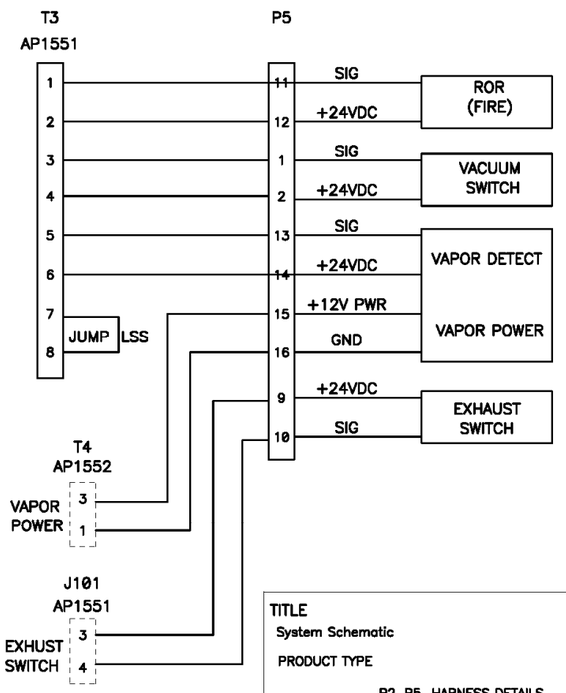
P5 (28 PIN)



VIEW
INSIDE CONTOLLER

P5 CONNECTIONS

	T3	CHART A	P5
FUSED (F3)	1	FIRE DI33	11
	2		12
	3	VAC SW FAIL DI34	1
	4		2
	5	VAPOR DETECT DI35	13
	6		14
	7	LIFE SAFETY SHUTDOWN DI36	JUMP
	8		
J101–3		EXHAUST SW. SEE SHT 2	9
J101–4			10
T4–3		VAPOR POWER AP1552	15
T4–1			16



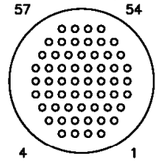
TITLE
System Schematic
PRODUCT TYPE
P2, P5 HARNESS DETAILS
COMPONENT CONNECTIONS

REV. NO.		REVISION DESCRIPTION	DATE	DRAWN
9		CHANGED TEXT AS PER MOC (ELC–01062346)	23DEC14	P.OVERCAST
8		REMOVED TEXT FOR P2J2	08AUG12	P.OVERCAST
0	5729	INITIAL RELEASE	17OCT07	P.OVERCAST

REVISIONS

BOARD #/Rev:
SCALE: NONE
DWG. NO. SYS–SCH0019B
REV. 9
FILE: SYS–SCH0019B R9.sch
SHEET: 13 OF 14

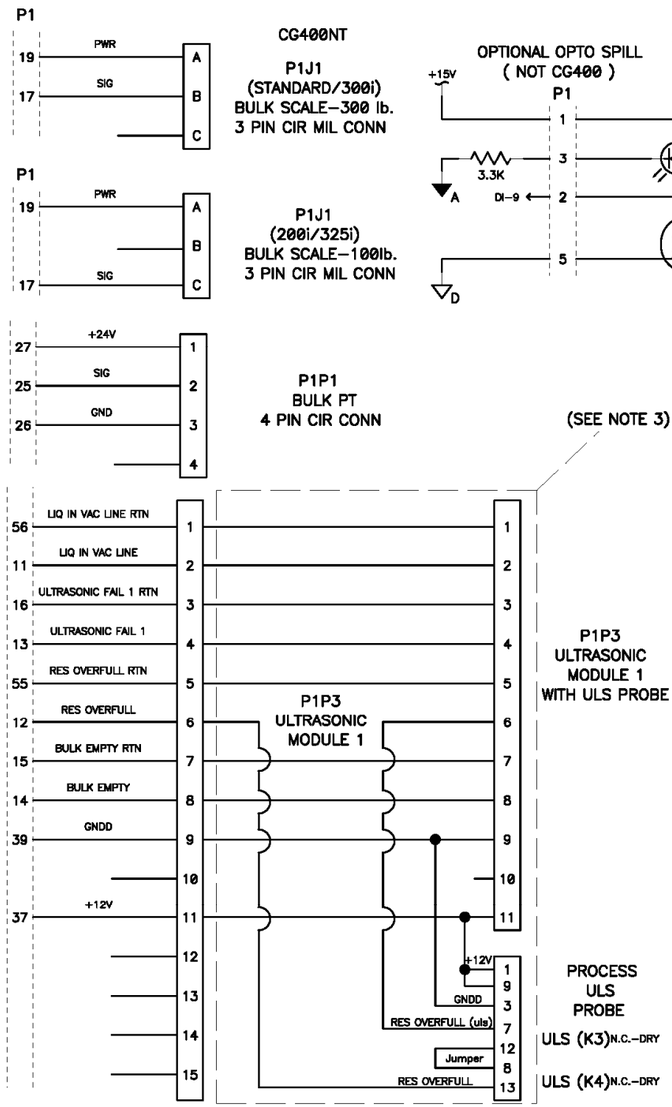
P1 (57 PIN)



VIEW
INSIDE CONTROLLER

CABINET INTERFACE CHART P1
CG100–CG400

	P1	SIGNAL	SIGNAL NAME	FUSE AP1552
	1	+15V	OPTO SPILL PWR	
	2	DIN 9	SPILL DETECT (OPTO/FLOAT)	
	3	LED CURRENT	OPTO SPILL RTN	
	4	AIN 5 PWR	SPARE	F8
	5	GNDD	SPILL DETECTED 2 _RTN	
	6	DIN 11	DOOR OPEN	
	7	GNDD	DOOR OPEN _RTN	
	8	AIN 6	SPARE	
	9	GNDA	SPILL DETECTED _RTN	
	10	DIN 10	SPILL DETECTED 2	
	11	DIN 12	LIQUID IN VAC LINE	
	12	DIN 13	RES OVERFULL	
	13	DIN 14	ULTRASONIC FAIL 1	
	14	DIN 15	BULK EMPTY	
	15	GNDD	BULK EMPTY _RTN	
	16	GNDD	ULTRASONIC FAIL _RTN	
	17	AIN 2	BULK SCALE _SIGNAL	
	18	GNDA	SPARE	
	19	BLK SCL PWR	BULK SCALE _POWER	F4
	20	DIG PWR +24V	SPARE	F1
	21	GNDA	SPARE	
	22	GNDA	SPARE	
	23	AIN 7 PWR	SPARE	F9
	24	AIN 7	SPARE	
	25	AIN 4	BULK PUSH PRESS _SIG	
	26	GNDA	SPARE	
	27	AIN 4 PWR	BULK PUSH PRESS _PWR	F3
	28	DIG PWR +24V	SPARE	F1
	29	GNDA	SPARE	
	30	GNDA	SPARE	
	31	AIN 8 PWR	SPARE	F10
	32	AIN 8	SPARE	
(CG400NT)	33	DIN 16	UVIR FAULT	
	34	VAC DRV 163 mA	VAC DRIVE	
	35	VAC SIG IN	VAC SIGNAL	
	36	VAC REF	VAC REF	
	37	+12V	ULTRASONIC 1 PWR	F18
	38	DIG PWR +24V	SPARE	F1
	39	GNDD	ULTRASONIC 1 GND	
	40	GNDA	VAC GND	
	41	N/C	NOT USED	
	42	–15V	BARATRON PWR –	F7
	43	N/C	NOT USED	
	44	+15V	BARATRON PWR +	F6
	45	N/C	NOT USED	
	46	N/C	NOT USED	
(CG400NT)	47	DIN 27	UVIR DETECT	
(CG400NT)	48	GNDD	UVIR FAULT_RTN	
	49	DIN 28	SPARE (NOTE 1)	
	50	GNDD	SPARE	
	51	N/C	NOT USED	
	52	N/C	NOT USED	
(CG400NT)	53	UVIR 1	UVIR RELAY(+24VDC)(NOTE 2)	F2
	54	N/C	NOT USED	
	55	GNDD	RES OVERFULL_RTN	
	56	GNDD	LIQUID IN VAC LINE_RTN	
(CG400NT)	57	GNDD	UVIR GND	



NOTES :
1. DI26, DI27, AND DI28 SWITCH TP +24VDC.
   ALL OTHER INPUTS SWITCH TO GNDD
2. THIS (F2) FUSE IS LOCATED ON THE AP1551 PCB.
3.) USE PROCESS ULS PROBE CABLE ADAPTER
   FOR 325, 325i, 400 MODELS

REV. NO.		REVISION DESCRIPTION	DATE	DRAWN
9		ADDED THIS SHEET AS PER MOC (ELC–01062346)	23DEC14	P.OVERCAST
0			17OCT07	P.OVERCAST

REVISIONS

TITLE
System Schematic
PRODUCT TYPE P1 HARNESS DETAILS
COMPONENT CONNECTIONS
W/ UVIR CONNECTIONS

BOARD #/Rev:
SCALE: NONE
DWG. NO. SYS–SCH0019B
REV. 9
FILE: SYS–SCH0019B R9.sch
SHEET: 14 OF 14

Addendum B

Gas Filter Setup

Requirement:

A filter is required on the push gas supply to the ChemGuard cabinet to remove particles and gas impurities. Without a filter, particles can accumulate on the push gas regulator seat preventing the poppet from properly sealing against the seat and causing the regulator to creep.

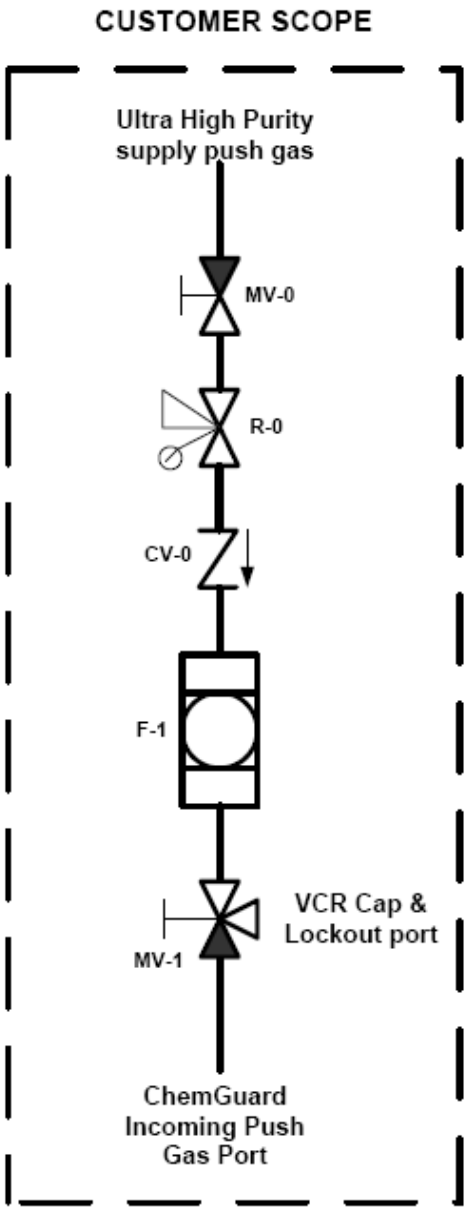
The minimum filter specifications:

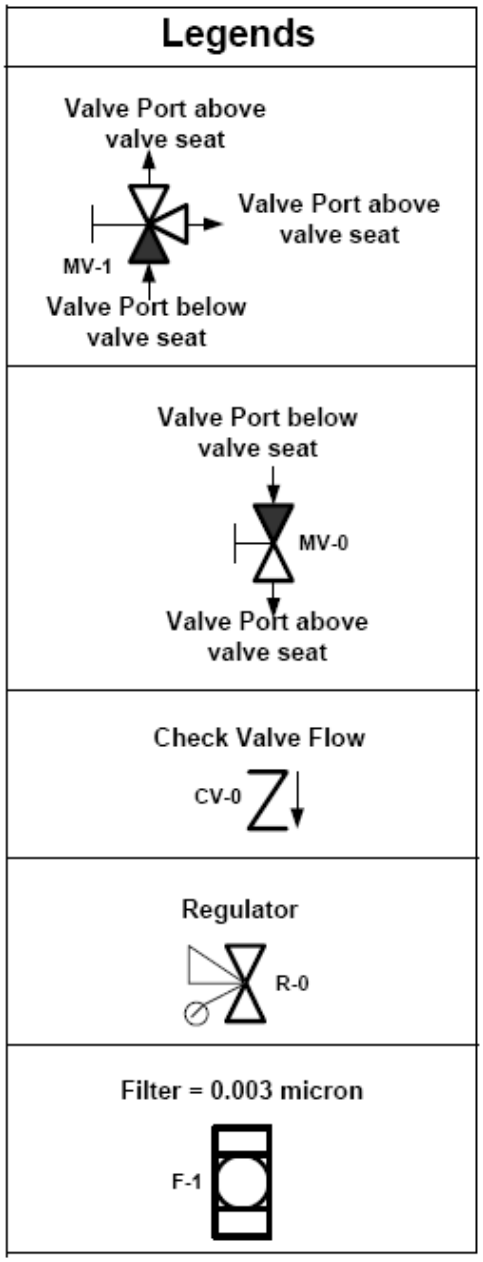
- Filter = 0.003 micron
- Flow = 50 slpm
- Material = Electropolished 316L Stainless Steel
- Membrane = 316L Stainless Steel or PTFE
- Leak Tested = 100% Helium leak tested to $5x10^{-9}$ atm cc/sec ($3.8x10^{-9}$ Torr L/sec)

Follow the filter manufacturer's recommendations based on usage. The typical practice is to replace the filter when pressure drop across the filter begins to increase. This is evident if the regulator needs adjustment to maintain the same Bulk and Process push pressures.

Figures 1 and 2 show recommended facilitation setup of houseline push gas supply. The setup provides isolation and purging capability when replacing filter or other inline components on the houseline. Follow the work procedure when replacing the gas filter or any inline components.

Figure 1: Setup when using inert gas as push gas source



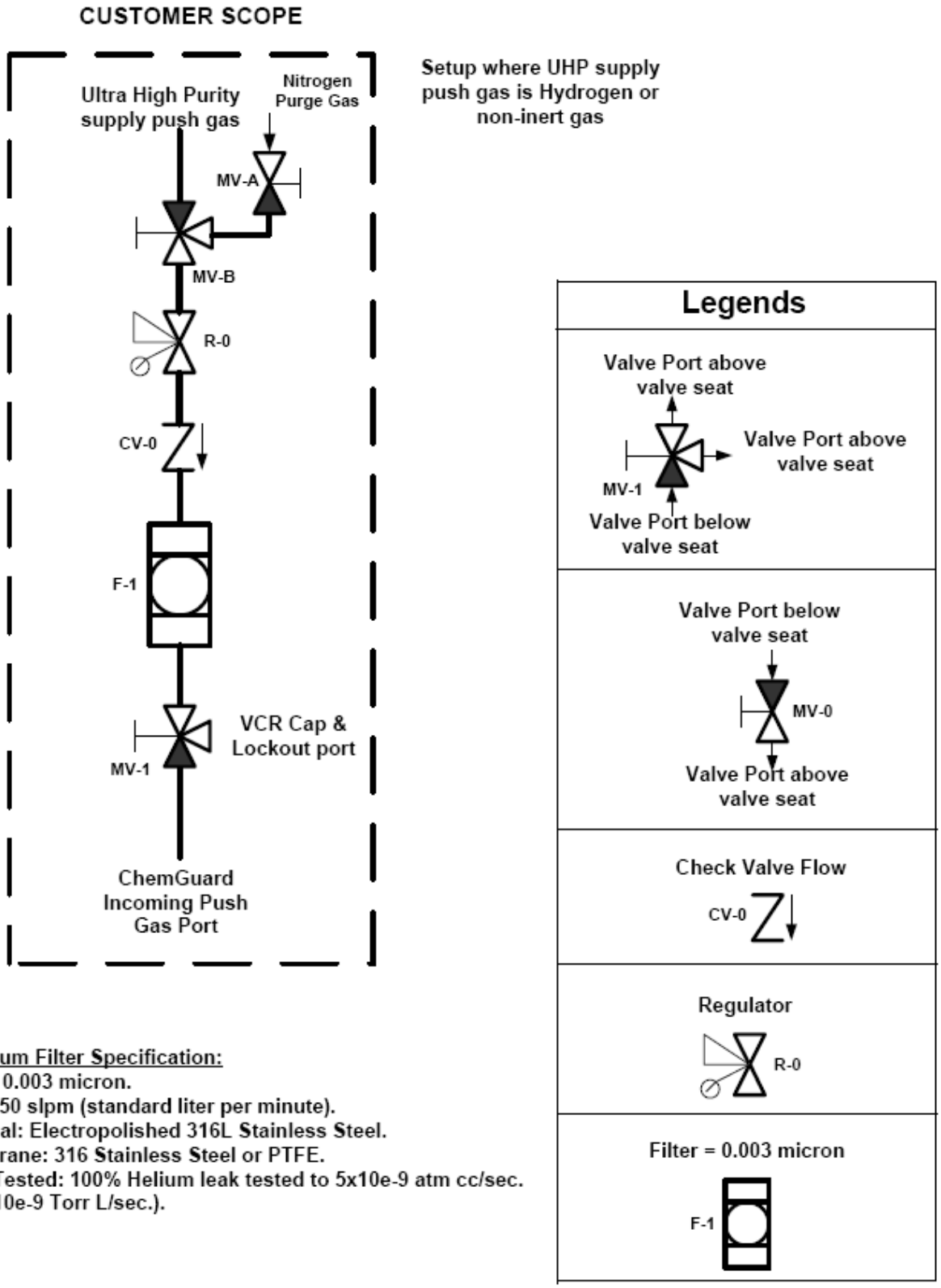


Minimum Filter Specification:
Filter: 0.003 micron.
Flow: 50 slpm (standard liter per minute).
Material: Electropolished 316L Stainless Steel.
Membrane: 316 Stainless Steel or PTFE.
Leak Tested: 100% Helium leak tested to 5x10e-9 atm cc/sec.
(3.8x10e-9 Torr L/sec.).

Replacing and Purging Technique:

1. Close manual valves MV-0 and MV-1. Reference Figure-1.
2. Locate filter or failed component on the houseline.
3. Remove and replace filter or failed component on the houseline (caution the line has high pressure push gas, loose VCR fitting slowly to relieve pressure).
4. Verify all VCR connection made properly.
5. Remove VCR lock at purge port MV-1.
6. Remove VCR plug or cap fitting at MV-1 purge port.
7. Remove and replace with new VCR gasket at MV-1 purge port and re-install plug or cap, DO NOT tighten VCR port at this time.
8. Ensure regulator R-0 on the houseline is fully open.
9. Partially open MV-0 to allow flow purge through MV-1 port.
10. Purge for 1-2 hours at low flow rate.
11. While continuing to purge, tighten and close VCR fitting at MV-1 port.
12. Install VCR lock at MV-1.
13. Temporarily close regulator R-0 on the houseline.
14. Fully open MV-0 for normal operation.
15. Fully open MV-1 for normal operation.
16. Adjust regulator R-0 on the houseline to desire operational pressure.
17. Component replacement and purge completed.

Figure 2: Setup when using Hydrogen or non-inert gas as push gas source



Minimum Filter Specification:
Filter: 0.003 micron.
Flow: 50 slpm (standard liter per minute).
Material: Electropolished 316L Stainless Steel.
Membrane: 316 Stainless Steel or PTFE.
Leak Tested: 100% Helium leak tested to 5x10e-9 atm cc/sec. (3.8x10e-9 Torr L/sec.).

Replacing and Purging Technique:

1. Close regulators inside the cabinet. Reference cabinet P&ID.
2. Close manual valves MV-B and MV-1. Reference Figure-2.
3. Locate filter or failed component on the houseline.
4. Remove and replace filter or failed component on the houseline (caution the line has high pressure push gas; loose VCR fitting slowly to relieve pressure).
5. Verify all VCR connections made properly.
6. Remove VCR lock at purge port MV-1.
7. Remove VCR plug or cap fitting at MV-1 purge port.
8. Remove and replace with new VCR gasket at MV-1 purge port and re-install plug or cap, DO NOT tighten VCR port at this time.
9. Remove VCR lock and plug or cap at purge gas port MV-A.
10. Connect remote Nitrogen purge gas source supply at purge gas port MV-A.
11. Partially open MV-A to apply remote Nitrogen purge.
12. Ensure regulator R-0 on houseline is fully open.
13. Purge for 1-2 hours at low flow rate.
14. While continuing to purge, tighten and close VCR fitting at MV-1 port.
15. Install VCR lock at MV-1.
16. Close MV-A on the houseline.
17. While continuing to purge, disconnect the remote Nitrogen purge gas source supply line from MV-A. Maintain Nitrogen purge at port MV-A during gasket replacement. Re-install and tighten VCR plug or cap at MV-A.
18. Install VCR lock at MV-A.
19. **Flow purge and vacuum pump down to remove Nitrogen in the process push gas flow path**.
    a. Verify Bulk container both manual valves are close.
    b. Ensure regulator R-0 on the houseline is fully open.
    c. Open MV-A on the houseline.
    d. Fully open regulator R1 ONLY inside cabinet.
    e. Open V1A (CG100-400) or V1 (CG010, CG050, BCD100-200).
    f. Open V2A (CG100-400) or V2 (CG010, BCD100-200).
    g. Open V4A (CG100-400) or V4 (CG010, BCD100-200) or V5 (CG050).
    h. Open MV-1 on the houseline.
    i. Fully open MV-B to allow process gas flow.

j. Allow flow purge for 30 minutes.
k. Temporally close MV-B on the houseline.
l. Wait for 1-2 minutes.
m. Close V4A (CG100-400) or V4 (CG010, BCD100-200) or V5 (CG050).
n. Open V7 and verify vacuum reach base pressure.
o. Open V5A (CG100-400) or V5 (CG010, CG050, BCD100-200).
p. Allow vacuum pump down for 1-2 hours.
q. Close MV-A on the houseline.
r. Close V2A (CG100-400) or V2 (CG010, BCD100-200).
s. Close V1A (CG100-400) or V1 (CG010, CG050, BCD100-200).
t. Close V7, V5A (CG100-400) or V5, V7 (CG010, CG050, BCD100-200).
u. Temporarily close regulator R-0 on the houseline.
v. Temporarily close regulator R1 inside cabinet.
w. Flow purge and vacuum Pumpdown completed.

20. Fully open MV-B on the houseline for normal operation.
21. Fully open MV-1 on the houseline for normal operation.
22. Adjust regulator R-0 on the houseline to desire operational pressure.
23. Adjust regulators for Bulk and/or Process inside cabinet to desire operational pressure.
24. Component replacement and flow purge completed.

Addendum Y

UVIR Detector

VERSUM MATERIALS, INC.' RECOMMENDATIONS FOR FLAME DETECTION

NOTE: Versum Materials, Inc. recommends that the customer review and refer to the UVIR device manual shipped along with the system. The manual provides accurate information regarding operation, specification, calibration and maintenance of the UVIR.

1.1 For flame detection, Versum Materials, Inc. uses a Fire Sentry/Honeywell SS4-A or SS4-A2 UV/IR in GG500, APx, TEx, and ChemGuard cabinets, racks, wall-mounts, VMBs, VMPs, HFS, VHFS, and BSGS. Versum Materials, Inc. strongly recommends the use of a UV/IR detector over any other type of flame detection device.

1.1.1 The Model No. SS4-A/-A2 Detector is a microprocessor based Electro-Optical Fire/Flame Detector that "sees" the ultraviolet (UV), visible and wide band infrared (IR) spectral bands of optical spectra. This fast-acting, digital, configurable Fire Detector will alarm to Type A, B, and C fires (Table 1).

