Mini-GASS™

Sample Conditioning System

Featuring Nafion Membrane Drying Technology

Model MG-1228

User's Manual

Perma Pure LLC • A Halma Company • info@permapure.com • www.permapure.com Rev 04
Telephone: 732-244-0010 • Toll Free: 800-337-3762 • Fax: 732-244-8140
1001 New Hampshire Ave., Lakewood, NJ 08701 USA

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Caution Statement

CAUTION STATEMENT

Thank you for purchasing sample gas conditioning equipment from Perma Pure LLC. We want your new sample gas conditioning equipment to operate safely. Anyone who installs or uses this equipment should read this publication before installing or operating this equipment.

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and usually change with time. It is your responsibility to determine which codes should be followed and to verify the equipment, installation and operation are in compliance with the latest revision of these codes.

At a minimum, you should follow all applicable sections of the National Fire Code, National Electrical Code, and the codes of the National Electrical Manufacturer's Association (NEMA). There may be local regulatory or government offices that can also help determine which codes and standards are necessary for safe installation and operation.

Equipment damage or serious personal injury can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your system design, installation or operation. This product should not be operated in any manner that is inconsistent with its intended use.

If you have any questions concerning the installation or operation of this equipment, or you need additional information, please call us at 1-800-337-3762.

This publication is based on information that was available at the time it was printed. At Perma Pure we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without any obligation. This publication may also discuss features that may not be available in certain revisions of the product.

This equipment is to be installed and operated by trained personnel, with sufficient command of the English language to clearly understand the instructions and safety warnings.

Trademarks

Nafion™, Viton™, and Teflon™ are registered trademarks of The Chemours Company.

IMPORTANT SAFETY WARNINGS

Please be sure to review the following basic safety procedures. These procedures represent the MINIMUM requirements to operate the equipment safely. It is the ultimate responsibility of the operator to ensure proper safety practices are utilized at the point of operation.
NEVER attempt to operate this equipment in an explosive, wet, or otherwise hazardous area.
NEVER exceed any specified rating for the equipment. Temperature and pressure ratings must be closely observed and not exceeded. Voltage rating of the equipment MUST match the rating on the data label. Please make sure that it matches before powering up the equipment.
Condensate is potentially dangerous. NEVER handle drain lines, impingers or any other item that may have been in contact with the gas stream or any hazardous material, without adequate personal protective equipment. ALWAYS assume that any liquid present is hazardous.
Sample gas is potentially dangerous. A leak test is recommended at initial start-up and as often as necessary to maintain a safe working environment around the equipment. The gas stream exhaust must exit away from all personnel to prevent dangerous exposure.
NEVER operate the equipment with any part of the enclosure unsecured. All operated doors and covers must be in place and secured prior to operation. Electrical current may be present behind covers or doors, even if tools are not necessary to access these components.
NEVER attempt service on this equipment without first disconnecting all energy sources. Repair of this equipment should only be done by properly trained personnel that are familiar with the potential risks involved with servicing of the equipment.
NEVER operate this equipment if it is visibly damaged or the possibility exists that it may have been damaged.
The use of components that have not been purchased through an authorized Perma Pure dealer or directly from Perma Pure may compromise the safety of the operator. Additionally, use of non-authorized components may change the operating characteristics of this equipment. Any changes to the equipment, that modify its operation in any way, are dangerous, and are strictly prohibited.
Read the entire operating manual before attempting to set up or operate the equipment.
Please heed all warning labels on the equipment. They are there to remind you of possible hazardous conditions.
Verify the integrity of any connections that are made to the unit.
Verify that the unit is plumbed properly to operate effectively.

WARRANTY INFORMATION

Perma Pure (Seller) warrants that product supplied hereunder shall, at the time of delivery to Buyer, conform to the published specifications of Seller and be free from defects in material and workmanship under normal use and service. Seller's sole obligation and liability under this warranty is limited to the repair or replacement at its factory, at Seller's option, of any such product which proves defective within one year after the date of start-up (or within 18 months after original shipment at the discretion of Seller) and is found to be defective in material or workmanship by Seller's inspection.