Table 1: Fire Types

Class of Fire	Fuel Source
A	Ordinary combustibles (i.e., trash, wood, paper, cloth)
B	Flammable Liquids (i.e., oils, grease, tar, gasoline, paint, thinners)
C	Electricity (i.e., live electrical equipment)

1.1.2 "The Fire Sentry UV/IR model SS4-A features algorithms that process multiple spectrums to determine if a fire exists while also rejecting false alarm signals. UV/IR monitors are tuned to respond to both UV and IR emissions (as well as other variables such as visible light, flicker frequency, etc) that algorithms use to declare a flame or reject as a false alarm. The SS4-A detector analyzes ultraviolet (UV), visible (VIS), and wideband infrared (IR) energy before declaring a fire. Generally, flames have little VIS but significant UV and IR allowing the VIS signal to assist in false alarm rejection logic. In the case of non-hydrocarbon fires, and Silane fires in particular, the spectrum that is emitted results from the interaction of oxygen and hydrogen that forms water vapor (H_20) as well as oxygen-hydrogen (OH) radicals. OH emits strongly in the 306 nanometer UV spectral band and additional emission peaks within the UV spectral band between 180 – 240 nanometers. It also emits IR radiant energy in the Near IR band with several peaks within the 1 – 3 micron spectral IR band. Water (H_20) emits mainly in the near IR band with a strong peak at 2.7 microns. Detecting the emitted radiation from a Silane flame simultaneously at both these spectral bands (UV and IR) enables fast and reliable Electro-Optical fire detection with high immunity to false alarms. Note that this Silane flame detection does not rely on IR absorbance associated with CO_2 (4.3 microns) evolution from hydrocarbon fires." (Excerpt from Matthew H. MacConnell's "UVIR Flame Detection", Rev 1, 30 May 03)

1.2 Field of View: The UVIR can detect a fire within a 120 degree cone. The detector is pointed at the largest fire threat area for the fastest response times to the smallest size fire. In Versum Materials, Inc.' equipment the UVIR will be positioned to see all VCR connections.

1.3 Certifications:

Class I, Div. 1 & 2, Groups B, C, & D

Class II, Div. 1 & 2, Groups E, F, G

Class III

1.4 Versum Materials, Inc. Configuration Settings

The configuration of the SS4-A/-A2 UV/IR Detector is set using DIP switches located on the middle circuit board of the detector. Configuration options and Versum Materials, Inc. settings are discussed below.

1.4.1 Verification Time: The verification time is the amount of time the detector will wait until it declares a fire. If a fire is detected, the detector will use the specified amount of time to confirm the existence of a fire. If at the end of the time period the detector no longer detects a flame, the detector will not alarm. If at the end of the time period the detector still detects a flame, the detector will alarm. Verification time helps in reducing the number of false detections. Versum Materials, Inc. sets the verification time to 5 seconds and the verification time is always enabled. Therefore, if the detector detects a flame for 5 continuous seconds, the detector will declare a Fire Verify. Verification time is controlled by the settings of dip switches 1, 2, and 3.

1.4.2 Latching: In the SS4-A/-A2 Latching mode, the Fire or Verify Relay will energize and Red LEDs will remain illuminated until the detector power is cycled (power is turned off and on). If Verify is enabled when the Verify Relay energizes it will remain energized until the detector is reset. Latching is determined through the setting of dip switch 4.

1.4.3 IR-Only Enable: The IR-only setting allows the detector to declare a fire in situations where UV is not present or is obscured. For Silane systems, the detector must detect both UV and IR to declare a fire. This is done to reduce false detections, since silane systems are sometimes sited outdoors. These detectors are labeled with “Configured for Silane”. For all other gas systems, the detector will declare a fire if UV and IR are present, but can declare a fire with only the presence of IR. False detections have not occurred on systems using the IR only mode. When the detector detects only IR in this IR only mode, it begins a UV self test. During this test, the internal UV source is turned on, UV reflects off the metal lens guard, and should be sensed by the UV sensor. If the detector does not sense the internally generated UV, it assumes that the lens is blocked, and will declare a fire based only on IR. If the internally generated UV is sensed, the detector assumes that it is working properly, and that IR is present without UV (and therefore, no fire exists). The detector will not declare a fire in this condition. IR-Only Enable is controlled by the dip switch 5 setting.

1.4.4 Test Cycle: Testing of the UV sensor occurs every 30 minutes. The detector has an internal UV source and performs a self-test every 30 minutes. During the self-test, the UV source is turned on, and UV is reflected off of the metal lens guard. The UV should

be sensed by the UV sensor. If the detector does not sense the UV, a fault alarm will be set off. The test cycle frequency is controlled by the dip switch 6 setting.

1.4.5 Fire Range/Sensitivity: The fire range/sensitivity setting is measured by the distance between the sensor and the fire (15, 30, 45, or 60 ft). The sensitivity setting refers to the distance that the detector is guaranteed to detect a burning 1 square foot puddle of gasoline. Versum Materials, Inc. sets the UV/IR so it will detect a 1 square foot gasoline fire at a distance of 60 feet. Since a leaking low pressure VCR connection would produce a significantly smaller flame than a puddle of gasoline, the sensitivity is set to a much higher distance than the actual distance of the potential leak. The fire range/sensitivity is controlled by the dip switches 7 and 8 settings.

1.4.6 Dip Switch Settings (GG500, APx, TEx, ChemGuard)

The SS4-A/-A2 is configured at the Versum Materials, Inc. Factory as listed in Table 2.

Table 2: Versum Materials, Inc.' SS4-A/-A2 Dip Switch Setting

Switch	State	Description
1	Closed	Verify is enabled and the verify time is 5 seconds
2	Open	
3	Open	
4	Closed	Latching mode (LEDs stay on until reset)
5	Open	Used for silane only. UVIR must detect both UV and IR to declare a fire. This is done to reduce false detections, since Silane systems are sited outdoors. These detectors are labeled with "Configured for Silane".
5	Closed	Used for all other gases. The detector will declare a fire if UV and IR are present, but can declare a fire with only the presence of IR.
6	Open	Testing of the UV sensor occurs every 30 minutes.
7	Closed	The UVIR is set to detect a 1 square foot gasoline fire at a distance of 60 feet.
8	Closed	

1.5 SS4-A/-A2 Detector System Relays

1.5.1 Fault Relay: The fault relay checks for normal operation of the UV/IR Detector. The detector issues a fault condition by de-energizing its Fault Relay and the controller will show a UV/IR Fault alarm on its screen. If there is a fault, the detector will illuminate one LED to visually indicate the fault. The list of Detector Faults include temperature fault, excessive input voltage fault, no power fault, detector fault, relay fault, self-checking fault, and analog '0' current. The LED will not light if the fault is "no power". If the fault condition is eliminated, the detector will return to normal operation and the LEDs will return to blinking every 10 seconds. Faults requiring factory recertification will be indicated with the LEDs rapidly blinking.

Temperature Fault: The detector will fault due to temperature if during operation the internal temperature rises about 85°C or falls below -40°C. This will cause both LEDs to blink rapidly. The corrective action for this type of fault is to return the UV/IR for factory re-certification.

Excessive Input Voltage Fault: The detector will fault due to excessive input voltage if the input voltage becomes greater than 45 Volts. This will also cause both LEDs to blink rapidly, and the corrective action requires returning the detector for factory re-certification.

Low Input Voltage Fault: The detector will fault due to low input voltage if the input voltage becomes too low. In this cause, one LED is illuminated until the fault is corrected.

No Power Fault: The detector will fault if there is no power and/or the input voltage is interrupted or turned off. The LEDs will not be lit in this case.

Detector Fault: The detector will fault if the Optical Sensors fail the automatic built-in lens test. In this case one LED is on until the fault is corrected. The user should clean the inside and outside of the lens, then the exposed surface of the UV sensors, and the protective grill mounted on the outside of the housing cover. Testing of the UV sensor (automatic built-in lens test) occurs every 30 minutes (Versum Materials, Inc. setting) and the testing frequency is controlled by dip switch 6.

Relay Fault: The detector will fault if one of its relay circuits fails. This fault will be indicated by one LED being lit continuously.

Self-Checking Fault: The detector will fault if its internal microprocessor finds a failure during its self-check of the hardware and software. One LED will be lit until the fault is corrected.

Analog "0" Current: All of the faults described will produce an output current loss with the 4- 20 mA module option.

1.5.2 Fire Relay: If the detector senses a fire, the fire relay will energize and the detector will fault. The detector fault will cause the controller to issue a shutdown alarm. The detector will monitor the same x/y coordinates for a specified duration of time to verify the existence of a fire. Versum Materials, Inc. specifies the verification time to be 5 seconds. The fire relay and verification time is enabled by dip switches 1, 2, and 3.

1.5.3 Verify Relay: The verify relay signals the existence of a fire. For Versum Materials, Inc. applications, the Fire Verify Relay is always enabled. In the case of a fire, the Verify Relay will energize and the Fire Relay will de-energize if the fire conditions are still present at the end of the Verify Time period of five seconds. Therefore, if the sensor detects a fire (through the use of the fire relay), the Fire Verify Relay will energize and if it continues to detect a fire in the exact x/y coordinates for five seconds, the detector will declare a fire in the cabinet. The verify relay is controlled by dip switches 1, 2, and 3.

1.6 Controller Alarms Associated with the SS4-A/-A2 UV/IR Detector

1.6.1 UV/IR Fault – If the detector's fault relay deenergizes, the controller's UV/IR fault alarm will be initialized. The UV/IR Fault alarm is a fault alarm and indicates that the UV/IR detector is not functioning properly (possible detector faults are described in section 1.5.1).

1.6.2 Flame Detect – If the detector's fire relay energizes, the controller's flame detect alarm will be initialized. The flame detect alarm is a shutdown alarm and will close all the valves on the side of the system that detected a fire. On VMBs, this alarm is a hardwire alarm

1.6.3 Flame Verify – If the detector's verify relay energizes, the controller's flame verify alarm will be initialized. The flames verify alarm is a shutdown alarm, and the alarm will close all valves throughout the system and stop the flow of gas. Power will also be turned off to the UV/IR detector. This alarm is initiated when the detector senses a steady flame or fire for five seconds. Flame verify is a hardwire alarm. The alarm is not used on VMBs since only two inputs are used, UV/IR Fault and Flame Detect (which is hardwired).

1.7 Operation of the Fire Sentry SS4-A UV/IR (excerpt taken from PTB071, Jan 22, 2004)

There are two LEDs on the SS4-A UV/IR that indicate the state of the detector. During normal operation without an alarm condition, the LED's on the face of the UV/IR will blink every 10 seconds. Every 30 minutes, as defined by switch 6, the detector performs a self-test. The detector tests itself by turning on a UV source inside the housing. This UV is transmitted through the lens, reflects off the metal lens guard, and is detected by the UV sensor. If the detector fails to sense the self generated UV, it will go into fault, and the controller will declare a UV/IR fault.

If the UV/IR detects a fire during testing or operation, both LED's will remain on continuously. The controller will alarm with UV/IR Flame Detect (a shutdown alarm), closing all valves on the side that detected the fire if two UV/IRs are used, or all valves if only one detector is used. If the detector continues to detect a flame for 5 continuous seconds, as defined by switches 1 through 3, the detector will declare a Fire Verify. The controller will alarm with the hardwired shutdown UV/IR Flame Verify, closing all system valves. If the system is an Automatic Backup System (ABS) Primary, it will also signal the ABS Backup to Shutdown. The fire alarm LEDs will remain on until power is cycled to the unit (power turned on and off).

The controller turns off UV/IR power when the UV/IR Flame Verify occurs. Power is restored to the UV/IR when the operator presses the controller's reset button. This causes the UV/IR to reset and un-latch. Since this Flame Verify would interrupt process gas, alternate methods can be used to manually reset the detector without interrupting process gas.

1.8 Version SS4-A2: "The operation of this unit is identical to the SS4-A, except the fire alarm LEDs turn off once the fire threat is eliminated, without power cycling of the device." Excerpt from Installation and Operating Manual, Model SS4-A/-A2, Rev A, July 2014.

Since Versum Materials, Inc. controllers use the relay outputs not the LEDs for detection, the SS4-A and SS4-A2 are considered identical and interchangeable in Versum Materials, Inc. equipment.

1.9 Testing/Maintenance of the SS4-A/-A2 Flame Detector

1.9.1 The SS4-A/-A2 can be manually tested to verify proper operation and should be done at least yearly. Testing the SS4-A/-A2 will require a shutdown of the equipment. A UV/IR Fault can be simulated by placing a non-reflective surface (i.e. black paper) in front of

the UV/IR metal lens protector for at least 30 minutes. This causes the UV/IR to fail its self-test, and generate a fault.

A UV/IR Flame Detect can be simulated by generating UV and IR in front of the lens. This can be done with an actual flame (NOTE: This method is dependent upon the hazard location of the UV/IR and should not be done in an area considered to be hazardous), or with a UVIR test source. It must be done continuously for at least 5 seconds. Any interruption in the UV/IR source during the 5 seconds will cause the UV/IR to restart the 5 second period.

1.9.2 Automatic testing of the detector is performed during detector operation. Versum Materials, Inc. specifies that the detector will self test every 30 minutes. A red LED on the detector will remain illuminated to indicate contamination of the window lens, missing the protective self-test grill, or when removing the enclosure.

1.8.3 The housing glass or lens should be cleaned at least every 6 months if the device is located indoors. If located outdoors, the lens should be cleaned at least monthly. To clean the housing glass, a blast of an air hose or an oil-free cloth (oil degrades the performance of UV detectors) can be used. The use of a solvent, such as alcohol, is acceptable in some cases.

2.0 RELATED DOCUMENTS

2.1 Visit honeywellanalytics.com for Product Description, Specifications, Data Sheets, and FAQs.

2.2 See attached Fire Sentry SS4-A/-A2 Operating Manual.

END

Addendum Z

USB Barcode
Setup and Operation

Doc #: MNL000001.doc
Revision: 2

Versum Materials, Inc.
7201 Hamilton Blvd.
Allentown, PA 18195-1501
USA
(866) 257-6158

For Your Safety, Read This First

WARNING

You must read and understand the Safety Information Section of this manual before installing, operating, or maintaining the Gas or Liquid System. All operating and maintenance personnel must complete the Gas or Liquid System training course administered by Versum Materials, Inc.

Failure to comply with these requirements can result in serious injury or death.

WARNING

System Hazards

Potential hazards when working with Gas and Chemical System are:

- **Health Hazard Chemical**
- **Reactive Chemical**
- **Flammable Chemical**
- **Oxidizing Chemical**
- **Oxygen-Deficient Atmosphere**
- **Pressurized Chemical Hazards**
- **Cylinder Handling Hazards**
- **Electrical Hazards**

WARNING

Equipment Changes

Do not make any changes to the System without authorization from an Versum Materials, Inc.' Representative. Death or serious injury may result from unauthorized System changes.

Emergency Response – 24-Hour Service

If a chemical release emergency occurs that cannot be alleviated by a trained operator or supervisor, call Versum Materials, Inc. at one of the following telephone numbers.

North America:

- United States, Canada and Puerto Rico (800) 523-9374 (toll free)
- FAX (610) 481-3772
- VERSUM MATERIALS, INC. Operator (610) 481-4911

European Community / Middle East: (32) 2-752-39-40

All Other Locations: (US Country Code) (610) 481-7711

Material Safety Data Sheet (MSDS)

- Fax-On-Demand Service: (800) 245-2746 (toll free)
- Internet www.airproducts.com

Addendum – USB Barcode

Overview

Controllers have been equipped with an external USB port for barcode scanning. It is important to note the following before using the port or the USB barcode reader.

1) The barcode reader is not approved for Class I Division 2 locations (US) or a Group II Category 3 Zone 2 (Europe) area, but can be used in a flammable area if the area is known to be non-hazardous. It is up to the customer to determine how they determine if the area is non-hazardous (through gas monitoring, detection, etc).
2) The barcode reader or any other USB device is not intended to be permanently connected to the external USB port. The external USB port is intended for intermittent use and USB devices connected to it should be used for as short a time as possible.
3) If a customer desires to keep a device permanently connected to the external USB port, the customer must ensure that the USB device has the appropriate certifications for permanent use in a Class I Division 2 location or a Group II Category 3 Zone 2 area.

USB Connection Port

A controller may be equipped with an external USB port. The external USB port allows a USB connection to be made without having to open the controller door. Electrical devices should never be operated, connected to, or disconnected from the USB port unless the area surrounding the equipment is known to be free of flammable material. All controllers with a USB port on the controller will also have a warning label (Figure A) for operation in a flammable area. The USB port has a cap that can be used to cover the port when not in use.

Figure A: USB Port Warning Label

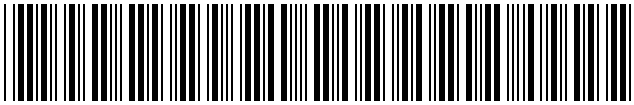
AP10/ChemGuard Gen II USB Barcode Feature

Barcode Data Window

On the controller, a window accessed via the System Setup menu of the Configuration Menu will allow the viewing and modification of the barcode data. This window will show all the barcodes stored in the controller in a 2 column list. The columns will be the Barcode Number, which is a combination of the process line character and the barcode number, and Barcode String. The Barcode Number will be a number from 1 to the maximum number of barcodes for the process line. The process line character will be L or R, A to H, 1 to 8, or B for ChemGuard. This window will allow each barcode to be selected and modified, and contains a full set of keyboard characters accessible via a Shift button. The Shift button will toggle the case of all the alphabetic characters, and allows access to all the different symbols.

Barcode Setup

The system can be configured with a barcode verification feature. When used properly, this feature ensures that only designated product is installed during the cylinder change process. The feature requires use of cylinders that have been systematically labeled with a code that identifies the product contents. See example label below. If the controller was purchased with the external barcode scanner option, the information may be entered automatically by scanning the barcode. Otherwise, the information may be entered manually thru a pop-up keypad on the controller screen.



A00187602125324

If the barcode verification feature is not used, skip this section.

Before connecting the USB Barcode Reader device, the Technician must be aware of the equipment to ensure no gas safety alarm and flammable atmosphere are present.

Enabling the Barcode Feature on AP10\ChemGuard Gen IIB Based Products

How to enable barcode feature:

1) From the Configuration Menu:

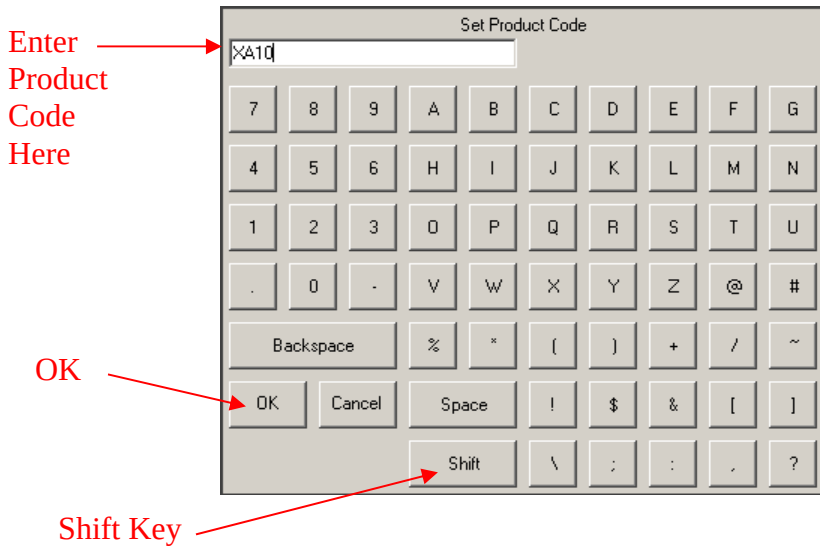
   a. Log-in to controller.

   b. Select “Configuration Menu”.

   c. Select “System Setup”.

   d. Select “Set Product Code” from the System Setup menu.

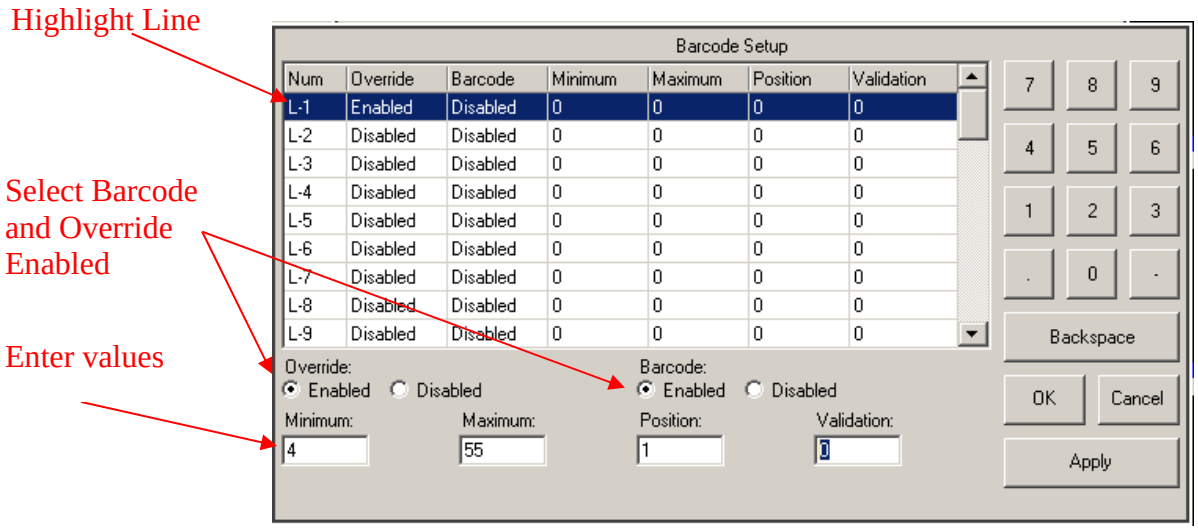
   e. Enter the Product Code for the gas type to be used in this cabinet. The product code is the portion of the code within the barcode string that identifies the product type. It is the piece of information that will be compared to confirm that the correct cylinder has been installed. Press “OK” when complete.



Note: Barcode strings are case sensitive. Be sure to use the proper case when entering letters. The case can be toggled between uppercase and lowercase by pressing the shift key.

f) Select “Barcode Setup” from the System Setup menu.

g) Select/highlight the first line for the left or right side. Lines L1 thru L20 are reserved for the left side process cylinders. Lines R1 thru R20 are reserved for the right side process cylinders.



h) Change the Barcode field to “Enabled”.

i) Change the Override field to “Enabled”.

j) Enter the minimum allowable number of characters in the barcode string.

Note: The minimum number must be at equal to or greater than the number of characters in the Product Code plus the number of the starting position for the product code. Otherwise, the system will produce an error message.

k) Enter the maximum allowable number of characters in the barcode string.

Note: The maximum number cannot exceed 55.

l) Enter the starting position of the product code.

Example: For product code XA10 in the following:

ABC346XA10ZZ123 starting position is 7.

XA10ABC346ZZ123 starting position is 1.

m) Enter the validation code:

   i) "0" – No other restrictions. The only check is to verify that barcode contains the product code.

   ii) "1" – In addition to verifying the product code, this validation method verifies that the Barcode is not the same any previously installed cylinder.

   iii) "2" – In addition to verifying the product code, this validation method verifies that the Barcode is not the same as the most recently installed cylinder on that process side.

   iv) "3" – This selection should not be used. This option causes the system to ignore the barcode command. It is only used in development testing.

n) Enter "Apply" if editing multiple barcode lines and return to step g).

o) Enter "Ok" when complete.

Connecting and Disconnecting USB barcode reader

Before connecting the USB Barcode Reader device, the Technician must be aware of the equipment to ensure no gas safety alarm and flammable atmosphere are present.

1) Plug the USB barcode reader into the system Controller USB port.

2) System is ready for scanning the cylinder barcode label.

3) Always scan the barcode label on the cyclinder before removing and/or opening the cylinder cap or valves.

4) After the barcode is scaned and confirmed, disconect USB Barcode Reader device before resuming the cylinder change sequence.