Buyer agrees that (1) any technical advice, information, suggestions, or recommendations given to Buyer by Seller or any representative of Seller with respect to the product or the suitability or desirability of the product for a particular use or application are based solely on the general knowledge of Seller, are intended for information guidance only, and do not constitute any representation or warranty by Seller that the product shall in fact be suitable or desirable for any particular use or application; (2) Buyer takes sole responsibility for the use and applications to which the product is put and Buyer shall conduct all testing and analysis necessary to validate the use and application to which Buyer puts the product for which Buyer may recommend the use or application of the product by others; and (3) the characteristics, specifications, and/or properties of the product may be affected by the processing, treatment, handling, and/or manufacturing of the product by Buyer or others and Seller takes no responsibility for the nature or consequence of such operations or as to the suitability of the product for the purposes intended to be used by Buyer or others after being subjected to such operations.

SELLER MAKES NO OTHER WARRANTY, EXPLICIT OR IMPLIED, OF THE PRODUCT SUPPLIED HEREUNDER, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, AND ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY EXCLUDED. SELLER SHALL HAVE NO LIABILITY FOR LOSS OF PROFITS, OR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES UNDER ANY CIRCUMSTANCES OR LEGAL THEORY, WHETHER BASED ON NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILITY, TORT, CONTRACT, OR OTHERWISE. SELLER SHALL IN NO EVENT BE LIABLE IN RESPECT OF THIS ORDER AND OR PRODUCT DELIVERED ON ACCOUNT OF THIS ORDER FOR ANY AMOUNT GREATER THAN THAT PAID TO SELLER ON ACCOUNT OF THIS ORDER.

UNPACKING

Perma Pure has made every effort to ship you a high-quality product that has been thoroughly inspected and tested. It has been carefully packed to ensure that it arrives at your facility in good condition. Even though every effort has been made to prevent damage during transportation, damage can occur by the carrier. This is out of Perma Pure LLC's control and is the responsibility of the carrier to ensure that your equipment arrives intact and undamaged.
Inspect outside packaging. If there is any visible damage, inform the carrier at the time of delivery. ***This inspection is important! Once the package is signed for, responsibility for any visible damage then transfers to the consignee.***
Unpack your equipment. Visually inspect the outside of your equipment for any damage. If there is any damage, ***contact the carrier immediately***. Generally, a carrier must be notified within 24 hours of the delivery to make a hidden damage claim. Save the packing material in the event a damage claim must be verified by the carrier.

Items in the carton include:
(1) Mini-GASS sampling system
(1) Heated line seal fitting
(1) Mounting feet
(1) User's Manual
(1) Quality Assurance Checklist

If any of the above parts are missing or damaged, contact Perma Pure at 1 (800) 337-3762.

Introduction

General description

Perma Pure Mini-GASS sample gas conditioning systems are designed to prepare a gas sample stream for analysis. The Mini-GASS system will condition moisture containing sample gas, eliminating acid mists or with an optional Ammonia Scrubber (if present) remove ammonia without removing the compounds being monitored.

Proven tube-in-shell membrane technology is the basis of the Mini-GASS™ Conditioning System, which selectively and passively removes water vapor from a gas stream. The driving force is the water vapor pressure differential between the sample gas and the purge gas counter-flowing around the membrane tubing. This effectively dries the sample gas to very low humidity, much lower than can be achieved by a typical thermoelectric cooler and without losses of water-soluble gases.

The Mini-GASS standard features include a heated enclosure, particulate and/or coalescing filter, Nafion® gas dryer, temperature controller and dryer purge flow controls. There are also options which may have been included in your system.