How to disable the barcode feature:

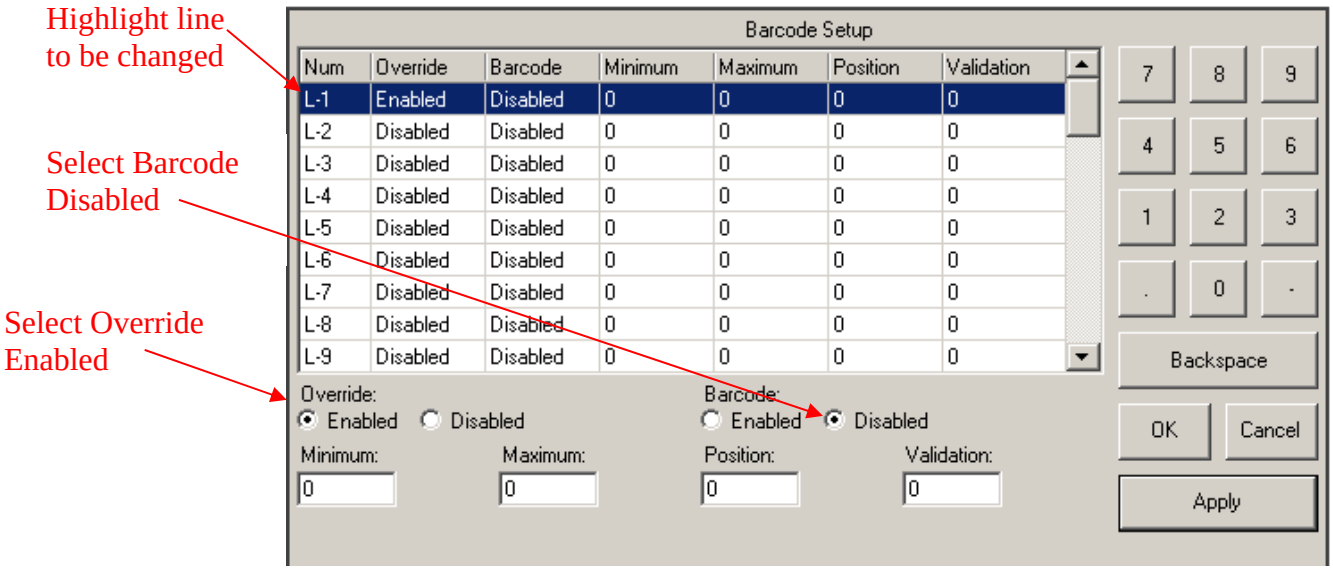
a. Highlight the input line.

b. Select Override: Enabled.

c. Select Barcode: Disabled.

d. Select “Apply” if editing multiply lines and return to step a).

e. Select “OK” when complete



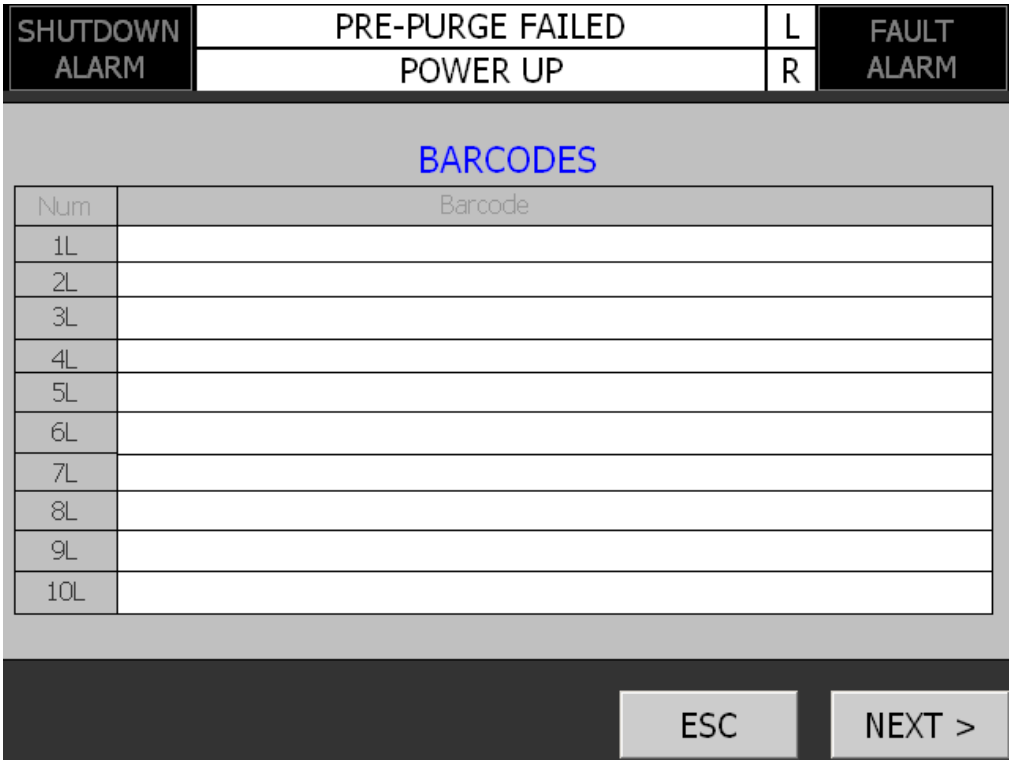
TE10 USB Barcode Feature

Barcode Data Window

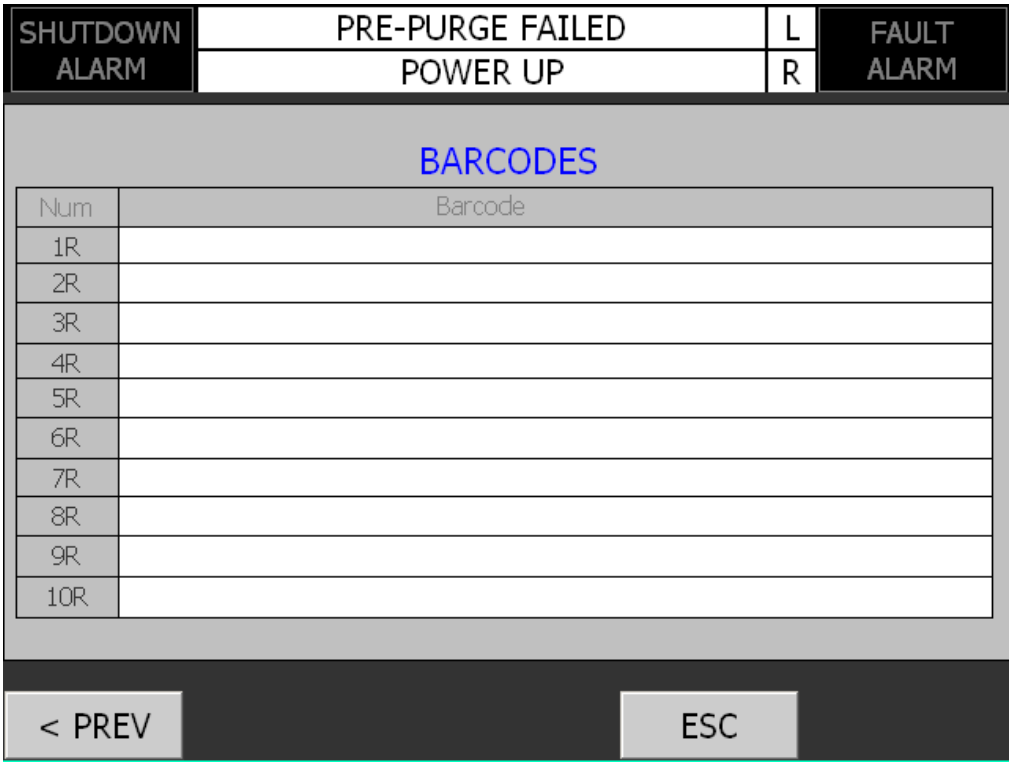
On the controller, a window accessed via the System Setup menu of the Configuration Menu will allow the viewing and modification of the barcode data. This window will show all the barcodes stored in the controller in a 2 column list. The columns will be the Barcode Number, which is a combination of the process line character and the barcode number, and Barcode String. The Barcode Number will be a number from 1 to the maximum number of barcodes for the process line. The process line character will be L or R. This window will allow each barcode to be selected and modified, and contains a full set of keyboard characters accessible via tapping the screen in the blank barcode field. The Up and Down arrow keys will toggle the case of all the alphabetic characters, and allows access to all the different symbols.

Barcodes Screen

Left side



Right side


SHUTDOWN ALARM
PRE-PURGE FAILED
POWER UP
L
R
FAULT ALARM
BARCODES
Num
Barcode
1R
2R
3R
4R
5R
6R
7R
8R
9R
10R
< PREV
ESC

Enabling the Barcode Feature on TE-10 Based Products

How to enable barcode feature:

1) From the Configuration Menu:

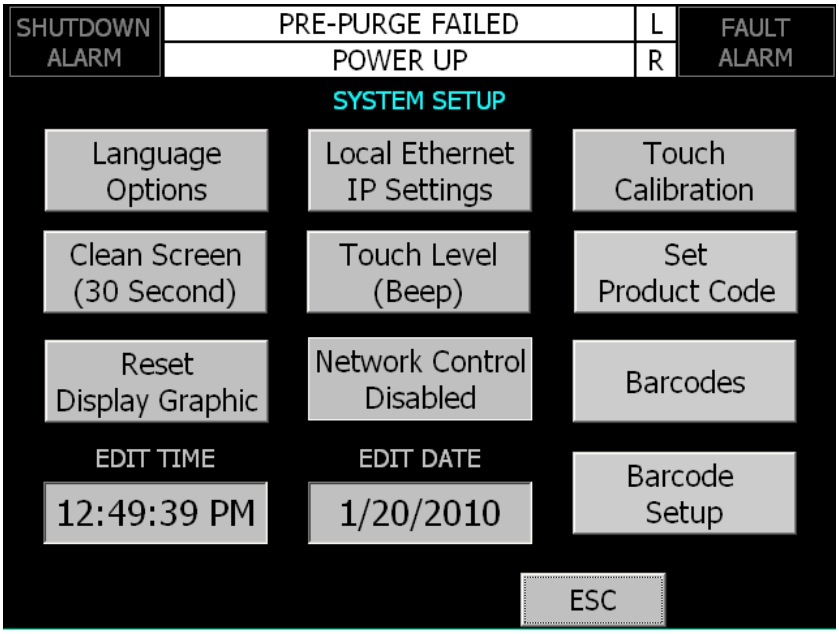
   a. Log-in to controller.

   b. Select “CONFIGURATION/ TEST MENU ”.

   c. Select “System Setup”.

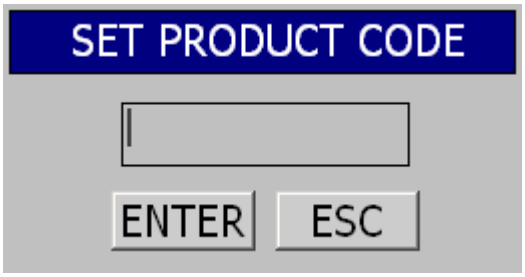
   d. Select “Set Product Code” from the System Setup menu.

System Setup Screen



   e. Enter the Product Code for the gas type to be used in this cabinet. The product code is the portion of the code within the barcode string that identifies the product type. It is the piece of information that will be compared to confirm that the correct cylinder has been installed. Press Enter Key on the keyboard and “ENTER” below the Product Code when complete.

Set Product Code Screen

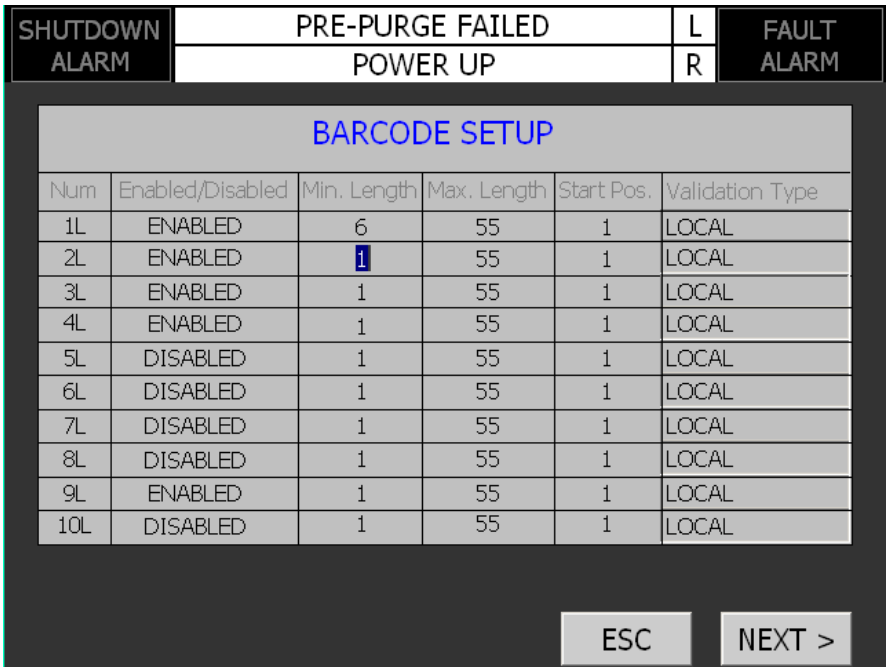


Note: Barcode strings are case sensitive. Be sure to use the proper case when entering letters. The case can be toggled between uppercase and lowercase by pressing the Up arrow and Down arrow keys on the keyboard

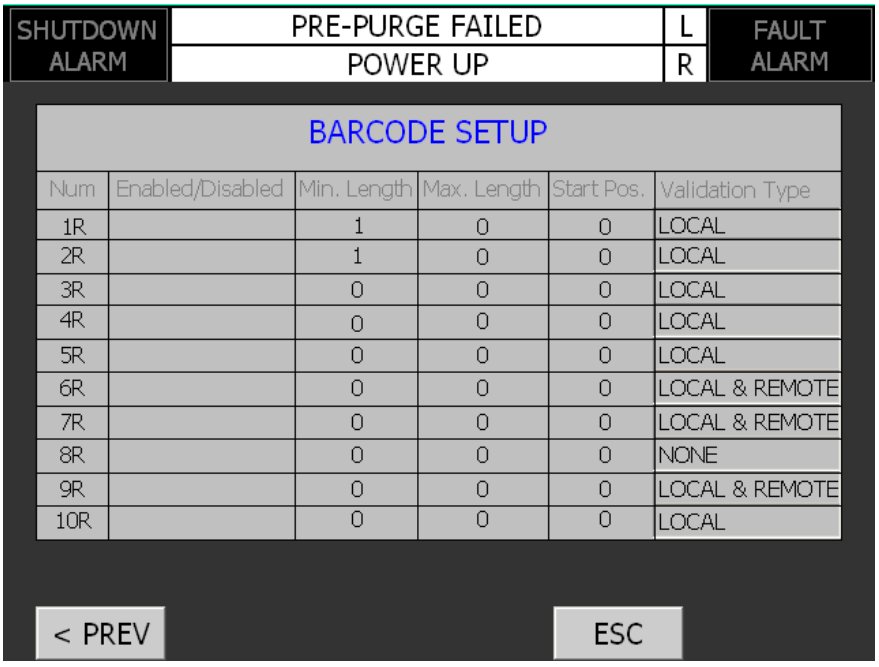
f. Select “Barcode Setup” from the System Setup menu.

g. Lines 1L thru 10L are reserved for the left side process cylinders. Lines 1R thru 10R are reserved for the right side process cylinders.

Barcode Setup screen (Left side)



(Right side)



h. On the first line for the left or right side change the Enabled/Disabled field to “Enabled”.

i. Enter the minimum allowable number of characters in the barcode string.

Note: The minimum number must be at equal to or greater than the number of characters in the Product Code plus the number of the starting position for the product code. Otherwise, the system will produce an error message.

j. Enter the maximum allowable number of characters in the barcode string.

Note: The maximum number cannot exceed 55.

k. Enter the starting position of the product code.

Example: For product code XA10 in the following:

ABC346XA10ZZ123 starting position is 7.

XA10ABC346ZZ123 starting position is 1.

l. Enter the validation type:

i) "LOCAL" – This selection verifies that the barcode scanned contains the product code in the proper position.

ii) "REMOTE" – Reserved for future use.

iii) "LOCAL & REMOTE" – Reserved for future use.

iv) "NONE" – This selection only check is to verify that a barcode has been entered no product code validation is preformed.

m. Enter "ESC" when complete.

Connecting and Disconnecting USB barcode reader

Before connecting the USB Barcode Reader device, the Technician must be aware of the equipment to ensure no gas safety alarm and flammable atmosphere are present.

1) Plug the USB barcode reader into the system Controller USB port.

2) System is ready for scanning the cylinder barcode label.

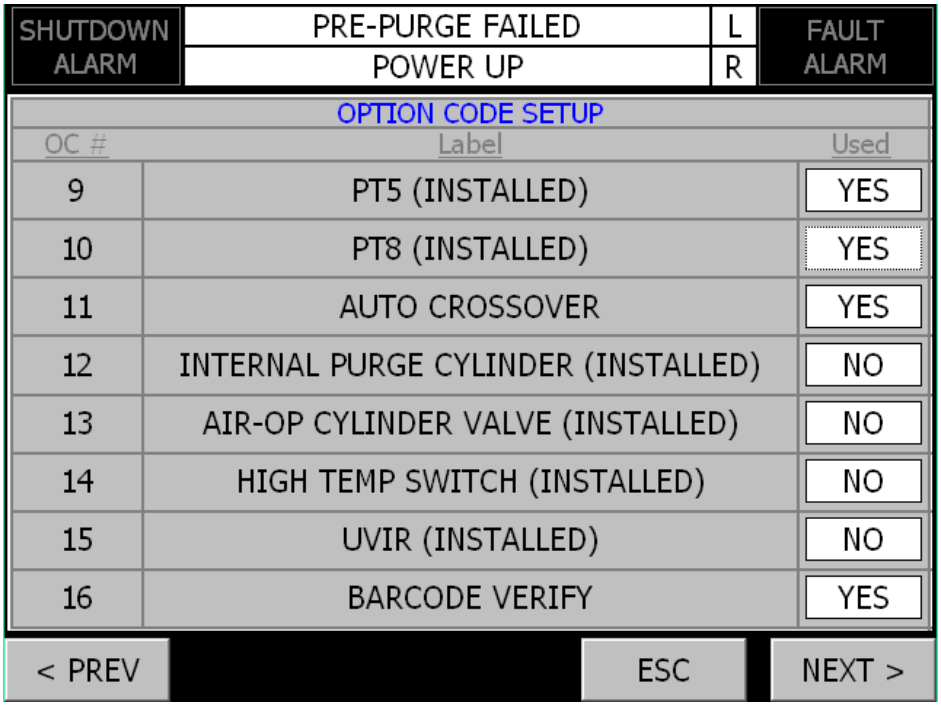
3) Always scan the barcode label on the cyclinder before removing and/or opening the cylinder cap or valves.

4) After the barcode is scaned and confirmed, disconect USB Barcode Reader device before resuming the cylinder change sequence.

Option Code to be enabled for barcode:

To operate the USB Barcode Reader the controller requires setup and the option code must be enabled. Contact Versum Materials, Inc. EES Group Service personnel to assist with enabling.

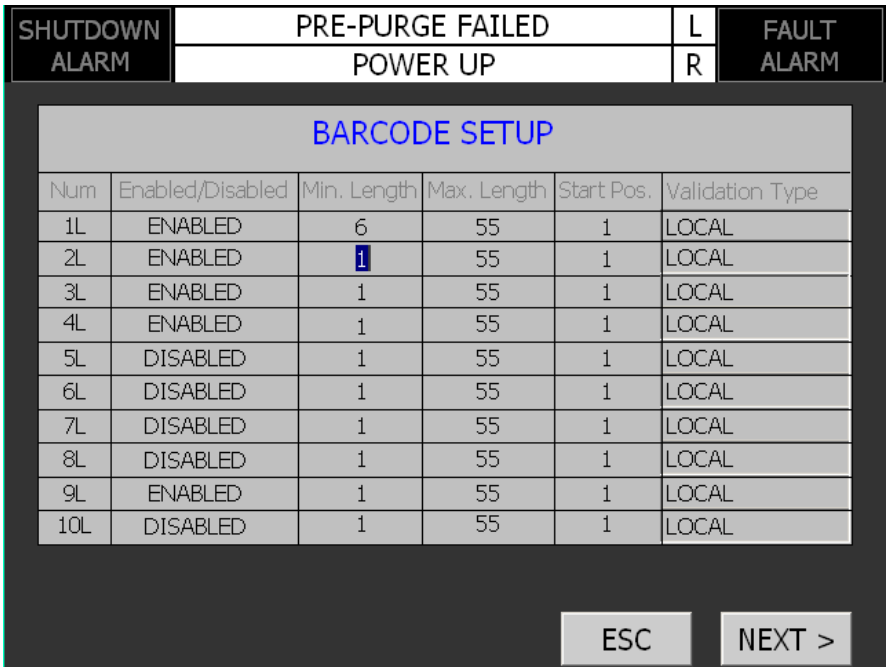
Option Code Setup screen



How to disable the barcode feature:

a. On the line desired to be disabled change the Enabled/Disabled field to "Disabled".

b. Press "ESC" when complete.



Num	Enabled/Disabled	Min. Length	Max. Length	Start Pos.	Validation Type
1L	ENABLED	6	55	1	LOCAL
2L	ENABLED	1	55	1	LOCAL
3L	ENABLED	1	55	1	LOCAL
4L	ENABLED	1	55	1	LOCAL
5L	DISABLED	1	55	1	LOCAL
6L	DISABLED	1	55	1	LOCAL
7L	DISABLED	1	55	1	LOCAL
8L	DISABLED	1	55	1	LOCAL
9L	ENABLED	1	55	1	LOCAL
10L	DISABLED	1	55	1	LOCAL

This page intentionally left blank

Appendix A

Standard Degasser Test Procedures

The procedures described in this appendix are directed to those persons servicing and maintaining the system. In the event of failure, the degasser will detect any liquid spill within its vessel and shut down the ChemGuard. However, the chemical will remain contained and will not present a hazardous condition. Moreover, vapor residue present, if any, will also be contained within the vessel. Replacement is the recommended procedure for servicing.

To service and maintain the vacuum pump, refer to the service manual from the **Manufacturer Vacuum Pump Operating Instructions** (shipped with the vacuum pump). The pump oil has a potential for contamination in the form of chemical residue exposure. Therefore, it should be considered a hazardous material and treated such. Consult the pump manual, site Environmental Health and Safety EH&S (and Versum Materials, Inc. EH&S), local governing agencies and state/local laws (i.e. Clean Water Act, Clean Air Act, Hazardous Waste Laws).

NOTE: Whenever maintenance is performed on the Degasser, the Degasser Vacuum Pump should be turned on for a period of 15 minutes before starting any chemical fill processes.

1. PRESSURE DECAY CHECK OF TEFLON COIL TUBING

1. Provide power to the controller.
2. Ensure all plumbing lines leading to the Degasser Inlet and Outlet valves are leak tight.
3. Ensure Degasser Vacuum Pump is turned off.
4. Ensure the Degasser Outlet valve output port is capped off (closed).
5. Connect a calibrated pressure gauge 0-60 psig to the Degasser Inlet valve port.
6. Apply maximum Helium gas source of 55.0 psig to a calibrated pressure gauge at the Degasser Inlet valve port.
7. Ensure pneumatic pressure is provided to the controller to operate the Degasser Inlet and Outlet valve actuators.
8. Allow the Teflon tubing inside the Degasser to be pressurized for 15 minutes at 55.0 psig.
9. Close the Helium gas source and monitor the calibrated pressure gauge for any pressure drop.
10. If the pressure starts to drop immediately (greater than 0.25 psi/min) during the first five (5) minutes then there is a problem, which must be addressed prior to proceeding. Refer to Work Instruction 1306-0449 to isolate problem.

NOTE: If there is leakage, the problem is most likely at: 1) Swagelok connections, 2) VCR connections, or 3) Leak across the valve seats (By-pass, Inlet, and Outlet valves).

11. After five (5) minutes, record the pressure reading at the calibrated pressure gauge and start time.
12. Allow the test to continue for a minimum of thirty (30) minutes. After thirty (30) minutes record the pressure reading at the calibrated pressure gauge and end time.
13. Calculate the difference of the Ending Time from the starting time and write it in the Elapsed Time.
14. Calculate the difference of the Ending Pressure from the Starting Pressure and write it in the Pressure Change.
15. Compare the Pressure Change with Elapsed Time against the diagram on the Degasser Test Procedure for pass/fail criteria.

Elapsed Time (Min.)	Pressure Change (psig)	Delta, Pressure Change Less Than	Delta, Pressure Change Greater Than
0	0	Pass	Fail
15	0.5	Pass	Fail
30	0.83	Pass	Fail
45	1.35	Pass	Fail
60	1.75	Pass	Fail

16. If the test is passed, continue the steps below. Otherwise, refer to Work Instruction 1306-0449 to isolate problem.
17. If proceeding to Pressure Decay Check of Bypass Tubing, skip the sub-steps below.
    a) Remove the Calibrated Pressure Gauge and Helium source hook-up from Degasser Inlet valve port.
    b) Replace new VCR gasket and reconnect the plumbing line to the Degasser Inlet valve port.