Standard Features

- Heated Enclosure
- Filter(s) – Particulate and/or Coalescing
- Perma Pure Nafion™ Gas Dryer(s)
- Temperature Controller
- Dryer Purge Flow Controls
- Purge gas eductor

Options

- Purge Air Dryer
- Heated Head Sample Pump
- Automatic Filter Drain- vacuum or pressure types available
- Ammonia Scrubber(s)
- Z-Purge- for hazardous classified areas
- Probe Filter and Hastelloy Heat Exchanger

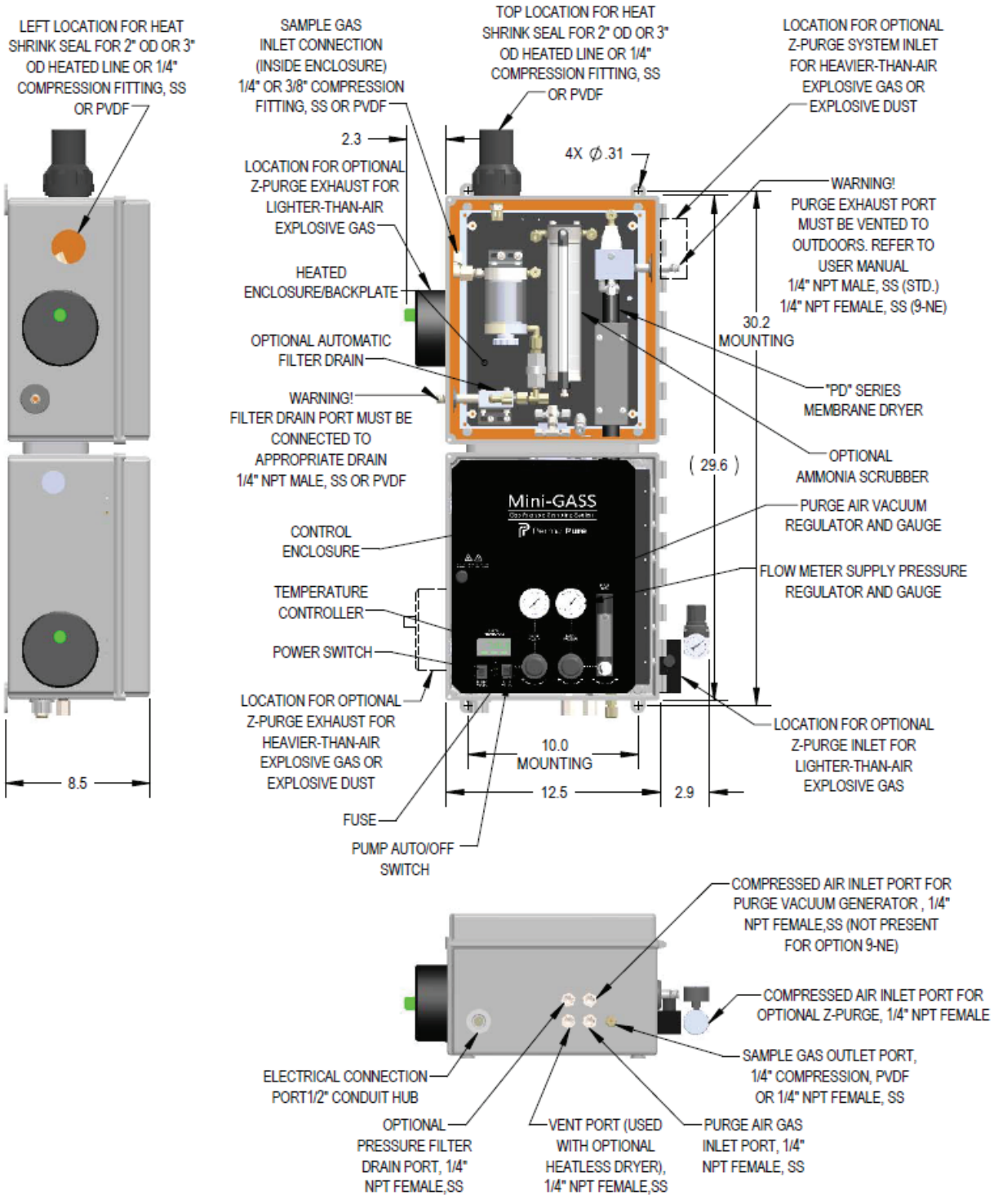

Figure 1 - General System Layout

Specifications and Features

Specifications:	
Physical	
System mount connection	Wall mounted
Enclosure ratings	UL 508A Listed; Type 4, 4X, 12, 13; File No. E61997cUL Listed per CSA C22.2 No 94; Type 4, 4X, 12, 13; File No.E61997
Sample gas tubing connections	1/4" or 3/8" tube compression, Kynar® (PVDF) or 316SS
Umbilical line seal, optional	Heat shrink style, 2" or 3" min expanded I.D.
Weight	Approximately 45lb.(24.4kg) depending on selected options
Utility Requirements	
Electrical requirement	115V ±10% / 230V ±10%, 5.0A/2.5A, 50/60Hz
Compressed/instrument air requirements	30-100 psig (2-7 bar), 1 scfm (28 slpm) Instrument air required only when optional "Heatless" air dryer is not included
	60-100 psig (4-7 bar), 2 scfm (56 slpm) Compressed air required when optional purge air dryer,"Heatless dryer" is included.
	Additional 2 scfm (56 slpm) required as cooling air when the sample pump is included
Drain/exhaust requirement	.25 scfm (7 slpm) air with entrained acidic mist. Operates in a timed cycle. Not continuous.
Environmental	
Temperature range, Operational	-20°C to 40°C ambient temperature
Humidity range, Operational	0-95% RH
Sample Gas Limits	
Temperature	275°F (135°C)
Pressure	Maximum 20 psig
	Minimum 5" H2O vacuum without purge eductor (9-NE option)
	Minimum 5" Hg vacuum with purge eductor (standard)
Humidity	Maximum 30% by vol., ~63C dew point
Control and Electrical	
Temperature controller	PID type with low temperature alarm
Heater type	480watt silicone pad heater on enclosure back panel
Alarm outputs	SPDT relays, 3A, 250VAC (de-energized in alarm state). Screw terminal connection.