2. PRESSURE DECAY CHECK OF BYPASS TUBING

1. Provide power to the controller.
2. Ensure all plumbing lines leading to the Degasser Inlet and Outlet valves are leak tight.
3. Ensure Degasser Vacuum Pump is turned off.
4. Ensure the Degasser Outlet valve outlet port is capped off (closed).

5. Connect a calibrated pressure gauge 0-60 psig to the Degasser Inlet valve port.
6. Apply maximum Helium gas source of 55.0 psig to a calibrated pressure gauge at the Degasser Inlet valve port.
7. Ensure pneumatic pressure is provided to the controller to operate the Degasser Inlet and Outlet valve actuators.
8. Remove the banner sensor fiber optic cables from the controller to simulate a spill condition, thereby opening the Degasser Bypass valves and closing the Degasser Inlet and Outlet Valves (variable 68 must be set to 0 for the bypass to be operational).
9. If Degasser Assembly is equipped with Ultrasonic Spill Sensors, disconnect the DB15 cable from the Ultrasonic module to simulate a spill condition, thereby opening the Degasser Bypass valves and closing the Degasser Inlet and Outlet Valves (variable 68 must be set to 0 for the bypass to be operational).
10. Allow the bypass tubing on the Degasser to be pressurized for 15 minutes at 55.0 psig.
11. Close the Helium gas source and monitor the calibrated pressure gauge for any pressure drop.
12. If the pressure starts to drop immediately (greater than 0.25 psi/min) during the first five (5) minutes there is a problem which must be addressed prior to proceeding. Refer to Work Instruction 1306-0449 to isolate problem.

NOTE: If there is leakage, the problem is most likely at: 1) VCR connections or 2) Leak across the valve seats.

13. After five (5) minutes, record the pressure reading at the calibrated pressure gauge and start time.
14. Allow the test to continue for a minimum of thirty (30) minutes. After thirty (30) minutes record the pressure reading at the calibrated pressure gauge and end time.
15. Calculate the difference of the Ending Time from the starting time and write it in the Elapsed Time.
16. Calculate the difference of the Ending Pressure from the Starting Pressure and write it in the Pressure Change.
17. Compare the Pressure Change with Elapsed Time against the diagram on the Degasser Test Procedure for pass/fail criteria.
18. If the test is passed, continue the steps below. Otherwise, refer to Work Instruction 1306-0449 to isolate problem.
19. Remove the Calibrated Pressure Gauge and Helium source from Degasser Inlet valve port.
20. Reinstall the banner sensor fiber optic cables in the controller, thereby closing the Degasser Bypass valves and opening the Degasser Inlet and Outlet valves.

21. If Degasser Assembly is equipped with Ultrasonic Spill Sensors, reconnect the DB15 cable to the Ultrasonic module, thereby closing the Degasser Bypass valves and opening the Degasser Inlet and Outlet valves.

22. Replace new VCR gasket and reconnect the plumbing line to the Degasser Inlet valve port.

3. VACUUM LEAK CHECK OF BYPASS TUBING

1. Provide power to the controller.

2. Ensure all plumbing lines leading to the Degasser Inlet and Outlet valves are leak tight.

3. Ensure Degasser Vacuum Pump is turned off.

4. Ensure the Degasser Outlet valve outlet port is capped off (closed).

5. Connect a calibrated vacuum gauge to the Degasser Inlet valve port.

6. Apply vacuum source to the calibrated vacuum gauge at the Degasser Inlet valve port.

7. Ensure pneumatic pressure is provided to the controller to operate the Degasser Inlet and Outlet valve actuators.

8. Remove the banner sensor fiber optic cables from the controller to simulate a spill condition, thereby opening the Degasser Bypass valves and closing the Degasser Inlet and Outlet Valves (variable 68 must be set to 0 for the bypass to be operational).

9. If Degasser Assembly is equipped with Ultrasonic Spill Sensors, disconnect the DB15 cable from the Ultrasonic module to simulate a spill condition, thereby opening the Degasser Bypass valves and closing the Degasser Inlet and Outlet Valves (variable 68 must be set to 0 for the bypass to be operational).

10. Close the vacuum source and monitor the calibrated vacuum gauge pressure for any pressure rise.

11. If the pressure starts to rise immediately (greater than 5 mTorr/min) during the first five (5) minutes there is a problem which must be addressed prior to proceeding. Refer to Work Instruction 1306-0449 to isolate problem.

NOTE: If there is leakage, the problem is most likely at: 1) VCR connections or 2) Leak across the valve seats.

12. After five (5) minutes, record the pressure reading at the calibrated vacuum gauge and start time.

13. Allow the test to continue for a minimum of thirty (30) minutes. After thirty (30) minutes record the pressure reading at the calibrated pressure gauge and end time.

14. Calculate the difference of the Ending Time from the starting time and write it in the Elapsed Time.

15. Calculate the difference of the Ending Pressure from the Starting Pressure and write it in the Pressure Change.

16. The Pressure Change should not be greater than 5 mTorr/min.
17. If the test is passed, continue the steps below. Otherwise, refer to Work Instruction 1306-0449 to isolate problem.
18. Reinstall the banner sensor fiber optic cables in the controller, thereby closing the Degasser Bypass valves and opening the Degasser Inlet and Outlet valves.
19. If Degasser Assembly is equipped with Ultrasonic Spill Sensors, reconnect the DB15 cable to the Ultrasonic module, thereby closing the Degasser Bypass valves and opening the Degasser Inlet and Outlet valves.
20. Remove the Calibrated Vacuum Gauge and Vacuum source from Degasser Inlet valve port.
21. Replace new VCR gasket and reconnect the plumbing line to the Degasser Inlet valve port.

4. DEGASSER SPILL DETECT SENSOR TEST

1. Provide power to the controller.
2. Ensure all plumbing lines leading to the Degasser Inlet and Outlet valves are leak tight.
3. Ensure Degasser Vacuum Pump is turned off.
4. Ensure the Degasser Inlet and Outlet valve ports are capped off (closed).
5. If Degasser assembly is equipped with Ultrasonic Spill Sensors, perform sub-steps below to trigger a spill condition. Otherwise, proceed to step 6 for the banner sensor (Optical Spill Sensor).
   a) Remove each of the three (3) Ultrasonic Spill Sensors from stainless steel tubing, one at a time, to trigger a Fault alarm (Degasser Leak 1, Degasser Leak 2, Degasser Leak 3). Replace each spill sensor before testing the next.
   b) Remove each combination of two (2) Ultrasonic Spill Sensors to trigger a shutdown alarm (Dual Spill Detect). Verify the Degasser Inlet and Outlet valves are deactivated (closed) and the Degasser Bypass valves are activated (open) (variable 68 must be set to 0 for the bypass to be operational).
   c) Replace the Ultrasonic Spill Sensors and acknowledge the Shutdown alarm. Verify the Degasser Inlet and Outlet valves are activated (open) and the Degasser Bypass valves are deactivated (closed) (variable 68 must be set to 0 for the bypass to be operational).
6. If Degasser Assembly is equipped with Optical Spill Sensor, perform sub-steps below to trigger a spill condition.
   a) Remove the Optical Spill Sensor from the Degasser Housing (be careful not to break the sensor quartz tip when removing from the VCR fitting).

b) Ensure the quartz tip sensor has a visible red light indicating the fiber optic sensor is ON.

c) Remove the protective cover on the mini-beam device inside the controller. Ensure the DO/LO pot is rotated fully clockwise until it rest against the LO side of the mechanical stop.

d) Rotate the gain pot counter-clockwise (-) until the status LED turns off.

e) Then rotate the same pot clockwise (+) slowly until the status LED turns on.

f) Carefully dip the quartz tip sensor into a liquid (e.g. alcohol or water). This will turn off the status LED.

g) Rotate the gain pot clockwise, counting the revolutions, until the gain pot turns back on.

h) Turn the gain pot half as many turns back in the counter-clockwise direction.

i) Test the operation of the sensor several times by dipping the quartz sensor in the test liquid.

NOTE: The status LED should be illuminated when the sensor is dry and out when wet. This can be seen on digital input 32. The input is closed when the sensor is dry and opens when we.

NOTE: Verify the Degasser Inlet and Outlet valves are deactivated (closed) and the Degasser Bypass valves are activated (open). If the Degasser Inlet and Outlet valves are not closing and Bypass valves are not opening.

NOTE: On average, the gain should be set so the fiber optic sensor's LED blinks 3-4 times a second. Ensure the sensor's "LO/DO" screw is turned completely clockwise for "LIGHT OFF (L.O.)" detection.

j) Dry off spill sensor and verify the Degasser Inlet and Outlet valves are activated (open) and the Degasser Bypass valves are deactivated (closed).

NOTE: When this alarm is triggered V8 will turn off and the degasser bypass loop will activate. The system will display a fault alarm "degasser leak". ***Pull the pneumatics on the degasser inlet/outlet and verify pressure at the inlet and outlet valves when the sensor is dry. When the quartz sensor is wet the inlet/outlet valves should turn off and the bypass valves should open (verify pressure).***

k) Return all protective cover, ***pneumatics***, and sensors to their original location.

l) Replace new VCR gasket and reinstall Optical Spill Sensor.

5. PRESSURE DECAY CHECK OF DEGASSER CHAMBER HOUSING

1. Provide power to the controller.
2. Ensure all plumbing lines leading to the Degasser Inlet and Outlet valves are leak tight.

3. Ensure Degasser Vacuum Pump is turned off.
4. Ensure the Degasser Outlet valve outlet port is capped off (closed).
5. Disconnect the Degasser Vacuum plumbing line at the Degasser Inlet valve port.
6. Connect a calibrated pressure gauge 0-60 psig to the Degasser Inlet valve port.
7. Apply maximum Helium gas source of 55.0 psig to a calibrated pressure gauge at the Degasser Inlet valve port.
8. Ensure pneumatic pressure is provided to the controller to operate the Degasser Inlet and Outlet valve actuators.
9. Allow the Degasser Chamber Housing to be pressurized for 15 minutes at 55.0 psig.
10. Close the Helium gas source and monitor the calibrated pressure gauge for any pressure drop.
11. If the pressure starts to drop immediately (greater than 0.25 psi/min) during the first five (5) minutes there is a problem which must be addressed prior to proceeding. Refer to Work Instruction 1306-0449 to isolate problem.

NOTE: If there is leakage, the problem is most likely at: 1) NW40 Flange and O-Ring or 2) VCR connection V8 valve or 3) VCR connection at Spill sensor.

12. After five (5) minutes, record the pressure reading at the calibrated pressure gauge and start time.
13. Allow the test to continue for a minimum of thirty (30) minutes. After thirty (30) minutes record the pressure reading at the calibrated pressure gauge and end time.
14. Calculate the difference of the Ending Time from the starting time and write it in the Elapsed Time.
15. Calculate the difference of the Ending Pressure from the Starting Pressure and write it in the Pressure Change.
16. Compare the Pressure Change with Elapsed Time against the diagram on the Degasser Test Procedure for pass/fail criteria.
17. If the test is passed, continue the steps below. Otherwise, refer to Work Instruction 1306-0449 to isolate problem.
18. Remove the Calibrated Pressure Gauge and Helium source from Degasser Inlet valve port.
19. Replace new VCR gasket and reconnect the plumbing line to the Degasser Inlet valve port.
20. Reconnect the plumbing line at the Degasser Inlet valve port.

6. CHECK PUMP OIL LEVEL AND MAINTENANCE

Please refer to the OEM vacuum pump operation manual for proper oil level and maintenance schedule.

This page intentionally left blank.

Appendix B

Network Setup ChemGuard

NETWORK SETUP –CHEMGUARD®

Device Type = ‘z’

Analog Inputs - Left

Net #	*Analog #*	*Device Label*		
		CG100-CG400	**CG050**	**CG010**
1	*	Bulk Push Pressure	Bulk Push Pressure	Bulk Push Pressure
2	*	Bulk Scale	Bulk Scale	Bulk Scale
3	*	Vacuum	Vacuum	Vacuum
4		No Mapping	No Mapping	No Mapping
5		No Mapping	No Mapping	No Mapping
6		No Mapping	No Mapping	No Mapping
7		No Mapping	No Mapping	No Mapping
8		No Mapping	No Mapping	No Mapping
9		No Mapping	No Mapping	No Mapping
10		No Mapping	No Mapping	No Mapping
11		No Mapping	No Mapping	No Mapping
12		No Mapping	No Mapping	No Mapping
13		No Mapping	No Mapping	No Mapping
14		No Mapping	No Mapping	No Mapping
15		No Mapping	No Mapping	No Mapping

16		No Mapping	No Mapping	No Mapping

Analog Inputs - Right

Net #	*Analog #*	*Device Label*		
		CG100-CG400	**CG050**	**CG010**
1	*	Process Push Pressure	No Mapping	No Mapping
2	*	Process Scale	No Mapping	No Mapping
3	*	Vacuum	No Mapping	No Mapping
4		No Mapping	No Mapping	No Mapping
5		No Mapping	No Mapping	No Mapping
6		No Mapping	No Mapping	No Mapping
7		No Mapping	No Mapping	No Mapping
8		No Mapping	No Mapping	No Mapping
9		No Mapping	No Mapping	No Mapping
10		No Mapping	No Mapping	No Mapping
11		No Mapping	No Mapping	No Mapping
12		No Mapping	No Mapping	No Mapping
13		No Mapping	No Mapping	No Mapping
14		No Mapping	No Mapping	No Mapping
15		No Mapping	No Mapping	No Mapping
16		No Mapping	No Mapping	No Mapping

* Analog # can vary dependent on system type.

Valves - Left

Net #	*Valve #*	*Proc Line*	*Device Label*		
			CG100-CG400	**CG050**	**CG010**
1	1	1	V1A	V1A	V1A
2	2	1	V2A	V2A	V2A
3	3	1	V3A	V3A	V3A
4	4	1	V4A	V4A	V4A
5	5	1	V5A	V5A	V5A
6	6	1	V6A	V6A	V6A

7	7	1	V7	V7	V7
8	8	2	V8A	V8A	V8A
9	9	1	V9A	V9A	V9A
10	10	1	V10A	V10A	V10A
11			No Mapping	V11	No Mapping
12			No Mapping	No Mapping	No Mapping
13			No Mapping	No Mapping	No Mapping
14			No Mapping	No Mapping	No Mapping
15			No Mapping	No Mapping	No Mapping
16			No Mapping	No Mapping	No Mapping
17			Not Available (VMB only)	No Mapping	No Mapping

Valves - Right

Net #	*Valve #*	*Proc Line*	*Device Label*		
			CG100-CG400	**CG050**	**CG010**
1	1	3	V1B	No Mapping	No Mapping
2	2	3	V8	No Mapping	V8
3	3	3	V3B	No Mapping	No Mapping
4	4	3	V4B	No Mapping	No Mapping
5	5	3	V5B	No Mapping	No Mapping
6	6	3	V6B	No Mapping	No Mapping
7	7	3	V7	No Mapping	No Mapping
8			No Mapping	No Mapping	No Mapping
9	9	3	V9B	No Mapping	No Mapping
10	10	3	V10B	No Mapping	No Mapping
11	11	3	V11	No Mapping	V11
12	12	3	V12	No Mapping	V12
13	13	3	V13	No Mapping	V13
14	14	3	V14	No Mapping	V14
15			No Mapping	No Mapping	No Mapping
16			No Mapping	No Mapping	No Mapping
17			Not Available (VMB only)	No Mapping	No Mapping

Modes

Local Mode	*Network Mode Number*	*Mode Type*		
		CG100-CG400	**CG050**	**CG010**
Idle	00	---		
Local Single Action	08	---		
Network Single Action	09	---		
Bulk to Process	60	Process	No Mapping	No Mapping
Process Fill	61	Process	Bulk	Bulk
Change Bulk	62	Purge	Purge	Purge
Change Process	63	Purge	No Mapping	No Mapping
Line Clear	64	Purge	Purge	Purge
Reservoir Vent	65	Purge	No Mapping	No Mapping
Cycle Purge	66	Purge	No Mapping	No Mapping
Line Purge	67	Purge	Purge	No Mapping
Backfill	68	Purge	No Mapping	No Mapping
External Fill	69	Process	No Mapping	No Mapping
Trickle Purge	70	Purge	No Mapping	No Mapping
Leak Check	71	Purge	No Mapping	No Mapping
Equalize	72	Purge	No Mapping	No Mapping

DEVICE MODIFICATION SUBFIELD

Controller Type **[**15 14 13 12 – 11 10 9 8 – 7 6 5 4 – 3 2 1 0]

Controller Type - 0	=	Not Used
Controller Type - 1	=	AP1
Controller Type - 2	=	AP2
Controller Type - 3	=	AP3
Controller Type - 4	=	AP10
Controller Type - 5	=	Not Used
Controller Type - 6	=	Not Used
Controller Type - 7	=	Not Used

Graphic Type **[**15 14 13 12 – 11 10 9 8 – 7 6 5 4 – 3 2 1 0]

Graphic Type - 0	=	Standard
Graphic Type - 1	=	Not Used
Graphic Type - 2	=	Not Used
Graphic Type - 3	=	Not Used
Graphic Type - 4	=	Not Used
Graphic Type - 5	=	Not Used
Graphic Type - 6	=	Not Used
Graphic Type - 7	=	Not Used

Special Options **[**15 14 13 12 – 11 10 9 8 – 7 6 5 4 – 3 2 1 0]

Special Option #1	=	Vent/Purge
Special Option #2	=	N2 Purge
Special Option #3	=	Not Used
Special Option #4	=	Not Used
Special Option #5	=	Not Used
Special Option #6	=	Not Used
Special Option #7	=	Not Used
Special Option #8	=	Not Used
Special Option #9	=	Not Used
Special Option #10	=	Opp VERSUM MATERIALS, INC. Valve Color

This page intentionally left blank

Appendix C
Spare Parts Lists

Consult your Local sales representative for ChemGuard Gen II spares list details.

NOTE: When ordering spare parts, the part number is:
Cabinet Commodity Code / Serial No. / Description
Where;
Cabinet Commodity Code = 801-470xxxx
Serial No. = Axxxx-xxxx or 200xxxxxx-x
Description = Description of Spool Piece from chart
Example:
831-4701234 / 2000123456-1 / Process header (1x) 1495-3159-1A

COMMON: ChemGuard® CG100-CG325 Gen II

Spools Assemblies

Description
Process header (1X) - 1495-3159-1A (V11)
Process header (2X) - 1495-3155-1A (V11, V12)
Process header (4X) - 1495-3151-1A (V11, V12, V13, V14)
Process header (2XN2) - 211928 (V11, V12)
Process header (4XN2) - 1495-3165-1A (V11, V12, V13, V14)
Bulk pigtail in (Standard pigtail) - 1495-3103A
Bulk pigtail out (All CGs) - 1495-3104A
Input spool from V3B to process header – 211923

Note: Exclude CG200.

Components

Mechanical Components

Description
1/4" VCR locking device - 7134-2246

ADA Coupling - twin female - 7242-0012
ADA Coupling - insert male - 7242-0013
Cover Display Cable – 130668
Check Valve, Vent (1 psig) - 839-607321
Pressure transducer - 5500-1876 (Obsolete)
Pressure transducer - 407631
Pressure transducer (alternate) – 180165 (Obsolete)
Pressure relief valve - 839-607320
Exhaust vane switch - 1491-3144
Nylon 4MM OD tubing (1ea = 1 meter) - 7401-2518
Ultra sonic level detection - 5500-1878
Valve repair kit (tool) - 4120-0086
*Regulator - 839-609631A
*Regulator (alternate) – 223201

***Note:** Regulator is excluded CG200 and CG250.

Controllers

Description
*Systems with degasser option - 179706
Systems without degasser option – 179707

*Note: A 8-amp circuit Breaker is required where degasser vacuum pump is supplied with Degasser option install inside the ChemGuard cabinet,

Electrical Components

Description
VIPER CPU board – 174391
Analog board - 122254
Analog filter board – 134991
Digital I/O board – 129826
I/O relay board – 122238
Fuse 500mA sub-miniature – 41662
Power supply - 24 Vdc - 195764
Instrument air gauge/switch - 287-606454
Surge protection kit with base and plug - 809-607198
Mallory sonalert horn - 287-606452
Degasser interface board – 146126

Tool Interface board (AP1555) – 162624
ChemGuard Interface board (AP1552) – 172106
Main System I/O board (AP1551) – 146127
Display to Controller Cable – 126624
Display to Cover Ribbon Cable – 131042
Touchscreen Display Assy – 141184
Solenoid pneumatic harness (left) – 143828
Solenoid pneumatic harness (right) – 143829
Cabinet; Cable Assembly Res-A (w/Dual Float) – 155451
Sump Spill (Dual Float) Assy. – 153475
Cabinet; Cable Assembly Res-B – 155452

Options

Standard Degasser with Pump (optional)

Description
*Pfeiffer pump replacement – 424538
*Pfeiffer pump retrofit kit (Alcatel replacement) – 427452
Standard Degasser assembly with Pfeiffer pump - 839-607518 (obsolete)
Kit, Degasser assembly with Pfeiffer pump - 158815
Fiber optic cable with Quartz rod - 839-607379
Vacuum switch (75 torr) - 839-607347
Quartz rod - 5300-1309
8A (Amperes) Circuit Breaker – 406485 Note: An 8-amp circuit Breaker is required where degasser vacuum pump is supplied with Degasser option install inside the ChemGuard cabinet.

Note: Exclude CG200.

*Note: An 8-amp circuit Breaker is required where degasser vacuum pump is supplied with Degasser option install inside the ChemGuard cabinet.

Standard Degasser without Vacuum Pump (optional)

Description
Standard Degasser assembly - 839-607436 (obsolete)
Kit, Degasser assembly No Pump - 183239
Degasser assembly w/ Valves & Bypass pipe - 238268

Degasser Valve Bracket - 450230
Degasser Bypass Valve OP/3 - 450328 (require above bracket)
Duplex outlet, GFCI, 120V - 2151-0001
Fiber optic cable with Quartz rod - 839-607379
Vacuum switch (75 torr) - 839-607347
Quartz rod - 5300-1309

Note: Exclude CG200.

High Flow Degasser (optional)

Description
*Pfeiffer pump replacement – 424538
*Pfeiffer pump retrofit kit (Alcatel replacement) – 427452
High Flow Degasser with Inlet/Outlet spools and spill detect - 219471
High Flow Degasser – 219472
Degasser ultrasonic spill detect - 5500-1878
Vacuum switch (75 torr) - 839-607347

CG Lite (optional)

Description
CG Lite kit - 839-607904

CG Fire (optional)

Description
Actuator (resettable) - 839-607923
Sensor, Rate-of-Rise - 839-607381
CGFire Controller assembly – 163792
CO2 bottle - 839-608189
Fire Suppression System complete kit assembly – 163793

CG Scale

Description
300# Scale – 421900 (obsolete)
Bulk Scale Adapter Plate (SS) – 403584
300# Process Scale Retrofit kit – 453438
300# Bulk Scale Retrofit kit – 453437
Hardware Retrofit kit – 427425

CG Vapor (optional)

Description
Sensor assembly with cable - 839-607380

Process Container

Description
4 Liter – 19137
11 Liter – 19096
19 Liter – 19124
Note: Exclude CG200 and CG325.

Common and ChemGuard® CG100 Gen II

Spools Assemblies

Description
Bulk pigtail in -1/2" MVCR (Boron) - 1495-3154A
Bulk pigtail in -1/2" FVCR (Phos) - 1495-3153A
Main panel - 1491-3113-1A
Input spool from V3B to Degasser - 1495-3105A
Degasser bypass spool – 45805

Components

Mechanical Components

Description
Vacuum thermocouple gauge - 5500-2500
Valve repair kit, (AP3550 - V1, V2, V3A, V4, V8) - 889-605104
Valve repair kit (AP4550 - V3B, V5, V6, V7) – 124157

Common and ChemGuard® CG200 Gen II

Spools Assemblies

Description
Process header (1X) - 1491-3138-1A (V11)
Process header (2X) - 215807 (V11, V12)
Process header (4X) - 215808 (V11, V12, V13, V14)
Process header (1XN2) - 210259 (V11)
Process header (2XN2) - 215806 (V11, V12)
Process header (4XN2) - 43789 (V11, V12, V13, V14)
Process header (4XN2I) - 210260 (V11, V12, V13, V14)
Bulk pigtail in - 1495-3103A
Bulk pigtail out - 1495-3104A
Main panel - 1491-3113-3A
Input spool from V3B to process header – 211923

Components

Mechanical Components

Description
Regulator (alternate) – 177120
Vacuum thermocouple gauge - 5500-2500
Valve repair kit, (AP3550 - V1, V2, V3A, V4, V8) – 123076
Valve repair kit (AP4550 - V3B, V5, V6, V7) – 124158

Process Container

Description
4 Liter –
11 Liter – 19094
19 Liter – 19119

Common and ChemGuard® CG250 Gen II

Spools Assemblies

Description
Main panel -
Input spool from V3B to process header –
N2 Trickle Vent Purge Plumbing -

Components

Mechanical Components

Description
Regulator - 223203
Capacitance manometer gauge - 5500-1879
Valve repair kit, (AP3550 - V1, V2, V3A, V4, V8) -
Valve repair kit (AP4550 - V3B, V5, V6, V7) -

Common and ChemGuard® CG300 Gen II

Spools Assemblies

Description
Main panel - 1491-3113-2A
Input spool from V3B to process header – 211923
N2 Trickle Vent Purge Plumbing - 1495-3156

Components

Mechanical Components

Description
Capacitance manometer gauge - 5500-1879 (obsolete model 626A)
Capacitance manometer gauge - 417626
Valve repair kit, (AP3550 - V1, V2, V3A, V4, V8) - 889-605104
Valve repair kit (AP4550 - V3B, V5, V6, V7) - 124157

Common and ChemGuard® CG325 Gen II

Spools Assemblies

Description
Main panel - 1491-3113-2A
Input spool from V3B to process header - 211923
N2 Trickle Vent Purge Plumbing - 1495-3156

Components

Mechanical Components

Description
Capacitance manometer gauge - 5500-1879 (obsolete model 626A)
Capacitance manometer gauge - 417626
Valve repair kit, (AP3550 - V1, V2, V3A, V4, V8) - 889-605104
Valve repair kit (AP4550 - V3B, V5, V6, V7) - 124157
CABLE, U-SONIC AND PROCESS OVERFULL - 839-607942

Process Container

Description
11 Liter with Overfull Detect - 165349

Common and ChemGuard® CG400NT Gen II

Spools Assemblies

Description
Main panel - 1491-3113-2A
Input spool from V3B to process header - 211923
N2 Trickle Vent Purge Plumbing - 1495-3156

Components

Mechanical Components

Description
Capacitance manometer gauge - 417626
Valve repair kit, (AP3550 - V1, V2, V3A, V4, V8) - 889-605104
Valve repair kit (AP4550 - V3B, V5, V6, V7) - 124157
CABLE, U-SONIC AND PROCESS OVERFULL - 839-607942

Process Container

Description
11 Liter with Overfull Detect - 165349

UVIR Sensor assembly

Description
UVIR Sensor assembly - 447024

This Page Intentionally Left Blank

Appendix D

Facilities Preparation Checklist

Checklist:

The following is the Facilities Preparation Checklist and sign-off for the ChemGuard. This checklist is to be used to identify the requirements for installation. Preparation of all required facilities must be completed prior to the start of installation.

Included a sign-off list, which should be completed, and a copy faxed to Versum Materials, Inc. before scheduling the installation and start up of your system.

Refer to Chapter 2 and 3 for the ChemGuard facilities requirements connections, locations, dimensions, and fitting types.

CHEMGUARD SERIAL NUMBERS (found on the inside of the ChemGuard lower door)

_____

_____

_____

_____

_____

_____

_____

_____

Verify the following for facilities are hookup:

Refer to Chapter 2 for more details.

- Environmental
- Electrical
- Supply Gases
- Vacuum source
- Venturi source
- Exhaust
- Vent
- Chemical Delivery Lines
- Coaxial Lines (optional)
- Refill option

Please complete the check list below	Signature required
AC power connected and verified	_____
Supply Gas connected and verified	_____
Pneumatic Gas connected and verified	_____
Vacuum connected and verified	_____
Exhaust and Vent connected and verified	_____
Chemical delivery lines connected and verified	_____

Comments

_____

_____

Customer _____

Checklist Completed By _____

Position _____

Completion Date _____

Installation Start Date _____

When complete, please FAX checklist to VERSUM MATERIALS, INC. EES Group Technical Support Center to schedule installation start date. Retain the original for your records.

Complete and Fax To:

Versum Materials, Inc. EES Group Technical Support Line.

610-706-5082

or

Call:

EES equipment in North America	866-624-7677
EES equipment in Asia and Europe	866-257-6158
	610-706-7377

NOTE: Checklist must be received three weeks prior to scheduling installation start date.

This page intentionally left blank

Appendix E

Versum Materials, Inc. GasGuard OPC Server

Versum Materials, Inc.

GasGuard OPC Server
Version 1.24

Operator's Manual

Introduction

This document provides an overview of the GasguardOPC application. The GasguardOPC Server software provides a link between a GasGuard Controller and any other external OPC Client. OPC Client software is available for many applications, including popular HMI packages. This allows a convenient and rapid interface between GasGuard controllers and any OPC compliant application.

Overview

The GasguardOPC Server software acts as an interface between the GasGuard controller hardware and an external OPC client. To interface from the controller to the client, a configuration must be created. This configuration is created using the GasguardOPC configuration tool. This configuration maps the data items from one system to the other. This is accomplished through the exchange of data with entities known as tags or OPC items. The OPC items can be grouped together logically. The GasguardOPC Server supports bi-directional data flow. The GasGuard OPC Server is fully compliant with Versions 2.0 and 1.0 of the OPC specification.

Functional Description

The GasguardOPC programs runs under the Windows NT/Windows 2000 operating system(s). Two executable files (tasks) are provided for “configure” and “runtime”. In the configuration task, a user can change settings and create OPC GasGuard Devices. The runtime task uses the currently loaded configuration to communicate with the external GasGuard equipment. GasguardOPC supports the following:

□□GasguardOPC Server configuration dialog allows user to define the external GasGuard equipment by the creation of ports and channel addresses. This port and channel addressing scheme automatically creates the configuration necessary to communicate with the Downstream GasGuard equipment, and creates all available data points in each controller.

□□□The GasguardOPC Server allows the user to create virtual controllers for segmenting or grouping ports. Virtual controllers are also used to allow segmentation of serial communication GasGuard controllers and Ethernet GasGuard controllers.

□□The GasguardOPC Server allows the user to create Devices, but is limited to the total number of devices that are allowed by the level of license purchased.

Installation

The GasguardOPC Server is supplied on the installation CD. This CD is supplied with an AutoRun.EXE file, which will automatically invoke the Windows Installer when the CD is inserted into the drive. If the installer program does not start automatically, it can be manually

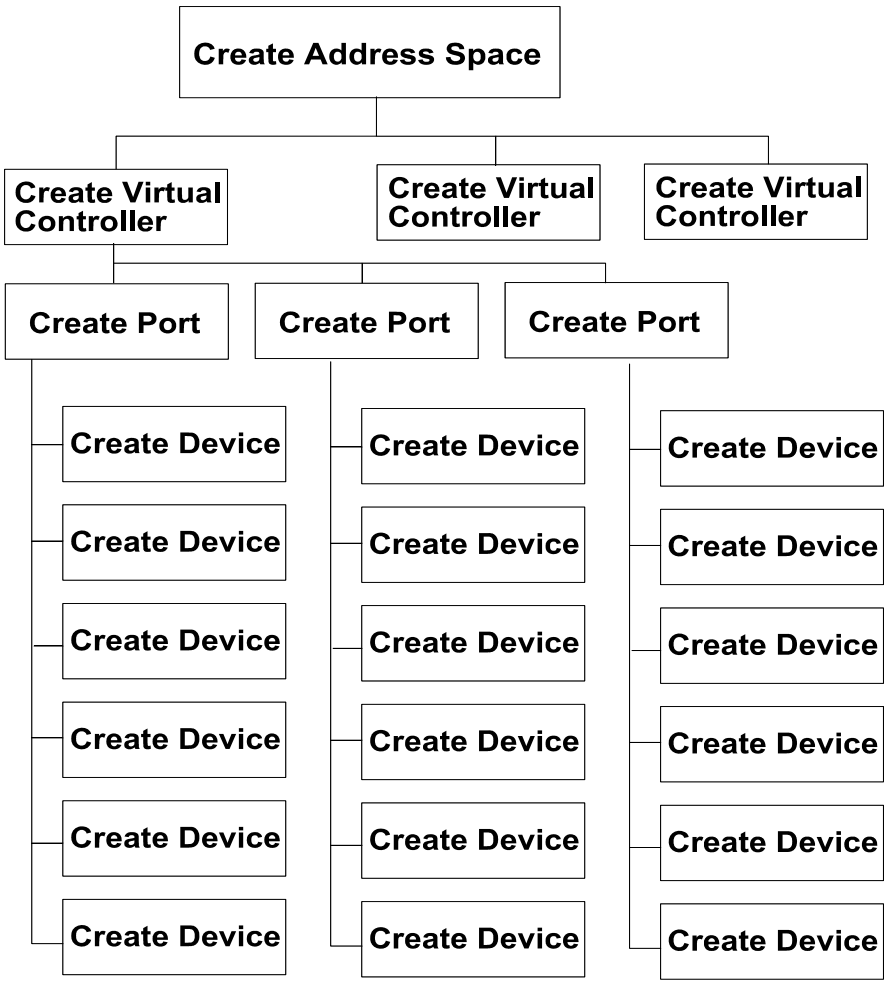
started using the Start/Run function with following command line: F:\gasguard.msi (where F: is the drive letter of your CD ROM).

Once started, the operator should accept the default values for the installation destination unless the specific target computer requires a custom install. The install procedure results in an active OPC driver with no system reset required.

Windows NT systems may require the installation of Microsoft MDAC (V. 2.5), which is included on the installation CD. Windows 2000 systems should already have this installed. The GasGuard installer will determine if this added installation is required.

Configuring the OPC Server Software

The OPC Server software must be configured before it can be used to communicate with and supply data from GasGuard Controllers. The process for configuration must be completed in a prescribed order. Some of the steps of configuration are only done once for implementation of the server. Other steps can be performed as needed to expand the configuration as new equipment is added to the site.



As is shown to the right, the Address Space is created once. Virtual controllers can be created and added to the system as needed. Each Virtual Controller can have multiple ports, and each port can have multiple devices.

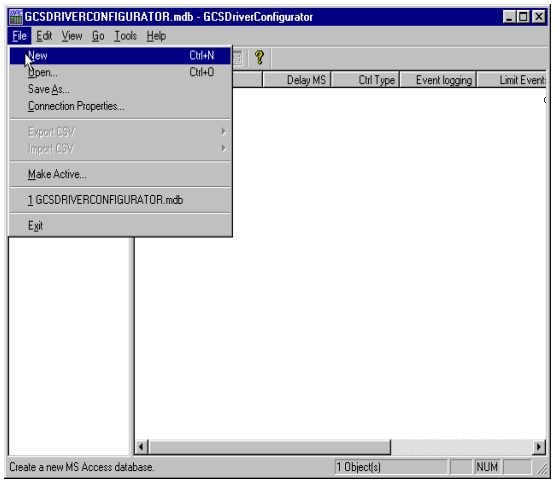
This diagram forms the basis for the configuration process. Each step is detailed below.

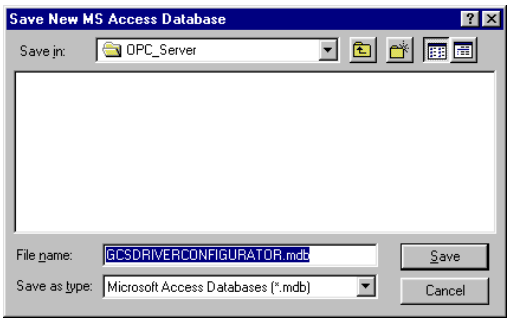
Configuring a New OPC Server

Creating an Address Space

When configuring a new OPC server, it is necessary to create an Address Space. This operation is only required to be done once for the server. The creation of the Address Space is done through the creation of the configuration database files as is described below:

Execute the GasguardOPC_Configurator application to obtain the Configuration Window. Click on File/New to create the required database.

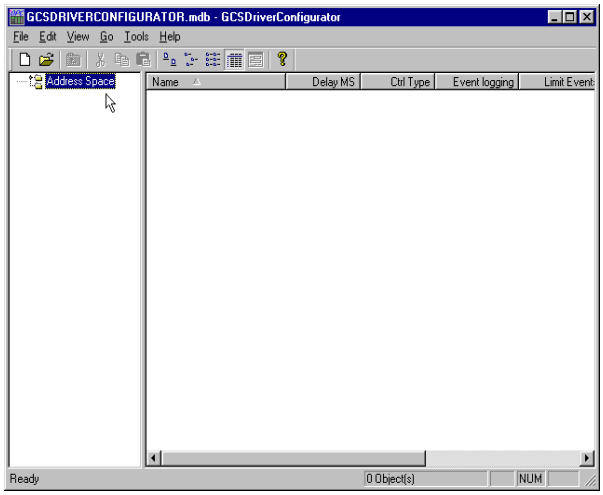




Supply a filename for the database file, or accept the default.

Click Save.

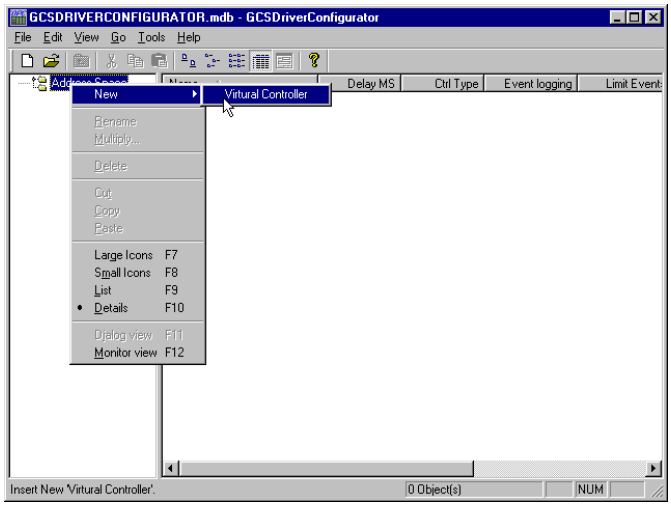
The system will add the created Address Space, as shown in the figure to the right.



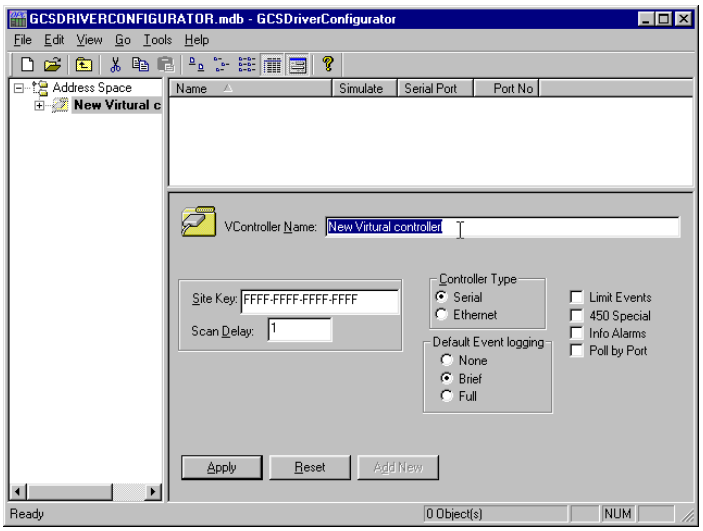
Create New Virtual Controller

A Virtual controller defines an execution thread of the OPC Server. The OPC Server requires at least one virtual controller to operate. An instance where you would want to create multiple virtual controllers would be to segregate your serial and Ethernet controllers allowing for heterogeneous communications within the virtual controller. Spreading your devices across multiple virtual controllers can also increase scan rates as the you can have multiple execution threads operating in parallel to poll information from your controllers. It is recommended that you configure about 2-4 ports of devices per virtual controller (serial devices). For ethernet based controllers, a good rule would be to associate about 50-100 devices per virtual controller. Keep in mind that each additional virtual controller will increase the demand on system resources; therefore, the way in which you segregate your devices is also dependent on the capability of your server.

Highlight the Address Space Icon in the right pane, and click Edit/New/Virtual Controller. An alternative way to achieve this is to right mouse click on the Address Space icon in the right pane, and choose New/Virtual Controller, as is shown in the figure to the right.



Vcontroller Name – Supply the name of the new virtual contoller. This is a free text field which will be used to refer to the virtual controller. The field can be a maximum of 50 characters. The configuration task checks this name to insure that it conforms to filespec syntax.



Site Key – This key is used to encrypt data in Ethernet Type Controllers and is not used for Serial Type Controllers. If this new virtual controller is an Ethernet Type, then a Site Key must be supplied. Site key data should have been supplied by VERSUM MATERIALS, INC. as part of the documentation for the GasGuard equipment. The Site Key should be the same for all controllers in an area, or for the entire site.

Scan Delay – Determines the amount of delay before the system will initiate a new poll of configured devices. The default is 1, which should be adequate for most applications. Increasing this value will decrease the CPU usage for the server poll routines. Decreasing this value can result in a "tight loop" over-scan in some cases.

Controller Type – The GasGuard Controllers can communicate by serial or Ethernet means. The type of controller can only be set during the creation of a new virtual controller. If the type of controller must be changed, the virtual controller must be deleted and re-created. (**NOTE: Deleting a virtual controller will result in the deletion of all ports and devices associated with that virtual controller.)**

Default Event Logging – Event logging is not fully implemented in the OPC Server. Currently, only "None" and "Brief" are used. For normal use, "Brief" should be used and is the default. No changes are needed to these settings.

Additional Settings – There are additional settings at the right side of the window. Average users should not use these settings. These settings should only be used at the direction of VERSUM MATERIALS, INC. configuration experts.

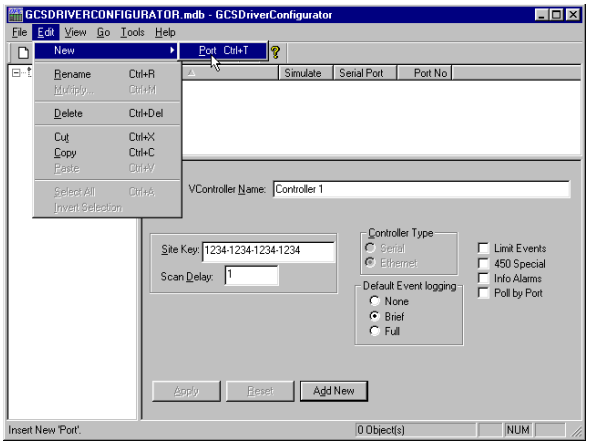
Apply – Click on this button when you have supplied all the necessary information, and wish to create this new virtual controller.

Add New – Allows the creation of another new virtual controller.

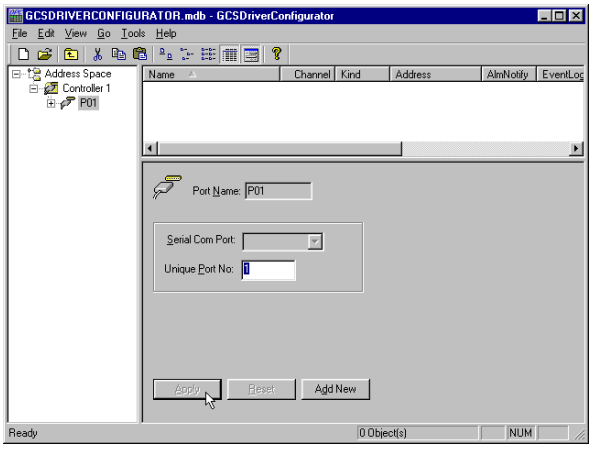
Creating a New Ethernet Port

Ports are normally used to determine a communications channel. In serial controllers, this is used to determine which COM port is to be used to communicate with the individual GasGuard controllers. In the case of an Ethernet controller, the port is used to group GasGuard controllers and as part of a unique identifier for each GasGuard controller (Device) in the system.

Highlight the virtual controller (of Ethernet Type) to which the port is to be added. Click on Edit/New/Port as is shown in the figure to the right. This can also be accomplished by a right mouse click and choosing New/Port from the right mouse menu.



Unique Port Number –Each port in the system requires a unique port number. Valid port numbers are between 1 and 99. The port number is used to name the port in the left pane. Although you will not have ports with a physical segment of cabinets in an Ethernet scenario, this identifier is still used to logically group controllers in your system and is therefore still used in addressing the controller. Simply make sure that when creating multiple ports, as you will need to do across multiple virtual controllers, that you use a unique number.



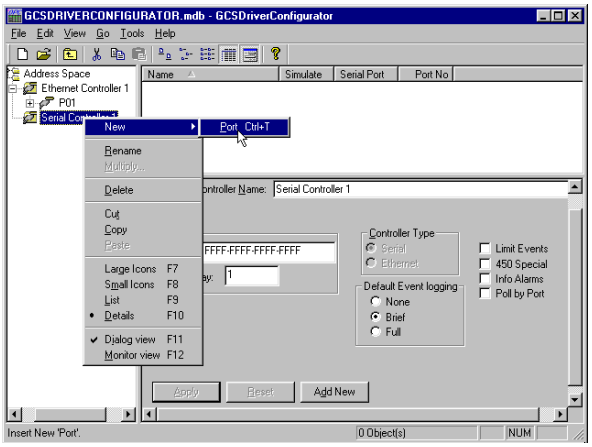
Apply – Click on this button when you have supplied all the necessary information, and wish to create this new port.

Add New – Allows the creation of another new port.

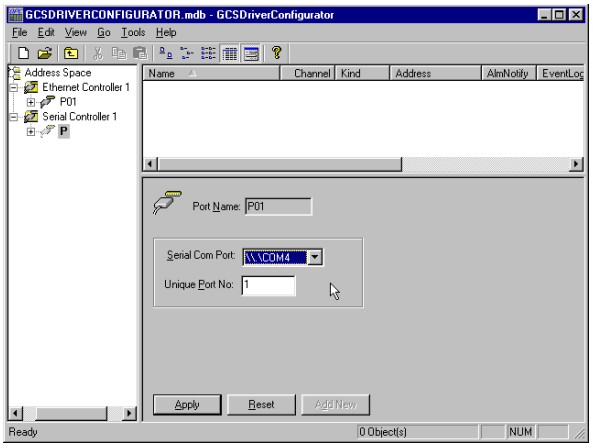
Creating a New Serial Port

In the instance of serial communications, the port assignment will be defined by the physical segment to which your devices are connected. In these instances, it will be the particular COM port which is to be used to communicate with the individual GasGuard controllers. As opposed to in the case of an Ethernet controller, the port is used to group GasGuard controllers and as part of a unique identifier for each GasGuard controller (Device) in the system.

Highlight the virtual controller (of Serial Type) to which the port is to be added. Click on Edit/New/Port as is shown in the figure to the right. This can also be accomplished by a right mouse click and choosing New/Port from the right mouse menu.



Serial COM Port – Serial type ports require the specification of a serial COM port which is known to the computer system, and is to be used to communicate with the serial GasGuard controller. The Serial COM Port is selected through the use of a drop down menu within the right pane. COM ports must be mapped to a physical serial port whether it'd be one directly off the back of your server or a remote serial port on a serial multiplexing device. Ensure that the selected COM port is available and has not been already allocated to another driver or port. Also ensure that the COM # used is the one that has been associated to the physical port in your system.



Unique Port Number - Each port in the system requires a unique port number. Valid port numbers are between 1 and 99. The port number is used to name the port in the left pane.

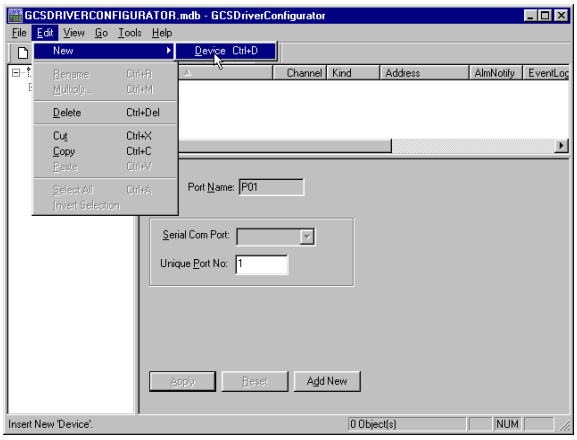
Apply – Click on this button when you have supplied all the necessary information, and wish to create this new port.