	one set of SPDT relay contacts available for low purge air flow alarm
	one set of SPDT relay contacts available for low temperature alarm
Materials	

System enclosure	Fiberglass reinforced polyester
Insulation	Silicone rubber foam
O-ring seals	FKM
Sample gas path fittings and tubing	PVDF/FEP or 316SS
Filter housing	PVDF (PVDF) / Glass shell or 316 SS / glass shell
Sample gas filter coalescing element	Glass Fiber, 0.01 um, 95% efficiency, Coalescing

Installation

The system enclosures are constructed of Fiberglass Reinforced Polyester and are rated UL / CSA Type 4x (see Specifications page for complete standards/certifications ratings)

Mounting MG-1228W

1. Install Mini-GASS 1228W system on vertical surface with dryer/filter compartment on top and control compartment on bottom.

1. The Mini-GASS is suitable for outdoor installation. If installed outdoors, it is highly recommended to install it in a location that does not get direct sunlight or provide a method of shading the system. In addition, a method of protecting the system from direct rain is also highly recommended.

3. Install provided mounting feet on each corner of enclosure with ends protruding vertically.

Mounting MG-1228P

1. Remove the protective plastic cap and install the threaded pipe flange on the filter at the back of the system with the raised face side facing outward. Tighten the threads and stop when the orientation of the bolt holes in the flange matches that of the stack nozzle it is being installed on.

2. Install the stinger pipe into the ½" NPT port in the filter at the back of the system and tighten with a pipe wrench.

3. Install the system on the stack nozzle with a gasket between the flanges and install the flange bolts. Tighten all bolts initially finger tight to assure proper alignment. Tighten bolts in a crisscross pattern.

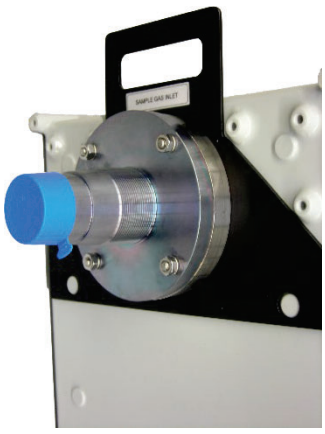

Figure 2 – MG-1228P Mounting

Plumbing Connections

Refer to drawing MG-1228-01-31, and section below for location of plumbing connections.

Refer to drawing MG-1228-04-17 and section below for electrical connections.