Add New – Allows the creation of another new port.

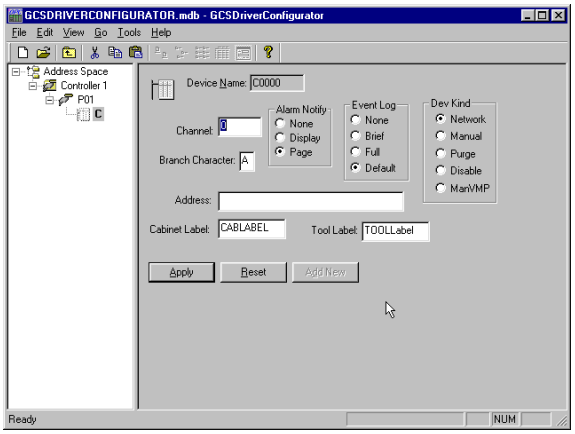
Adding a New Ethernet or Serial Device

Devices refer to a GasGuard Controller unit. GasGuard Controllers, which are used for a dual cabinet, have two units or devices associated with the left and right side. VMB controllers may also have two units or devices associated with a subset of the gas flow channels for the device. Individual GasGuard controllers can either be a single unit/device or dual unit/device.

Highlight the port, to which device is to be added. The port is shown in the left pane (e.g. P01). Click on Edit/New/Device. This can also be accomplished by a right mouse click and choosing New/Device from the right mouse menu.



Channel – Each device on a port has a unique channel number. The combination of port and channel is used to address a device in the system. Valid channel numbers are between 0 and 9999 for Ethernet virtual controllers. Valid channel numbers are between 0 and 63 for serial virtual controllers. The channel number that is used for the device in the OPC server must also be physically set at the controller in order for the OPC server to properly communicate to the device. *This field is required.*



Branch Character – The Branch Character is the base character, which is used to indicate the first label for VMB branch labels. This is usually set to "A" or "1" for the device. If "A" is used, the branch labels will be A-D for the left device and E-H for the right device. If "1" is used, the branch labels will be 1-4 for the left device and 5-8 for the right device. *This field is required.*

Address – This field is used in the configuration of Ethernet devices. It is not required for Serial devices. The field is used to contain the TCP/IP Address of the GasGuard Controller. (e.g. 192.168.10.30). If the network provides central name resolution through the use of a DNS, then a node name can be entered (e. g. Viper1). The TCP/IP address must also be physically set at the controller to match what is being used in the OPC Server. *This field is required for Ethernet Devices only*.

Alarm Notify – The alarm notification task is part of the HMI. In the Standalone OPC Server, this should be set to either "Display" or "Page" to insure that alarm strings are provided to the appropriate data item. No change in the setting of this value are needed for normal installations.

Event Log – The event log variable is not fully implemented in the Standalone OPC Server. To ensure that event data is available to the relevant data items, the Event Log should be set to something other than "None". The default is "default" and should not be changed for normal installations.

Dev. Kind – The Standalone OPC Server only uses two of the possible settings. Network – identifies the device as an online device, which should be polled. Disable – identifies the device as an offline device, which should not be polled. The Dev. Kind field can be used to temporarily disable a device by selecting "Disable". This is important in instances where you want to disable communications to a controller that could be decommissioned or getting serviced.

Cabinet Label – Cabinet Label is a free text field of 10 characters, which is downloaded to the GasGuard Controller to represent the name of the Gas Cabinet or VMB. *This data item is optional.* **(NOTE: Refrain from using punctuation or spaces at the beginning of this string.)**

Tool Label – Tool Label is a free text field of 10 characters, which is downloaded to the GasGuard Controller to represent the name of the downstream tool or VMB. *This data item is optional*. **(NOTE: Refrain from using punctuation or spaces at the beginning of this string.)**

Setting Device Capacity Key Level

The GasguardOPC standalone Server requires a license for operation. The Server software is supplied with a 10 unit license, which does not require any additional operator interaction. If the site requires the use of more than 10 units, then an additional license is required. If the Server software was purchased with additional licensing for additional units, then the additional license documentation should have been shipped with the software.

Setting the license level is simple, and can be accomplished through the GasguardOPC configuration tool.

Click on Tools/Options to display the options screen.

Enter the new Device Capacity Key. Notice that the system will respond to each keystroke with an asterisk and does not display the typed key. The current device capacity is also displayed on this screen. Once set, the new device capacity is immediately available for configuration and does **not** require system reboot or Server re-start.

Runtime Operations

The execution of the GasguardOPC Server automatically controlled. Once the Server software has been installed and configured, no operator intervention is normally needed. The GasguardOPC Server will automatically initiate execution whenever any of the data points that it serves, are referenced by a client application. The GasguardOPC Server will automatically stop execution when all the referenced data points are de-referenced. The de-referencing of data points is usually done when the client application is shutdown, as part of the task clean-up sequence.

Addressing OPC Data

Introduction

Once configured, the OPC Server responds to requests for data from the client OPC process used by a HMI program or other OPC client process. The manner in which the HMI is configured to access data from an OPC server varies with each HMI. It is necessary to "address" an individual data item in a manner that is consistent with the OPC server. A data point map has been provided (see GasguardOPC Data point Map).

Addressing OPC Data points

The overall addressing scheme is [//servername/]Ppp.Ccccc [.Folder].name[.member] [ ] = optional field

Where,

- //servername is the nodename that the server is running (e.g. SCADA1, etc.) If //servername is not supplied, the local node is assumed. //servername is an optional field.
- /Ppp is the port designation which matches a port configured in the server. Leading zeros must be supplied. (e.g. P02).
- .Ccccc is the channel designation which matches a channel configured in the server. Leading zeros must be supplied. (e.g. C0001).
- .Folder is the first hierarchical name of the data item and is normally associated with a folder name in the OPC server data structure. Folder names are started with a capital letter as a convention. The folder value must match a folder value in the Gasgaurd Datapoint Map. Folder is optional and can be text or numeric. (e.g. /mode, /name, /00239).
- .name is the name of the data item. The name field is started with a lower case letter as a convention. The name value must match a name value in the GasGuard Datapoint Map. Name field is required for all datapoint addresses.
- .member is an optional field which is used to specify which member of an array value is to be returned. There are two methods of addressing data in the OPC Server. The data can be returned as an array of values or as a single datapoint. If the HMI supports arrays, there is a significant reduction of overhead bandwidth required for array transactions when contrasted to an equal number of data items processed as single points.
    - .All returns the array of values. (note – Case Sensitive)
    - .x returns the xth value of an array as a single data point. (e.g. .1 = first member, .10 = tenth member).

The following are valid addresses for OPC items:

//GCS3/P01.C0004.Mode.num	Single Datapoint
//SCADA1/P03.C0024.Analog.lbl.1	Single Datapoint of an array
//Node1/P13.C0002.Analog.lbl.All	An Array of Analog labels

Many OPC clients do not support arrays or only support arrays of certain types. Please check your HMI documentation to determine if the OPC client that you are using can support the use of arrays. If arrays are not supported, reference each element discretely as shown below:

P00.C0001.Analog.val.All - would return an array of the Analog Values

P00.C0001.Analog.val.1 - would return a single Analog Value for Analog Value 1

OPC Groups and Scan Rate Optimization

The OPC standards allow for the OPC client software to create groups, in which individual data points can be added. Not all OPC clients are able to use groups, and each manufacturer's client software would be expected to use a different method for managing groups. An OPC group is used to set parameters for data points that have similar properties such as scan rate. Some of the data points will be expected to change frequently while others would be expected to change infrequently. By establishing groups of data points with similar scan frequency requirements, the system administrator can optimize the OPC Server and thus minimize CPU usage.

The proper setting of scan rate can be a critical factor in preventing changes from being missed. The proper assignment of scan rate is particularly important if the text alarm string data points are being implemented in the client HMI software. These string data points are particularly useful to view the alarm status of the GasGuard devices. There are two basic alarm string types:

- Ppp.Ccccc.Alarm.1 to 20 – These 20 discrete string data points are used to display the top 20 currently active alarms in the controller. The GasguardOPC server manages this stack of alarm status data points in a latest on top manner. This stack of data points can be used to represent the detail of the current alarm status of a controller. There are no scan rate limitations for these data points.
- Ppp.Ccccc.almaeclkstr – This discrete string data point is used to hold the most recent alarm or event text. The data point can be used to log the text of alarms if the logging for the data point is set to log on change. The Server has been designed to delay updating this data point to allow the client HMI software to have a chance to log the change. To preclude the chance of missing a change in this data point, it should be scanned at a rate that is 500 ms or shorter if unsolicited update is selected, or 250 ms if updated on a fixed scan rate.
- Ppp.Ccccc.aoclkstr – This discrete string data point is used to hold the most recent alarm text. This data point is used in a similar fashion as almaeclkstr, above. The same scan rate limitation applies.

Reference 1: GasguardOPC Datapoint Map

	Description of Item	Name Convention	No	Data Type

Analog Value Data Items

Analog Label(16)	Label describing analog function	//server.Ppp.Ccccc.Analog.lbl	16	char(13)
Label Defined(16)	Field indicating whether analog label is defined (TRUE=defined, FALSE=undefined)	//server.Ppp.Ccccc.Analog.lbldef	16	VT_BOOL
Current Value(16)	Numeric value of analog reading	//server.Ppp.Ccccc.Analog.val	16	VT_R4
Value Defined(16)	Field indicating whether analog value is defined (TRUE=defined, FALSE=undefined)	//server.Ppp.Ccccc.Analog.valdef	16	VT_BOOL
Setup Analog Min(16)	Minimum scaling for analog transducer (eg. –14.7)	//server.Ppp.Ccccc.Analog.sumin	16	VT_R4
Setup Analog Max(16)	Maximum scaling for analog transducer (eg. 2985)	//server.Ppp.Ccccc.Analog.sumax	16	VT_R4
Setup Input Signal Range(16)	Analog transducer type (65('A') = 0-5 volts, 66('B') = 1-5 volts, 67('C') = 4-20 milliamps, 64('@') = NOT USED)	//server.Ppp.Ccccc.Analog.surange	16	VT_I2
Setup Defined(16)	Field indicating whether analog transducer exists (TRUE=exists, FALSE=does not exist)	//server.Ppp.Ccccc.Analog.sudef	16	VT_BOOL
SP1 Label(16)	Label for first analog setpoint	//server.Ppp.Ccccc.Analog.sp1lbl	16	char(18)
SP1 Value(16)	First analog setpoint value	//server.Ppp.Ccccc.Analog.sp1val	16	VT_R4
SP1 Defined(16)	Field indicating whether first analog setpoint is defined (TRUE=defined, FALSE=undefined)	//server.Ppp.Ccccc.Analog.sp1def	16	VT_BOOL
SP2 Label(16)	Label for second analog setpoint	//server.Ppp.Ccccc.Analog.sp2lbl	16	char(18)
SP2 Value(16)	Second analog setpoint value	//server.Ppp.Ccccc.Analog.sp2val	16	VT_R4
SP2 Defined(16)	Field indicating whether second analog setpoint is defined (TRUE=defined, FALSE=undefined)	//server.Ppp.Ccccc.Analog.sp2def	16	VT_BOOL

Labels and Modes

Valve Label(17)	Label describing valve	//server.Ppp.Ccccc.Valves.lbl	17	char(6)
Valve State(17)	Field indicating current state of the valve (0=Closed, 1=Open, 2=DOES NOT EXIST)	//server.Ppp.Ccccc.Valves.state	17	VT_I2
Valve Count(17)	Number of valve-cycles since driver start-up	//server.Ppp.Ccccc.Valves.cnt	17	VT_I4
Mode Number	Current overall mode number of device (most significant mode for multi-branch devices) ** SEE MODE TABLE **	//server.Ppp.Ccccc.Mode.num	1	VT_I2
Non-RBS Mode	Local mode number of device while RBS (Remote Backup System) is active (NOTE: Mode Number will be 03 <Gas-To-Tool> during this time. Only Single-Branch devices are eligible for RBS). ** SEE MODE TABLE **	//server.Ppp.Ccccc.Mode.nonrbs	1	VT_I2
BR Mode(4)	Mode numbers for each device branch ** SEE MODE TABLE **	//server.Ppp.Ccccc.Mode.brnum	4	VT_I2
BR Label(4)	Primary mode description for each branch (Note: Only the first description is used for single-branch devices)	//server.Ppp.Ccccc.Mode.bralbl	4	char(20)
BR Operation Label(4)	Secondary mode description for each branch sometimes used to indicate RBS status (Note: Only the first description is used for single-branch devices)	//server.Ppp.Ccccc.Mode.braoplbl	4	char(20)
UP Label(10)	Label describing user parameter	//server.Ppp.Ccccc.Uprms.lbl	10	char(20)
UP Value(10)	User parameter value	//server.Ppp.Ccccc.Uprms.val	10	VT_I4
UP Type(10)	User parameter type (68('D') = Counter, 69('E') = Timer, 64('@') = NOT USED)	//server.Ppp.Ccccc.Uprms.type	10	VT_I2

Alarm Information

Total Acknowledged Red	Count of total current acknowledged Red/Shutdown alarms	//server.Ppp.Ccccc.Sts.ackred	1	VT_I4
Total Acknowledged Yellow	Count of total current acknowledged Yellow/Fault alarms	//server.Ppp.Ccccc.Sts.ackyel	1	VT_I4
Total UnAcknowledged Red	Count of total current un-acknowledged Red/Shutdown alarms	//server.Ppp.Ccccc.Sts.unackred	1	VT_I4
Total UnAcknowledged Yellow	Count of total current un-acknowledged Yellow/Fault alarms	//server.Ppp.Ccccc.Sts.unackyel	1	VT_I4
Alarms(20)	String list of current alarms present at the controller (a NULL string indicates no alarm in that slot)	//server.Ppp.Ccccc.alarms	20	char(19)

Miscellaneous Configuration Data

Expected Port Number	Expected Port Number of device during I.D. Mismatch communications status condition	//server.Ppp.Ccccc.Sts.expn	1	VT_I2
Current User	Current Local User of device (1...100 = First Level, 101...200 = Second Level, 202...226 = Third Level, 0 = Super User, 201 = NO USER)	//server.Ppp.Ccccc.Sts.user	1	VT_I4
Cabnum	Descriptive Cabinet Label for device defined during network configuration	//server.Ppp.Ccccc.Cfg.cabnum	1	char(10)
Toolnum	Descriptive Tool Label for device defined during network configuration	//server.Ppp.Ccccc.Cfg.toolnum	1	char(10)
Device	Code identifying the device type and characteristics ** SEE DEVICE CODE TABLE **	//server.Ppp.Ccccc.Cfg.device	1	VT_I2
Device String	String identifying the device type	//server.Ppp.Ccccc.Cfg.devicestr	1	char(15)
Last Branch Number (one-based)	Number indicating last supported branch for device	//server.Ppp.Ccccc.Cfg.lastbranch	1	VT_I4

Last Valve (one-based)	Number indicating last supported valve for device	//server.Ppp.Ccccc.Cfg.lastvalve	1	VT_I4
Device Mod Sub Field	Field used to indicate additional display options for the device ** NOTE: THIS FIELD IS NOT SUPPORTED IN THE STANDALONE DRIVER **	//server.Ppp.Ccccc.Cfg.subfield	1	VT_I4
Cabinet Position (Rel Pos)	Field indicating the device's relative position (83('S') = Single Controller, 76('L') = Left Side of Dual, 82('R') = Right Side of Dual)	//server.Ppp.Ccccc.Cfg.relpos	1	VT_I2
CPU Version	String representation of device's CPU version (eg."04.00")	//server.Ppp.Ccccc.Cfg.cpuver	1	char(5)
COMO Version	String representation of device's COMO version (eg."30.00")	//server.Ppp.Ccccc.Cfg.comover	1	char(5)
Display Version	String representation of device's Display version (eg."02.00")	//server.Ppp.Ccccc.Cfg.dispver	1	char(5)
Channel	Device's zero-based network channel number	//server.Ppp.Ccccc.Cfg.chan	1	VT_I4
Net Port Number	Device's one-based network port number	//server.Ppp.Ccccc.Cfg.netpnum	1	VT_I4
Other Sides Channel	A field indicating the network channel number of the device's other side (only relevant for Dual controllers)	//server.Ppp.Ccccc.Cfg.othchan	1	VT_I4
Prediction Analog Number(2)	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.Cfg.pralgnum	2	VT_I4
Prediction Full Level(2)	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.Cfg.prfulllvl	2	VT_R4
Prediction Empty Level(2)	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.Cfg.premptylvl	2	VT_R4
Prediction Validity Flag(2)	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.Cfg.prisvalid	2	VT_BOOL
Prediction Empty Time(2)	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.Cfg.premptytime	2	char(19)
Prediction Empty Error(2)	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.Cfg.premptyerr	2	char(19)
Prediction Daily Usage(2)	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.Cfg.prdailyusg	2	VT_R4
Command String	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.cmdstr	1	char(80)
Command String Response	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.cmdrsp	1	char(80)
Enet Address	The Enet address of this device	//server.Ppp.Ccccc.Cfg.enetaddr	1	char(30)
Alarm Event Clock string	String used by driver to cycle through all events and alarms occurring for the device	//server.Ppp.Ccccc.aeclkstr	1	char(80)

Alarm Only Clock string	String used by driver to cycle through only device alarms and communications-state changes	//server.Ppp.Ccccc.aoclkstr	1	char(80)
Alarm Ack	Boolean field to issue ACKNOWLEDGE-ALARM command to cabinet (set to TRUE to issue command, driver will set to FALSE when completed)	//server.Ppp.Ccccc.almack	1	VT_BOOL
Alarm Reset	Boolean field to issue RESET-ALARM command to cabinet (set to TRUE to issue command, driver will set to FALSE when completed)	//server.Ppp.Ccccc.almreset	1	VT_BOOL
Port Reconfiguration	Boolean field to issue PORT-RECONFIGURATION command to cabinet (set to TRUE to issue command, driver will set to FALSE when completed)	//server.Ppp.Ccccc.reconfig	1	VT_BOOL
Priority Poll	Boolean field to command the driver to temporarily poll the device more frequently (set to TRUE to issue command, driver will set to FALSE when completed)	//server.Ppp.Ccccc.prtypoll	1	VT_BOOL
Communications Status	Field indicating communication status with device (0=Good Communications, 1=Communications Failure, 2=I.D. Mismatch with device, 3=No Communication)	//server.Ppp.Ccccc.commsts	1	VT_I2
Alarm Status	Field indicating worst-case device alarm status (0=No Alarm, 1=Informational Alarm, 2=Yellow/Fault Alarm, 3=Red/Shutdown Alarm)	//server.Ppp.Ccccc.alarmsts	1	VT_I2
Object Status	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.objstate	1	VT_I4
Object Status String	Object Status String	//server.Ppp.Ccccc.objstatestr	1	char(13)
Alarm Status String	Alarm Status String	//server.Ppp.Ccccc.alarmstsstr	1	char(12)
Color	-- NOT IMPLEMENTED --	//server.Ppp.Ccccc.color	1	VT_I4
Gas status	Gas Availablity status of the device 0 = not used, 1 = Gas available - device will feed gas if it has gas from Upline Input devices(s), VMB's; or it is flowing gas, in the case of a cabinet. 2 = Gas Availability Non-input dependant 3=Gas Unavailable, 4=N/A Not a valid branch for this device type. 5=Status unknown	//server.Ppp.Ccccc.gasstat	1	VT_I2
Gas status reason codes	Why gas was not flowing	//server.Ppp.Ccccc.gasstatstr	1	char(80)

Reference 2: Standard GasGuard Modes

Standard Gas Cabinet Modes:

Mode #	Mode
0	Idle
1	Change Cylinder
2	Init Process
3	Gas to Tool Mode
4	Pre-Purge Mode
5	Post Purge Mode
6	Auxiliary Purge Mode
7	Local Mode
8	Single Action Mode
9	Single Action Mode
10	Power up Mode
11	Scram Shutdown Mode
12	Leak Isolation Mode
13	Cylinder Isolation Mode
14	Scram Dump Mode
15	Line Purge Mode
16	Auxiliary Purge-2 Mode
17	Condition
18	Panel Purge
19	Change Cylinder 2
20	Pre-Purge 2
21	Post-Purge 2
22	*Reserved*

Standard VMB Branchmode(x) Modes:

Mode #	Mode
0	Idle
1	*Not Used*
2	Initialization of Process
3	Gas to Tool Mode
4	Pre-Purge Mode
5	Post Purge Mode
6	Auxiliary Purge Mode
7	Local Mode
8	Single Action Mode
9	Single Action Mode
10	Power up Mode
11	Scram Shutdown Mode
12	Leak Isolation Mode
13	*Not Used*
14	Scram Dump Mode
15	Line Purge Mode
16	Auxiliary Purge-2 Mode

Special AP10 ChemGuard Modes:

Mode #	Mode
60	Bulk to Process
61	Process Fill
62	Change Bulk
63	Change Process
64	Line Clear
65	Reservoir Vent
66	Cycle Purge
67	Line Purge
68	Backfill
69	External Fill
70	Trickle Purge
71	Leak Check
72	Equalize

Reference 3: Standard Device Codes

Device Code	Equipment Description
65	*Reserved*
66	GG450 Special
67	GG450 (Standard)
68	VMB 1x4 12 Valve
69	VMB 2x4 12 Valve
70	VMB 1x4 17 Valve
71	VMB 2x4 17 Valve
72	VMB 1x4 17 Special
73	VMB 2x4 17 Special
74	GG450 HP Crossover
75	GG450 GIB
76	GG250 MX (dual) (was GG500)
77	GG250
78	GG400 (Standard)
79	GG400 (Scram)
81	VMB 250
82	GG450 12 Valve Extended
83	VMB 1x4 13 Valve Special
84	Low Pressure Vacuum System
85	High Pressure Vacuum System
86	VMB Multi Inlet (4x4, 17 Valve, 2 purge valves)
87	VMB 2x4 17 Valve Special 2 (2 purge valves)
88	VMB 1x4 17 Valve Special 2 (2 purge valves)
89	LR300
97	GG500
98	VMB500

99	GG500 (2 Process Cylinders)
100	VMB500 W/Mass Flow meter
101	GG250-CFG Auto Cross-over
102	GG250-CFG Dual Process Out
103	GG250 MXO W/Self Purge
104	GG500-CFG
105	GG250-CFG AXO W/4 Scales
106	VMB500-CFG Process Jacket Leak
107	GG500 Alternate ENG. Units
108	GG500-CFG Process Jacket Leak
109	GG450 BCL3 Panel (Cabinet)
110	34-VALVE VMB (1/2/4 Input)
111	Breathable Air-Handling System
112	VMB250 8 Stick
113	General Monitoring System
114	BSGS Types 1, 2, 3
115	AP Cabinet
116	AP VMB
116	AP VMB Common Vent/Purge Header (Graphics Type 1)
116	AP JVP (Graphics Type 2)
117	BSGS Tube-Switcher
118	AP BSGS
119	AP Universal Pigtail
120	AP High Flow System
122	AP ChemGuard

Reference 4: Standard Device Network Mapping

Listed below are the standard Network mappings for common device types. This is only to be used as a guide. These mapping are programmable, therefore based on customer requirements, extra analogs may be defined. Sites should check the device's configuration carefully.

HPCM

Left Side

Analog #	*Function*
1	Process Inlet - L
2	Process Delivery - L
5	Cylinder Weight-L <LOCAL CYLINDER SYSTEM ONLY>
6	Cylinder Temperature-L <LOCAL CYLINDER SYSTEM ONLY>
7	Heat Trace - L (TE-7A)
9	House Line Delivery Pressure
10	Inter Stage - L
11	JT Heater
12	TE-1409

Valve #	*Function*
1	Valve 1A <LOCAL CYLINDER SYSTEM ONLY>
2	Valve 2A
3	Process Valve 3A
8	Cylinder Valve 8A <LOCAL CYLINDER SYSTEM ONLY>
9	Valve 40A

Right Side

Analog #	*Function*
1	Process Inlet - R
2	Process Delivery - R
5	Cylinder Weight-R <LOCAL CYLINDER SYSTEM ONLY>
6	Cylinder Temperature-R <LOCAL CYLINDER SYSTEM ONLY>
7	Heat Trace - R (TE-7B)
9	House Line Delivery Pressure
10	Inter Stage - R
11	JT Heater
12	TE-1409

Valve #	*Function*
1	Valve 1B <LOCAL CYLINDER SYSTEM ONLY>
2	Valve 2B
3	Process Valve 3B
8	Cylinder Valve 8B <LOCAL CYLINDER SYSTEM ONLY>
9	Valve 40B

Universal Pigtail

Analog #	*Function*
4	Source Pressure
5	Source Weight
6	Process Jacket Leak
7	Exhaust Pressure (In. WC)
10	Source Temperature
14	Heat-Trace 1
15	Heat-Trace 2

Valve #	Function
1	Pigtail Outlet
4	Purge Isolation
5	Vent Isolation
7	Venturi Isolation
8	Cylinder Valve

AP Cabinet

Left Side

Analog #	*Function*
1	Cylinder Pressure
2	Delivery Pressure
3	Purge Cylinder Pressure
4	Purge Delivery Pressure
5	Vacuum Generator
6	Cylinder Weight
7	Cabinet Exhaust
8	Purge Back Pressure
9	Gas Leak Detector

Valve #	*Function*
1	High Pressure Process Valve V1
2	High Pressure Process Isolation Valve V2
3	Low Pressure Process Delivery Valve V3
4	Purge Valve V4
5	High Pressure Side Vent Valve V5
6	Low Pressure Side Vent Valve V6
7	Venturi Valve V7
8	Cylinder Valve
9	Trickle-Purge Valve V44
10	High Pressure Leak V10
11	Low Pressure Purge V11

Right Side

Analog #	*Function*
1	Cylinder Pressure
2	Delivery Pressure
3	Purge Cylinder Pressure
4	Purge Delivery Pressure
5	Vacuum Generator
6	Cylinder Weight
7	Cabinet Exhaust
8	Purge Back Pressure
9	Gas Leak Detector

Valve #	*Function*
1	High Pressure Process Valve V1
2	High Pressure Process Isolation Valve V2
3	Low Pressure Process Delivery Valve V3
4	Purge Valve V4
5	High Pressure Side Vent Valve V5
6	Low Pressure Side Vent Valve V6
7	Venturi Valve V7
8	Cylinder Valve
9	Trickle-Purge Valve V44
10	High Pressure Leak V10
11	Low Pressure Purge V11

12	Remote Backup System Valve V26

12	Remote Backup System Valve V26

AP VMB

Left Side

Analog #	*Function*
1	1st Branch Pressure
2	2nd Branch Pressure
3	3rd Branch Pressure
4	4th Branch Pressure
5	VMB Process Inlet Pressure
6	VMB Purge Inlet Pressure
7	VMB Exhaust Stack
8	VMB Vacuum Generator
9	1st Branch Jacket Leak
10	2nd Branch Jacket Leak
11	3rd Branch Jacket Leak
12	4th Branch Jacket Leak
13	Gas Leak Detector

Right Side

Analog #	*Function*
1	5th Branch Pressure
2	6th Branch Pressure
3	7th Branch Pressure
4	8th Branch Pressure
5	VMB Process Inlet Pressure
6	VMB Purge Inlet Pressure
7	VMB Exhaust Stack
8	VMB Vacuum Generator
9	5th Branch Jacket Leak
10	6th Branch Jacket Leak
11	7th Branch Jacket Leak
12	8th Branch Jacket Leak
13	Gas Leak Detector

Valve #	*Function*
1	Vent Valve V6-1
2	Process Valve V2-1
3	Purge Valve V4-1
4	Vent Valve V6-2
5	Process Valve V2-2

Valve #	*Function*
1	Vent Valve V6-5
2	Process Valve V2-5
3	Purge Valve V4-5
4	Vent Valve V6-6
5	Process Valve V2-6

6 Purge Valve V4-2	6 Purge Valve V4-6
7 Vent Valve V6-3	7 Vent Valve V6-7
8 Process Valve V2-3	8 Process Valve V2-7
9 Purge Valve V4-3	9 Purge Valve V4-7
10 Vent Valve V6-4	10 Vent Valve V6-8
11 Process Valve V2-4	11 Process Valve V2-8
12 Purge Valve V4-4	12 Purge Valve V4-8
13 Venturi Valve V7	13 Venturi Valve V7
14 Process Inlet Valve V1	14 Process Inlet Valve V1

AP JVP

Left Side

Analog #	*Function*
1	1st Branch Pressure
2	2nd Branch Pressure
3	3rd Branch Pressure
4	4th Branch Pressure
5	VMB Process Inlet Pressure
6	VMB Purge Inlet Pressure
7	VMB Exhaust Stack
8	VMB Vacuum Generator
9	1st Branch Jacket Leak
10	2nd Branch Jacket Leak
11	3rd Branch Jacket Leak
12	4th Branch Jacket Leak
13	Gas Leak Detector

Right Side

Analog #	*Function*
1	5th Branch Pressure
2	6th Branch Pressure
3	7th Branch Pressure
4	8th Branch Pressure
5	VMB Process Inlet Pressure
6	VMB Purge Inlet Pressure
7	VMB Exhaust Stack
8	VMB Vacuum Generator
9	5th Branch Jacket Leak
10	6th Branch Jacket Leak
11	7th Branch Jacket Leak
12	8th Branch Jacket Leak
13	Gas Leak Detector

Valve #	*Function*
1	Vent Valve MV1
2	Process Valve V51
3	Purge Valve MV3
4	Vent Valve MV4
5	Process Valve V52
6	Purge Valve MV6
7	Vent Valve MV7

Valve #	*Function*
1	Vent Valve MV1
2	Process Valve V55
3	Purge Valve MV3
4	Vent Valve MV4
5	Process Valve V56
6	Purge Valve MV6
7	Vent Valve MV7

8 Process Valve V53	8 Process Valve V57
9 Purge Valve MV9	9 Purge Valve MV9
10 Vent Valve MV10	10 Vent Valve MV10
11 Process Valve V54	11 Process Valve V58
12 Purge Valve MV12	12 Purge Valve MV12
13 Venturi Valve MV13	13 Venturi Valve MV13
14 Process Inlet Valve MV18	14 Process Inlet Valve MV18

AP VMB Common Vent/Purge Header

Left Side

Analog #	*Function*
1	1st Branch Pressure
2	2nd Branch Pressure
3	3rd Branch Pressure
4	4th Branch Pressure
5	VMB Process Inlet Pressure
6	VMB Purge Inlet Pressure
7	VMB Exhaust Stack
8	VMB Vent Pressure

Valve #	*Function*
2	Process Valve V2-1
3	Purge Valve V4-1
5	Process Valve V2-2
6	Purge Valve V4-2
8	Process Valve V2-3
9	Purge Valve V4-3
11	Process Valve V2-4
12	Purge Valve V4-4
13	Venturi Valve V7
15	Purge Inlet Valve V21
16	Vent Valve V22

Right Side

Analog #	*Function*
1	5th Branch Pressure
2	6th Branch Pressure
3	7th Branch Pressure
4	8th Branch Pressure
5	VMB Process Inlet Pressure
6	VMB Purge Inlet Pressure
7	VMB Exhaust Stack
8	VMB Vent Pressure

Valve #	*Function*
2	Process Valve V2-5
3	Purge Valve V4-5
5	Process Valve V2-6
6	Purge Valve V4-6
8	Process Valve V2-7
9	Purge Valve V4-7
11	Process Valve V2-8
12	Purge Valve V4-8
13	Venturi Valve V7
15	Purge Inlet Valve V21
16	Vent Valve V22

AP High Flow System

Left Side

Analog #	*Function*
1	PT-1A-1 Source Pressure
2	PT-2A Delivery Pressure
3	PT-3 Purge Cylinder Pressure
4	PT-4 Purge Delivery Pressure
5	TT-6 JT Heater Temp
6	WT-1A-1 Source Weight
7	FT-1 (EXHAUST-L)
8	PT-8 Purge Delivery Pressure
9	PT-5 Vent Pressure
10	PT-1A-2 Source Pressure
11	WT-1A-2 Source Weight

Right Side

Analog #	*Function*
1	PT-1B-1 Source Pressure
2	PT-2B Delivery Pressure
3	PT-3 Purge Cylinder Pressure
4	PT-4 Purge Delivery Pressure
5	TT-6 JT Heater Temp
6	WT-1B-1 Source Weight
7	FT-1 (EXHAUST-L)
8	PT-8 Purge Delivery Pressure
9	PT-5 Vent Pressure
10	PT-1B-2 Source Pressure
11	WT-1B-2 Source Weight

Valve #	*Function*
1	High Pressure Process Valve V1-1 source A-1
2	High Pressure Process Isolation Valve V2
3	Low Pressure Process Delivery Valve V3
4	Purge Valve V4
5	High Pressure Side Vent Valve V5
6	Low Pressure Side Vent Valve V6
7	Venturi Valve V7
8	Source Valve V8-1

Valve #	*Function*
1	High Pressure Process Valve V1-1 source B-1
2	High Pressure Process Isolation Valve V2
3	Low Pressure Process Delivery Valve V3
4	Purge Valve V4
5	High Pressure Side Vent Valve V5
6	Low Pressure Side Vent Valve V6
7	Venturi Valve V7
8	Source Valve V8-1

9 Source Valve V8-2	9 Source Valve V8-2
10 High Pressure Leak V10	10 High Pressure Leak V10
11 Low Pressure Purge V11	11 Low Pressure Purge V11
12 High Pressure Process Valve V1-2 source A-2	12 High Pressure Process Valve V1-2 source B-2
13 Purge Valve V13	13 Purge Valve V13
14 Purge Valve V44	14 Purge Valve V44
15 Trickle Vent Valve V113TP	15 Trickle Vent Valve V113TP

AP ChemGuard

Left Side

Analog #	*Function*
1	Bulk Push Pressure
2	Bulk Scale
3	Vacuum

Valve #	*Function*
1	V1A
2	V2A
3	V3A
4	V4A
5	V5A
6	V6A
7	V7
8	V8A
9	V9A
10	V10A
11	*No Mapping*
12	*No Mapping*
13	*No Mapping*
14	*No Mapping*
15	V15

Right Side

Analog #	*Function*
1	Process Push Pressure
2	Process Scale
3	Vacuum

Valve #	*Function*
1	V1B
2	V8
3	V3B
4	V4B
5	V5B
6	V6B
7	V7
8	*No Mapping*
9	V9B
10	V10B
11	V11
12	V12
13	V13
14	V14
15	*No Mapping*

This page intentionally left blank

Appendix F

Gas Sensor Modules

NOTE: Versum Materials, Inc. recommends customer always review and reference to the device manual shipped along with the ChemGuard equipment package, it is an indication a device in-use has accurate information such as operation, specification, calibration and maintenance schedule.

GAS SENSOR MODULES

MODELS 201-00
MODELS 203-00
MODELS 206-00

MODELS 2001-00
MODELS 2003-00
MODELS 2006-00

Sierra Monitor Corporation
1991 Tarob Court, Milpitas, CA 95035
(408) 262-6611
(800) 727-4377
Fax: (408) 262-9042
www.sierramonitor.com

GAS SENSOR MODULES

MODELS 201-00
MODELS 203-00
MODELS 204-00

MODELS 2001-00
MODELS 2003-00
MODELS 2006-00

APPLICABILITY & EFFECTIVITY

This manual provides instructions for the following Sierra Monitor products:

Model	Description
201-00	Combustible Gas Monitor - Outdoor
203-00	Hydrogen Sulfide Monitor - Outdoor
206-00	Carbon Monoxide Monitor - Outdoor
2001-00	Combustible Gas Monitors - Indoor
2003-00	Hydrogen Sulfide Monitors - Indoor
2006-00	Carbon Monoxide Monitor - Indoor

The instructions are effective for the above models as of November 2002

Instruction Manual Part Number: T10002
Rev E2

Applicability & Effectivity

TABLE OF CONTENTS

Table of Contents

Instruction Manual

1.0 PRODUCT DESCRIPTION

1.1 Introduction

The Sierra Monitor Gas Sensor Modules consist of two series of fixed-installation, single-alarm products, the 20X Series is an explosion proof model, and the 200X Series is in a general purpose enclosure. Both series include monitors for Combustible Gas, Hydrogen Sulfide, and Carbon Monoxide. Both series also include a dry contact relay. See Table 1.1 for a full list of available configurations.
This manual provides instructions for both 20X and 200X series Gas Sensor Modules.

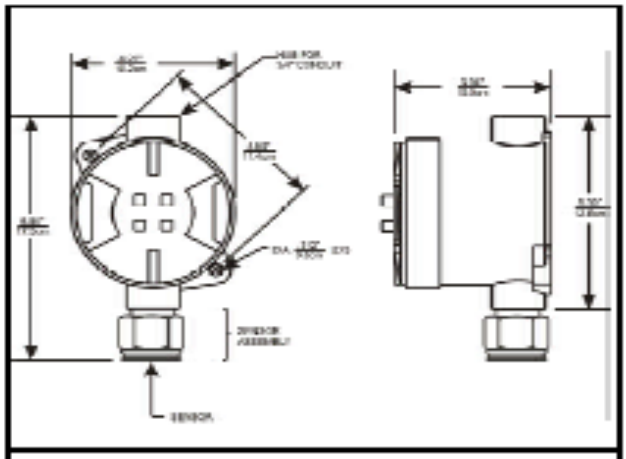


Figure 1.1 Outline View - 20X Series

1.2 Application

The Gas Sensor Modules are designed for qualitative continuous area monitoring of Combustible Gas, Hydrogen Sulfide or Carbon Monoxide where the gas being monitored is not normally present.

1.3 Configuration

1. Model 20X Series

The Model 20X series consists of three separate gas modules, Model 201 for Combustibles, Model 203 for Hydrogen Sulfide and Model 206 for Carbon Monoxide. An alarm signal is activated when the concentration of gas exceeds the factory-set (and user-adjustable) level. The signal may be used to activate a remote alarm, fan or process controller.

Contact Sierra Monitor for specifics on the devices that can be interfaced with these gas sensor modules. In addition, all versions include, as standard, a 0.5 amp, dry contact relay. Which can be configured as normal operating open or fail safe, normally operating closed.

A durable, cast aluminum explosion-proof enclosure houses the sensor electronics. The enclosure provides sealing for hazardous areas - Class I, Division 1, Groups C, D. The sensor with a porous metal cover is assembled in an aluminum housing that screws directly into the electronics enclosure. The cover protects the sensor and acts as a flame-arrestor. The monitor can be installed up to 500 feet from the remote power source.

Model	Gas	Outdoor	Indoor	TTL	Relay	Buzzer
201-00	Combustibles	X		X	X	
203-00	H_2S	X		X	X	
206-00	CO	X		X	X	
2001-00	Combustibles		X	X	X	X
2003-00	H_2S		X	X	X	X
2006-00	CO		X	X	X	X

Table 1.1 Gas Module Configurations

2. Model 200X Series

The Model 200X Series consists of three separate gas monitors, Model 2001 for Combustibles, Model 2003 for Hydrogen Sulfide and Model 2006 for Carbon Monoxide. A red LED (light-emitting diode) and audible 70 dB alarm activate when the concentration of gas exceeds the factory-set (and user-adjustable) level. A green LED indicator on the monitor shows that power is connected and it is a safe condition.

The standard configuration has a buzzer and normally operating open relay. This configuration can be changed by the user. (See table 2.1)

The 200X-00 series module includes a AC-to-DC power supply that may be plugged into a standard AC source. The device may also accept 9 - 24 VDC.

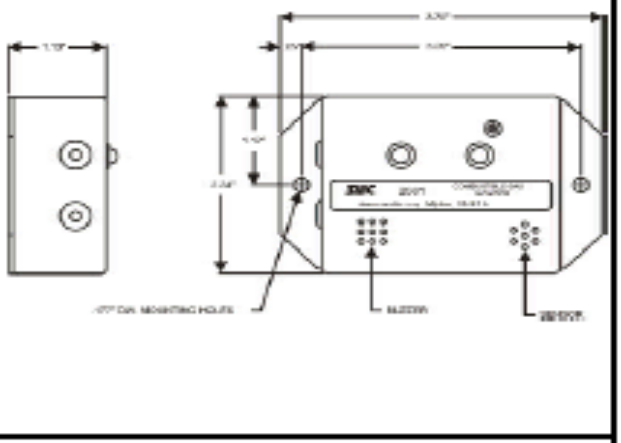


Figure 1.2
Outline View - 200X Series

3. Semiconductor-Type Sensor

A solid-state semiconductor-type sensor and associated electronic circuitry ensure trouble-free, long-term operation. All the electronic circuitry needed to operate the monitor, except the DC input power, is contained in a compact unit. There are no pumps, filters, or chemical cells to replace or maintain. Except for periodic calibration to verify the alarm setting, no attention is required after installation. The user may adjust the alarm level by applying a different calibration gas concentration.

A sensor self-check feature will flash the alarms on and off alternatively should the sensor fail (open circuit). The alarm flash includes LEDs, audible alarm, relay and alarm signal as applicable. On both the 20X and 200X series, the alarm output oscillates to indicate sensor failure.

4. Remote Alarm Available

If a remote alarm is desired, Sierra Monitor's Alarm Panel, Model 2102 Dual Channel can be connected up to 500 feet away from the monitors.

Instruction Manual

2.0 QUICK START

2.1 Overview

The Gas Sensor Module has been supplied factory calibrated and ready for immediate installation and operation. An installer familiar with installation and operation of gas detection products can use this section to begin immediate use of the monitor.

2.2 Wiring

Each module requires four-conductor wiring (two wires for power and two wires for the signal). See section 6.3 and Table 6.1 for wiring instructions.

2.3 Module Installation

1. Model 20X Series

The module can either be installed on the end of a 3/4" conduit, or attached to a vertical surface using the mounting flange on the enclosure. Two important warnings:

- The installation must meet any hazardous environmental codes for AC/DC Electrical Instrumentation.
- The sensor module enclosure mounting must be far enough away from any vertical surface to allow removal and replacement of the sensor assembly which is threaded into the second 3/4" conduit hub.

2. Model 200X Series

The Model 200X series are designed to mount on any indoor vertical surface. Mount the monitor in the desired location using the adhesive backing provided with the module or with screws through the mounting flange. All units are shipped with the plug-in AC/DC power supply connected to the monitor so the operator simply plugs the power supply into a nearby AC outlet.

- The installation must meet any hazardous environmental codes for AC/DC electrical instrumentation.

2.4 Wiring Connection

Terminal positions on the electronics board are as follows:

Terminal	Function
TB1-1	+ VDC (9 – 24)
TB1-2	GND (0VDC)
TB2-1	Relay NC (Normally Closed) or Output to Model 2102 Safe
TB2-2	Relay Common
TB2-3	Relay NO (Normally Open) or Output to Model 2102 Alarm

Table 2.1

Refer to section 6.3 for details on wiring the gas sensor module to a power supply or alarm panel.

2.5 Start-up & Operation

To begin operation of the Gas Sensor Module plug in the AC/DC power supply module (for the Model 200X Series) or provide 9 - 24 VDC from a regulated power supply such as one of the Sierra Monitor Alarm Panels, 2102-XX. Each time the sensor module is powered up it will perform a warm-up for 2 - 60 minutes.

During warm-up the monitor will, first, cycle through safe/alarm/safe condition at one hertz. This will be followed by a short period of continuous alarm before warm-up is completed.

(NOTE: For Models 206 and 2006 that have been off power for extended periods, the warm-up alarm may sound for several hours.)

2.6 Configuration

The default configuration for each module is to operate with a buzzer and a normally operating open (NOO) relay. The user can change this configuration using the jumpers provided. Refer to table 6.2.

Instruction Manual

4.0 CALIBRATION

4.1 Factory Calibration

The module has been factory calibrated to alarm as indicated in Table 4.1 or as marked on the calibration tag shipped with the module.

Calibration			
Model	Time	Gas	cc/min
201/2001	30 sec.	1000 ppm CH4	50
203/2003	1 min.	50 ppm H2S	50
206/2006	1 min.	100 ppm CO	50

Table 4.1

4.2 Frequency of Calibration

The manufacturer recommends that the calibration of each gas sensor module be verified monthly during the first three months of operation and then quarterly. More frequent checks are necessary during periods of extreme humidity and temperature changes. The monitor should have operated continuously (uninterrupted) for at least 24 hours prior to calibration adjustment.

4.3 Calibration Process

The output signal of the gas sensor module is calibrated using a calibration gas mixture containing a known concentration of the gas of interest and a balance of air. The concentration of the span gas must be within the full scale of the sensor module and must be equal to the alarm point desired.

Calibration requires application of the span gas to the sensor and adjustment of the sensitivity adjustment potentiometer.

Warning: During calibration the alarm will turn on and remote alarms connected to the alarm relays will be activated. Disable the remote alarm if necessary.

4.4 Equipment Required

The following tools and equipment will be required for calibration:

- Jewelers Screwdriver
- Calibration Gas
- Calibration gas delivery system

For accurate calibration use a gas mixture at the required concentration mixed in an air balance, rather than with an inert gas like nitrogen. This gas and the required delivery equipment such as the Model 1200-26 Calibrator is available from Sierra Monitor Corporation.

4.5 Calibration Procedure

1. The monitor should be in the safe condition prior to calibration (green LED "ON").
   - Be sure that the area is non-hazardous before proceeding.
   - Disable alarm devices
2. On the 20X, remove the cover prior to exposing the sensor with gas. On the 200X series (see Figure 1.1 or 1.2) the sensor is in the lower right hand corner of the electronics board and the cover does not need to be removed.
3. Apply calibration gas directly to the sensor.
4. If the monitor alarms (red LED "ON") within one minute and stops within one minute of the removal of the calibration gas, the monitor is in calibration and requires no adjustment.
5. If the monitor fails to alarm within one minute of the application of the gas, use a jeweler's screwdriver to adjust the sensitivity adjustment potentiometer (R4, Fig. 4.1) clockwise until the alarm turns "ON".
6. If the monitor fails to stop alarming within one minute of removal of the gas, adjust the potentiometer counterclockwise until the alarm stops.
7. After adjustment, repeat the application and removal of gas to verify calibration.
8. When the calibration is complete, reconnect any alarm equipment as necessary.

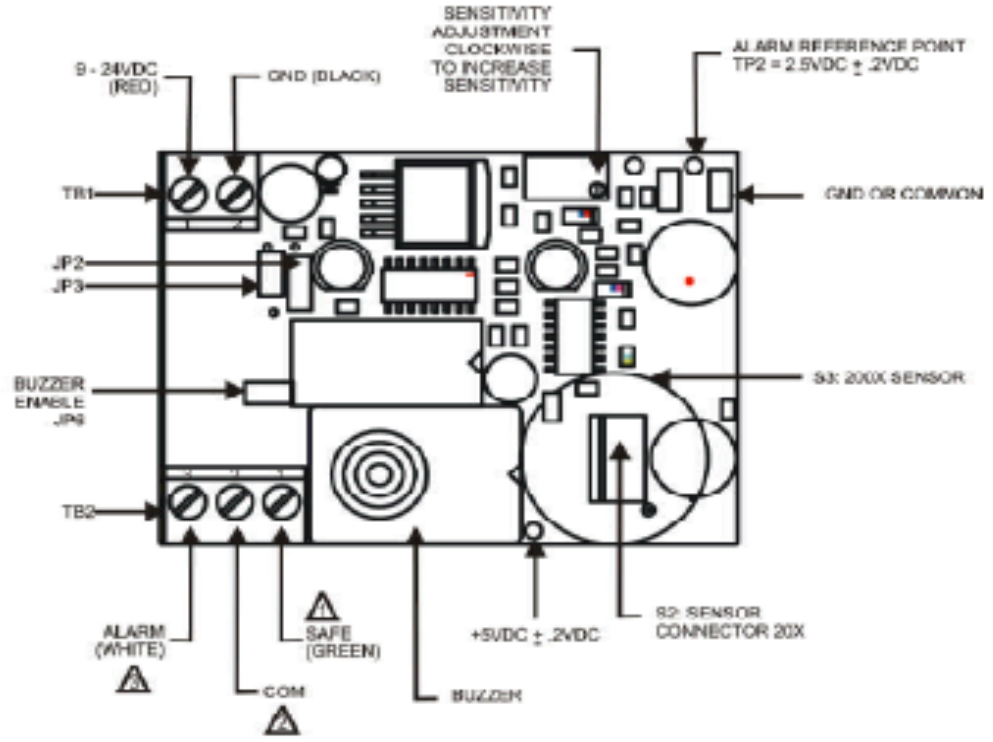


Figure 4.1
Electronics Board

Instruction Manual

6.0 INSTALLATION

6.1 Gas Sensor Module Locations

The gas sensor module is a diffusion type sensor that should be located close to the anticipated source or destination of the gas hazard. For heavy gases such as H_2S install the module within 24 inches of the ground. For lighter gases such as CO and combustible gases use a higher elevation.