Heated sample line (Sample gas inlet)

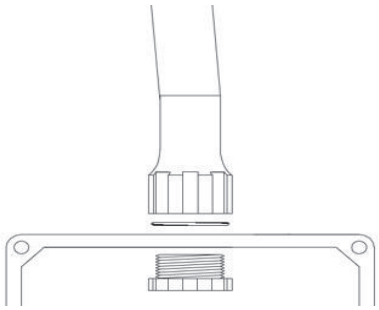

Figure 3 – Heated Line Seal

1. Install heated line sealing fitting by threading the male hub into sleeve.

2 Ensure O-ring seal is installed on outside of enclosure (between sleeve & enclosure wall).

3 Run heated sample line through entry seal and into enclosure.

4 Connect sample line to compression fitting (labeled "Wet Sample In")

5 ***Important -***Shrink entry seal tubing around heated sample line with heat gun or otherwise seal the heated line to the enclosure to prevent heat from escaping the enclosure.

Sample gas outlet

Connect sample outlet port of Mini-GASS to the sample line connected to the analyzer(s). High temperature heated line is not necessary for this connection. If sample line will be exposed to freezing temperatures, freeze protected line is recommended.

Compressed air connections

There are up to three air connections to be made to the system depending on the included options. See Figure 4 below.

1. Compressed air for the purge vacuum eductor system.

2. Compressed air or instrument air for the dryer purge.
   a. Clean compressed air can be used for systems that include the purge air dryer.

   b. Instrument air must be used for systems that do not include the purge air dryer

3. Compressed air for the hazardous area Z-purge system.

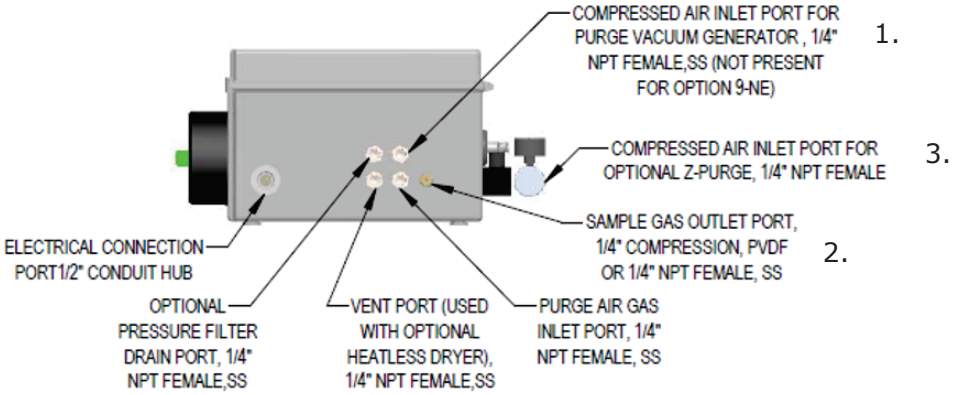

Figure 4 - Compressed Air Connections

Nafion Dryer Purge air exhaust

WARNING!

FAILURE TO PROPERLY VENT THE SYSTEM MAY RESULT IN PERSONAL INJURY AND/OR PROPERTY DAMAGE!

The gas exhausted from the purge exhaust port under normal operation is humid air. However, in the event of an internal failure of the PD sample gas PD dryer installed in the system, the exhaust may contain sample gas that may be hazardous. The purge exhaust must be permanently routed to a vent system or directly outdoors. Do not allow the purge to vent into a structure or confined space.

Connect tubing or pipe of an appropriate material from the purge exhaust outlet to a permanent vent designed for this type of discharge. 1/4" I.D. tubing can be used for runs up to 10 feet. Use larger I.D. tubing for longer exhaust lines. Too small of an ID and/or too long of a piping run will cause inadequate purge vacuum performance or collapse of the dryer membrane tubes resulting in poor drying performance and/or high sample gas flow restriction.

Filter Drain

WARNING!

FAILURE TO PROPERLY CONNECT THE FILTER DRAIN PORT MAY RESULT IN PERSONAL INJURY AND/OR PROPERTY DAMAGE!

Connect the line from the filter drain outlet to designated collection/exhaust basin capable of accepting acid mist and the sample gas present at this location.

Connect tubing or pipe of an appropriate material from the drain outlet to a permanent drainage system designed for this type of discharge.

For vacuum style drains:

Connect line from drain outlet to a sealed, designated collection/exhaust drain, or basin containing acid absorption media, to prevent release of exhaust to surroundings. 1/4" I.D. tubing can be used for runs up to 10 feet. Use larger I.D. tubing for longer exhaust lines. Too small of an ID and/or too long of a piping run will cause inadequate drain performance. For this reason, the number of elbows should also be kept to a minimum.

For pressure style drains:

Tubing with an ID of at least 1/8" is adequate.
Connect line from drain outlet to a sealed, designated collection/exhaust drain, or basin containing acid absorption media, to prevent release of exhaust to surroundings. 1/4" tubing can be used in most cases.

Electrical Connections

Main Power

Mini-GASS Model 1228 has a terminal strip for connection of mains voltage.
Due to the many variations in local requirements, the user is responsible for supplying the appropriate wiring and hardware that complies to local electrical codes and/or regulations.

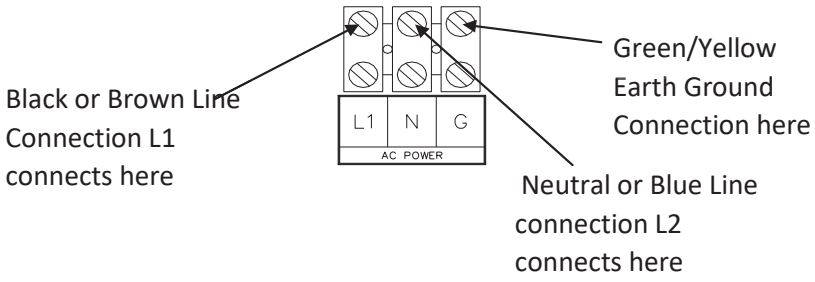

Figure 5 – AC Power Connections

Alarm Relays

The alarm relay connections are made via 6 pole terminal block that will allow for field wiring of alarm relays for connection of external alarm equipment (refer to figure 6). These connections will change state when the purge air flow and the low dryer temperature is reached. Likewise, if purge flow should drop below the minimum recommended rate the alarm relay would change state. If the dryer temperature drops below the alarm setting the alarm relay would change state.

Loss of power to the equipment will also change the alarm relay state.
When power returns, the Mini-GASS will restart providing the power switch is still in the "On" position.

Since both alarm relays are energized during normal operation, both alarm outputs will trigger during a power failure.

Relay contacts are rated at 250 VAC, 3A, resistive.

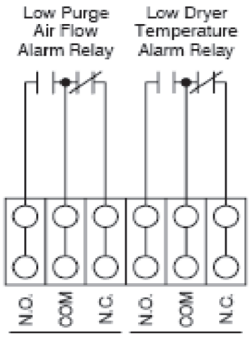

Figure 6 - Alarm Wiring Connections

System operation

External, downstream, sample pump connection/operation

WARNING!

If an external sample pump is used *with the pump plumbed downstream (after) the Mini-GASS system*, the optional purge eductor is *required*.
The purge eductor must be adjusted to prevent potential damage to the Nafion dryer

The external downstream pump configuration assumes that the sample gas stream is being pulled through the system and is therefore under a negative pressure. The purge eductor vacuum regulator should be set so that the gauge indicates 5" Hg. The purge eductor is used to balance the pressure difference between the sample gas stream pressure and the purge air pressure within the Nafion Dryer. Without this control on the purge pressure, vacuum drawn on the sample gas stream could potentially collapse the Nafion dryer tubes.

NOTE: If an external sample pump is used upstream of the Mini-GASS there will likely be additional maintenance required for the pump due to the presence of wet potentially corrosive gas. Use of the purge gas eductor is not necessary in this situation, because the sample gas exiting the sample pump and entering the PD Nafion Dryer will be at a positive pressure.