After optimum locations are determined based on the above recommendations, consideration should be given to placing the sensors in locations that are accessible for calibration service. Slight adjustments to the location of the sensor may have little impact on effectivity but major effect on accessibility.

6.2 Mounting

1. Model 20X Series

Where possible sensor modules should be installed with the sensor facing vertically down. The lid of the sensor module should face out for easy access.

Sensors may be mounted directly onto the end of a vertical conduit, or bracketed to a vertical surface using the two mounting flanges. Insure that the body of the enclosure is at least 1" from the wall so that the sensor assembly can be rotated for removal and replacement.

2. Model 200X Series

Where possible sensor modules should be installed on a vertical surface. The module can be mounted either using screws through the mounting flanges or using an adhesive tape provided with the unit.

These modules are intended for use with the plug-in AC/DC power supply shipped connected to the unit. The module should be mounted in an area convenient for the plug-in power supply. The power supply is removed if connecting the module to a Sierra Monitor Alarm Panel.

6.3 Wiring

Interconnect wiring from the controller to the module is by 4 conductor 22 AWG (or lower AWG) cable, conduit as necessary. Shielding is not required. For installations where the distance from the controller to the sensor is greater than 500 feet, 18 AWG cable is recommended.

The terminal strip on the electronics board in the module. The wiring must be connected as indicated in Figure 6.1 depending upon the controller or relay configuration being used.

6.4 Power Supply

The power supplied by the controlling device or an external power supply must meet the following specifications:

Voltage: 9 - 24 VDC
Current: 250 mA

The Model 200X Series includes a plug-in AC/DC power supply.

Terminal	Function
TB1-1	+ VDC (9 – 24)
TB1-2	GND (0VDC)
TB2-1	Relay NC (Normally Closed) or Output to Model 2102 Safe
TB2-2	Relay Common
TB2-3	Relay NO (Normally Open) or Output to Model 2102 Alarm

Table 6.1

6.5 Alarm Configuration

The Model 20X/200X allows the user to select the alarm/output configuration using jumpers. Please refer to table 6.2 to determine how to configure the monitor for your required condition.

Model 20X or 200X Configured with Alarm Relay Output				
Configuration Jumpers				
Buzzer Active		Relay Operation		
Yes	No	Normally Not Energized		Normally Energized
Default		Default		
Install Jumper JP6	Remove Jumper JP6 (Best for 20X)	Install Jumper JP2 pins 1-2		Install Jumper JP2 pins 2-3
Wiring Terminations				
Power Supply		Output Terminals		
TB1-1	TB1-2	TB2-1	TB2-2	TB2-3
+ DCV (9-24 VDC)	0 DC Common	NC	Common	NO
Model 20X or 200X Configured for Interface to Model 2102 Alarm Panel				
Configuration Jumpers				
Buzzer Active		Relay Operation		Interface Selection
Yes	No	Normally Not Energized	Normally Energized	Model 2102
Default		Default		
Install Jumper JP6	Remove Jumper JP6 (Best for 20X)	N/A	N/A	Install Jumpers JP3 pins 1-2
Wiring Terminations				
Power Supply		Output Terminals		
TB1-1	TB1-2	TB2-1	TB2-3	TB2-2
+ DCV To Model 2102 Terminal J5 -2 or J6-2	0 DC To Model 2102 Terminal J5 -3 or J6-3	Safe To Model 2102 Terminal J5 -1 or J6-1	Alarm To Model 2102 Terminal J5 -	Not Used

Table 6.2
Jumper Configuration and Wiring Terminations

In addition, the TB2 contacts need to be properly selected to ensure that the Model 2102 receives the correct alarm signal from the Model 20X/200X. (See Table 6.2)

Relay Operation			
Normally Not Energized			
	TB2-1 NC	TB2-2 Common	TB2-3 NO
No Power	Connected		Open
Sensor Fail	Oscillating		
Safe	Connected		Open
Alarm	Open	Connected	
Normally Energized - Fail Safe			
	TB2-1 NC	TB2-2 Common	TB2-3 NO
No Power	Connected		Open
Sensor Fail	Oscillating		
Safe	Open	Connected	
Alarm	Connected		Open

Table 6.2
Relay Operating States

6.6 Explosion Proof Installation

Where area classification requires explosion proof (NEMA-7) installation, a sealing fitting will be required immediately above the gas sensor module enclosure.

7.0 SPECIFICATIONS

Sensor Type:	Solid-State Metal Oxide Semiconductor
Visual Indicators:	Green LED for Monitor "ON/Safe", Red LED for Alarm LEDs oscillate ON/OFF for sensor failure (LEDs are external on the 200X Series, and internal for calibration on 20X Series)
Input:	9 - 24 VDC (±1V), 250 mA 200X Series includes plug-in 120 VAC AC/DC Power Supply
Range:	(at 50% relative humidity)
Model 201/2001	300-2,000 ppm Hydrogen, 500-10,000 ppm Methane
Model 203/2003	10-50 ppm Hydrogen Sulfide (H_2S)
Model 206/2006	50-500 ppm Carbon Monoxide (CO)
Factory Alarm Setpoint:	
Model 201/2001	1000 ppm Methane
Model 203/2003	50 ppm H_2S
Model 206/2006	100 ppm CO
Output:	
20X/200X-00 Series	0.5 amp dry contact, normally open, 100 VDC, 130 VAC and audible buzzer Nominal 5 volts DC, source 25 mA, SAFE and ALARM signals are user configurable
Response Time:	
Model 201/2001	Less than 30 seconds
Model 203/2003	For 50 ppm alarm, if 50 ppm H2S is present: 1-4 minutes, if >250ppm H2S is present: 30-90 seconds
Model 206/2006	Less than 30 seconds
Periodic Maintenance:	None, other than routine calibration
Operating Temperature Range:	-4°F to 158°F (-20°C to 70°C)
Enclosure Material:	
Model 20X Series	Cast aluminum for protection against galvanic corrosion
Model 200X Series	Stamped aluminum sheet metal
Size:	
Model 20X Series	6.75 x 4.0 x 3.5 in. (17.1 x 10.2 x 6.0 cm)
Model 200X Series	2.7 x 2.2 x 1.0 in. (7.0 x 5.7 x 2.5 cm)
Weight:	
Model 20X Series	24 oz (678 g)
Model 200X Series	3.8 oz (108 g)

Instruction Manual

8.0 LIMITED WARRANTY

SIERRA MONITOR CORPORATION warrants its products to be free from defects in workmanship or material under normal use and service for two years after date of shipment. SMC will repair or replace without charge any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by SMC personnel.

All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without SMC approval or which have been subjected to accident, improper maintenance, installation or application, or on which original identification marks have been removed or altered. This Limited Warranty also will not apply to interconnecting cables or wires, consumables (ie. calibration gases, batteries, sensors), nor to any damage resulting from battery leakage.

In all cases SMC's responsibility and liability under this warranty shall be limited to the cost of the equipment. The purchaser must obtain shipping instructions for the prepaid return of any item under this warranty provision and compliance with such instruction shall be a condition of this warranty.

Except for the express warranty stated above, SMC disclaims all warranties with regard to the products sold hereunder including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of SMC for damages including, but not limited to, consequential damages arising out of/or in connection with the use or performance of the product.

9.0 INDEX

Instruction Manual

10.0 APPENDICES

Appendix A

Cross Sensitivity Reference Chart for Combustible Gas Sensor Modules (201 & 2001)

Combustible Gas Modules will alarm in the presence of each of the listed gases at the concentration listed.

Gas	Concentration (PPM)
Methane	1000
Acetone	350
Acetonitrile	1000
Acrylonitrile	1000
Acetylene	4000
Acetic Acid	700
n-Butane	800
I-Butane	800
I-Butanol	700
2-Butanol	1000
1-Butanol	1000
t-Butanol	2000
Butanoic Acid	500
n-Butylamine	1500
Butylene	2000
Chloroform	160
Chlorobenzene	150
Chlorocyclohexane	100
Cyclohexane	1200
Cyclopentane	700
Diethylamine	800
Diethylketone	700
Dipropylether	400
Ethane	300
Ethanol	300
Ethylene	600
Ethyl Chloride	70
Ethylnitrile	1500
Formic Acid	2000
Freon 113	55

Gas	Concentration (PPM)
n-Heptane	1500
n-Hexane	1100
1-Hexanol	1500
Hydrogen	400
Methanol	500
Methylene Chloride	90
Methyl Bromide	150
Methyl Chloride	150
Methyl Ethyl Ketone	500
Methyl Propyl Ketone	500
Nitroethane	1000
Nitromethane	2000
1-Pentanol	1200
Pentanoic Acid	500
Propanal	500
Propane	900
n-Propanol	300
I-Propanol	800
Propanoic Acid	200
n-Propylamine	1500
I-Propylamine	1000
Propyl Chloride	100
Propylene	2000
Pyridine	1000
Tetrachloroethylene	150
Trichlorethylene	70
Triethylamine	800

Appendix B

Accessories and replacement parts

Alarm Panels

Model 2102-00	Alarm Panel - 2 channel
Model 2102-01	Alarm Panel - 2 channel with audible

Calibration Accessories

1200-26	Gas Sensor Calibrator w/2 gas cylinders (specify gas type/conc)
1290-03	Gas Cylinder - Methane 5000 PPM
1290-04	Gas Cylinder - Methane 1000 PPM
1290-05	Gas Cylinder - Carbon Monoxide 100 ppm
1290-07	Gas Cylinder - Hydrogen 500 PPM

Replacement parts

SPD21513	Sensor for 203-00
SPD22034	Sensor for 201-00
SPD22035	Sensor for 206-00
SPD22107-201	Electronics Assembly for 201-00
SPD22107-206	Electronics Assembly for 206-00
SPF22107-2001	Electronics Assembly for 2001-00
SPF22107-2003	Electronics Assembly for 2003-00
SPF22107-2006	Electronics Assembly for 2006-00
SPD32057-1	Enclosure for 20X
SPF33003	Sensor for 2001-00
SPF33007	Sensor for 2006-00
SPF33008	Sensor for 2003-00
SPF69020	Power Supply 9 VDC for 200X

Sierra Monitor Corporation
1991 Tarob Court, Milpitas, CA 95035
(408) 262-6611

Appendix G

Multi-Spectrum Digital, Electro-Optical Radiant Energy Models SS2 & SS4 Fire Detectors

NOTE: Versum Materials, Inc. recommends customer always review and reference to the device manual shipped along with the ChemGuard equipment package, it is an indication a device in-use has accurate information such as operation, specification, calibration and maintenance schedule.

Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions

Fire Sentry Corporation

Multi-Spectrum
Digital, Electro-Optical
Radiant Energy

Models SS2 & SS4 Fire Detectors

Frequently asked Questions

Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions

TABLE of CONTENTS

Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions

Question	Answer
What is an Electro-Optical Radiant Energy Fire Detector?	An Electro-Optical Radiant Energy Fire Detector senses the electro-optical radiant energy emitted by a fire. The radiant energy comprises Ultraviolet (UV), Infrared (IR) and Visible (VIS) light spectra. (Fire Sentry uses visible light to provide additional rejection of false alarm sources). Nothing known travels faster than electromagnetic radiant energy (about 300,000,000 meters per second or about 186,000 miles per second), therefore, an Electro-Optical Radiant Energy Fire Detector is truly an early warning device for the rapid detection of a flaming fire.
What is meant by the Detector's Field of View?	The Field-of-View describes the actual area the Fire Detector is capable of seeing with its sensor "eyes". For example, if the Detector has a 120-degree Field of View, the coverage is 60 degrees to either side of the axis of the Fire Detector like a conical funnel. The SS2 and SS4 cover a volumetric area approximately four (4) times that of conventional flame detectors with 90 degrees field-of-view.
What is an Ultraviolet (UV) only Flame Detector?	A UV Flame Detector, which uses a Geiger-Mueller gas filled tube, detects radiant energy in the 185-250 nanometer (0.185 to .25 micron) UV region of the electro-optical spectrum. Solar radiation in this ultraviolet band is absorbed by the atmospheric ozone layer before reaching the earth's surface. Although "solar blind" UV Fire Detectors are sensitive to fires, they also have a propensity to false alarm to many non-fire sources of UV radiation, such as arc welding, quartz halogen lamps, lightning, sparks, X-rays, etc.
What is an Infrared (IR) Only Narrow Band Flame Detector?	An IR only Narrow Band Flame Detector is a device that senses "flickering" radiant energy in the 4.3-micron narrow band IR (CO_2 emission band) region of the electro-optical spectrum. Conventional Fire Detectors utilize *pyroelectric* or *thermopile* thermal IR sensors. These IR sensors function by detecting the absorption of IR energy (heat) on their substrate, but many non-fire IR sources (sunlight, hot manifolds, etc.) can fool these devices. To reduce false alarms, with *pyroelectric* or *thermopile* IR sensors manufacturers use narrow band optical filters in order to selectively focus on the unreliable and unpredictable carbon dioxide (CO_2) emission band. This region of the IR spectrum, known as the "CO_2 spike", is located at approximately 4.3 microns and is characteristic of well oxygenated, hydrocarbon fires.

Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions

What are some of the numerous Inadequacies and Shortcomings of Narrow Band Single, Dual and Triple-IR Band 4.3 micron IR Flame Detectors?

The inadequacies and shortcomings of using IR only Narrow Band (or "spike band") for flame detection are numerous. These shortcomings are the same whether or not one or two (**Dual IR** and "**Triple IR**") guard bands are used for false alarm rejection purposes:

1. Only fires that have carbon are detectable, and therefore they can only detect hydrocarbon fires. While it is true that most fires are hydrocarbon, many are not and are classified as non-hydrocarbon fires.

2. The narrow CO_2 band IR flame detectors are susceptible to blindness due to water absorption in any form (ice, snow, rain, dew, fog, condensation, water mist suppression, etc.) whether on its window lens or in the path between itself and the fire.

3. They can be blinded by CO_2 gas (which is used as a suppression agent) itself since Kirchoff's Law states a good emitter is also a good absorber."

4. If the fire is not well oxygenated, the output tends to shift out of the 4.3-micron band because more carbon monoxide (CO) is produced instead of carbon dioxide (CO_2).

5. There are also limitations associated with the use of narrow band optical filters. The physical characteristics of these interference type filters means that the maximum sensitivity to radiant energy is on axis. As the off axis angle increases, sensitivity diminishes considerably. The optical filter selected is the narrow band CO_2 emission spike that means that there is very little signal to detect in real world "dirty fires". The result is a flame detector with low sensitivity and narrow field of view.

What is a UV/IR Fire Detector?

Conventional UV/IR Flame Detectors use narrow band IR sensor in conjunction with Geiger-Mueller type UV tube for detection of fires in an attempt to reduce the numerous false alarms. While this was an improvement, these devices still had a low sensitivity, narrow Fields of View and false alarm to non-fire sources. They are limited to detecting only well oxygenated, hydrocarbon based fires and could not detect non-hydrocarbon fires such as Hydrogen and Silane.

What is a Multi-Spectrum Radiant Energy Fire Detector?

A Multi-Spectrum Radiant Energy Fire Detector senses radiant energy over a large region of the electro-optical spectrum. The Fire Sentry Models SS2 and SS4 Fire Detectors detect Ultraviolet, Wide Band Infrared and Visible light spectrums. Coupled with microcomputer intelligence and advanced digital signal processing software algorithms, this makes Fire Sentry Fire Detectors superior to conventional Electro-Optical Fire Detector currently available.

Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions

What is the Difference between a Flame Detector and a Radiant Energy Fire Detector?	The difference between a "flame" and "fire" detector is a flame detector senses primarily the molecular spike emission of flames. The cleaner and purer the flame, the better these type of detectors perform. The most common molecular flame emitter is the 4.3 micron narrow band generated by combustible carbon dioxide (CO2) molecules. A true radiant energy fire detector, on the other hand, senses all the radiant energy a fire produces, not just the flames itself, but also the hot Planckian blackbody particulate radiators that real-world "dirty fires" generate. To accomplish this, Quantum type WideBand IR sensors are used. The primary reason most manufacturers use the 4.3 micron band for sensing the flame component of fires, is the fact that detector requires no actual signal processing. Without sophisticated signal process algorithms to process the WideBand IR™ signals, the detector would generate an unacceptable level of false alarms. The Models SS2 and SS4 series Fire Detectors utilize sophisticated signal processing algorithms as well as the UV and visible spectral bands to provide the highest level of false alarm immunity in the industry and this has been proven in thousands of successful installations worldwide since 1990.
Why are the Models SS2 and SS4 Multi-Spectrum Fire Detectors superior to the conventional Narrow Band UV/IR Fire Detectors?	The conventional combination of UV and IR sensors slightly improved the performance of older Fire Detectors, but the use of *pyroelectric* or *thermopile* thermal type IR sensors greatly limits their response to real world fires. The type of IR sensor used by Fire Sentry Corporation in its SS2 and SS4 Detectors is a lead sulfide (PbS) *quantum* type that detects WideBand IR™ radiant energy in the 0.7 to 3.5 micron range. The Wide Band *quantum* IR sensor directly captures incident IR photons, giving it a much faster response. This type of sensor is *many* times more sensitive and responsive than *pyroelectric or thermopile* IR sensors used by other manufacturers. This Wide Band IR™ technology enables Fire Sentry's Electro-Optical Radiant Energy Detectors to detect in excess of 88% of a fire's total radiated energy, compared to less than 1% seen by older type *pyroelectric or thermopile* IR sensors with narrow band optical filters. PbS IR sensors are used by NASA, the Department of Defense and all branches of the military for many different sensing applications.
Why do the SS2 and SS4 detect all fires?	Since the Fire Sentry Models SS2 and 4 Fire Detectors do not rely on the unpredictable and unreliable narrow 4.3 micron band CO_2 emission spike, the SS2 and SS4 are able to detect all types of hydrocarbon and non-hydrocarbon fires, whether or not water in any form (such as ice on the lens) is present or carbon dioxide gas is present as a suppression release.
Why do the SS2 and SS4 use a Visible sensor?	The use of the Visible light spectrum enhances fire detection capability while increasing non-fire source rejection. The information from the multi-spectrum sensor array (UV, Visible, Wide Band IR™) is processed by solid-state, digital microprocessor technology, which utilize sophisticated digital signal processing software algorithms. (fires emit very little or no significant Visible band radiant light)

Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions

Do the SS2 and SS4 have Built-In Self-Test?	The SS4 Detector has automatic built-in "through the lens" self-test which checks the window cleanliness, checks the sensor response and carries out an electronics diagnostic test. The SS2 Detector does not have built-in "through the lens" self-test, although it does have internal self-checking tests.
How are SS2 & SS4 Detectors UV sensor tubes different from other manufacturers?	One of the largest costs of ownership for UV/IR Detectors is the short life expectancy of UV tubes. Older type UV tubes are prone to early failure and are expensive to replace. Fire Sentry's UV tubes are manufactured to the highest quality standards. Anodes and cathodes are fabricated from steel and the large area of glass sealing the anode and cathode wires ensures no leakage or cracking during vibration and stress. This makes Fire Sentry SS2 & SS4 Fire Detectors extremely rugged and suitable for use in high vibration areas. Other manufacturers have to replace their UV tubes periodically, but Fire Sentry UV tubes have been rated for a service life in excess of ten years.
Do the SS2 and SS4 require a dedicated Controller?	The Model SS2 & SS4 Fire Detectors can be used as stand alone, unitized devices that do not require a Controller. Integral Fire and Fault dry contact relays can be connected to a conventional fire alarm panel or a PLC. Each Fire Detector requires regulated 24 VDC power. An optional 4-20mA output is available if required with the Model SS4 series.
What is the SS2 and SS4 power consumption?	For the SS2 Detector, the power consumption is a low 56mA in quiescent state and 75mA in alarm. For the SS4 the power consumption is a low 68mA in quiescent state and 75mA in alarm. Fewer backup batteries are required for 24-hour backup, which means smaller, lower cost fire control panels are required.
When would it be useful to use a Controller?	When the end-user requires a fully intelligent, addressable system, the Model CM1-A™ Controller is the best choice. The proven Model CM1-A wall-mount Controller monitors up to 30 Model SS4 or SS2 Fire Detectors and is a fully addressable and intelligent system using Fire Sentry FireBusI™ RS-485 (4) wire loop communication. The CM series Controller has many advanced features. It functions as the system manager, provides power to the Fire Detectors and continuously monitors all devices on a 4-wire RS-485 loop. Fire and Fault history files, Tri-Mode Plot™ and FirePic™ are stored in non-volatile, solid-state memory, and can be accessed via the RS-232 port, using a PC computer and Fire Sentry's UC2000™ software. System status is shown on a backlit LCD display and there is a built-in audible alarm and battery back-up system.

Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions

What are the outputs from the CM1-A™ Controller?	The Fire Sentry CM1-A™ Controller has six (6) each 10 amp SPDT relays for Fire Alarm outputs. One relay is the Common (Master) Fire Alarm relay and the remaining four Fire Alarm relays can be configured by zone or voting preference. One 10-amp SPDT relay is available for Fault annunciation. An RS-232 port is also available for interfacing with a PC or Laptop computer operating Fire Sentry's UC2000™ software.
What are the wiring requirements between the SS2 and SS4 and the CM1-A™ Controller?	Four conductor shielded cable is required. Fire Sentry recommends a minimum of 18 AWG solid wire. Two conductors are for 24 VDC power and two conductors are for RS-485 communications, using FireBusI™ protocol. Using the RS-485 loop requires far less wiring than traditional "home run" installations and therefore saves on wiring and installation costs.
What is the power consumption of the CM1-A™ Controller?	Low power consumption: 115mA in quiescent state; 312mA in alarm. Battery backup is provided. Less battery backup is required for 24-hour backup that means less costly fire control panels.
What is FirePic™?	Fire Sentry's FirePic™ is the capability of the SS2 and SS4 Fire Detectors to record the electro-optical data immediately prior to the fire alarm being declared. This data is stored in non-volatile solid-state memory and can be downloaded using Fire Sentry PC software and Interface Box, or via a CM1-A Controller and PC software. This is essential information to have when postulating the cause of a fire, especially if a fire event was not immediately apparent.
What is SnapShot™?	With SnapShot™, both the SS2 and SS4 Detectors have the ability to record the real-time spectral energy response of the UV, visible and IR sensor array against test fires and false alarm sources. To do this, use the Fire Sentry Interface Box, the Fire Sentry PC Software, and a laptop or desktop PC computer. The resultant data can be plotted and analyzed using a graphing program such Microsoft Excel®. The ability to record real-time data is invaluable when optimizing the SS2 and SS4 Detectors against new, untested combustible materials and unusual false alarm stimuli.
What is Tri-Mode Plot™?	Fire Sentry's Tri-Mode Plot™ is the capability of the Fire Detectors to see real-time the UV, IR and Visible electro-optical data in the Field of View. Tri-Mode Plot can be used as a diagnostic tool to "view" the local environment and to ensure that the Fire Detector is not detecting a potential source of "friendly fire", such as a flare stack. It can also be used as a preventive maintenance tool for regular checking of the normal operation of the Fire Detector.

Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions	
Can the SS2 and SS4 Interface with PLC and DCS systems?	The SS2 and SS4 Detector can interface with a variety of third party systems, such as rack-mounted controllers, PLC and DCS systems via dry relay contacts. The SS4 Detector can be supplied with an optional 4-20mA output module for interfacing with PLC or DCS systems.
Is there a swivel mount for the SS2 and SS4?	A swivel mount, Model SM4, is available for aiming the Detector. This is a fully adjustable, calibrated 316 Stainless Steel mounting bracket.

This page intentionally left blank