External, upstream, sample pump connection/operation

If an external sample pump is used upstream (before) the Mini-GASS there will likely be additional maintenance required for the pump due to presence of potentially corrosive, wet gas. In this case, the pump head must be actively heated to prevent condensation of liquid in the sample line. Use of the purge gas eductor is not necessary in this situation, because the sample exiting the sample pump will be at a positive pressure. The purge eductor may be turned off to reduce air consumption by turning the regulator fully counterclockwise.

Internal Sample Gas Pump option

Operation –

The internal sample gas pump is connected internally to move the sample gas stream through the system. Included with the sample pump plumbing is a 10psi check valve that functions as a pressure relief. In case the sample gas outlet flow is restricted below the inherent flow of the pump, which is typically the case, the check valve will open at 10psi and vent the excess flow back into the inlet port of the pump. This prevents the sample gas from exceeding 10 psi.

Motor Cooling –

The internal sample gas pump is mounted so that only the sample pump head is in the heated upper enclosure while the pump motor is in the lower control enclosure.

An air-cooling manifold is provided in the electrical enclosure to help cool the sample pump motor. A vent near the motor is included as an exhaust for the hot air.

Setup Check

Utilities

- Check that all relevant electrical and pneumatic connections have been made.
- Turn on compressed/instrument air to system.

Z-Purge (Optional) For Class I, Division II hazardous areas

If this option is included, a Z-Purge system, Cyclops, manufactured by Purge Solutions is installed at the factory based on the customer's selection of the type of explosive gas or dust present. Refer to the Purge Solutions Cyclops installation and user manuals.

WARNING!

It is up to the installer/customer to ensure that the system receives the proper local electrical inspections and certifications before powering the system.

Automatic Filter Drain Control (Optional)

The Automatic Filter Drain is controlled by an electronic cycle timer. The electronic cycle timer is located on the back side of the lower enclosure's control panel.

The cycle timer has two sets of (referred to as "DIP") switches which are located on the electronic cycle timer to provide a control for the drain and cycle time intervals.

The left set of DIP switches are selected to control drain time interval (length in time that the filter drains) and the right DIP switches control the cycle time interval (how often the drain is cycled)

NOTE: Standard factory setting is to drain for 0.1-minute (6 Seconds) once every (1) hour.

NOTE: Time unit settings on the sets of DIP switches of the electronic timer are additive.

Drain Time Interval ("ON Time"; left DIP switch setting)	Range is 0.1 minutes (1st switch on – all others off) To 102.3 minutes (all switches on)
Cycle Time Interval ("OFF Time"; right DIP switch setting)	Range is 1 hour (1st switch on – all others off) To 1023 hours (all switches on)

1. Adjust purge air pressure regulator to about 15PSIG. This regulator also supplies compressed air for filter drain, if equipped.

   Sample under vacuum: The purge air pressure regulator controls air pressure to the drain eductor of the automatic filter drain. This affects the vacuum applied during the drain cycle. The pressure regulator must be set to provide ample vacuum to remove collected condensate but not excessive enough to cause interruption in sample gas flow to analyzers. If the sample flow is being affected during the drain cycle, reduce the pressure slightly until the flow is no longer affected. The purge flowmeter will also need to be re-adjusted when the pressure changes.

   Sample under positive pressure: Condensate drain flow is directly controlled by a solenoid valve. When the solenoid valve is actuated (opened), positive pressure in the filter housing will push condensate out of the system through a drain line to the bottom of the Mini-GASS.

2. Initial adjustments of DIP switches on the electronic drain timer are set to drain for 0.1-minute (6 seconds) every (1) hour. Monitor fluid level in coalescing filter and adjust as necessary to minimize fluid accumulation. Time periods may need further adjustments after Mini-Gass system has been in operation. Cycle the system power after changing settings.

CAL 3300 Electronic Temperature Controller

Setpoint adjustment

1. Press and hold "★" key on the CAL 3300 temperature controller.
2. Press either the up or down key to adjust setpoint. Setpoint temperature will change one °C with each press of arrow key. Holding the key will cause the setpoint to change rapidly.
3. When the desired temperature setpoint is reached, release both keys.

Low Temperature Alarm

The Mini-GASS systems have a low temperature alarm that is programmed into the controller.

The default low-temperature setting for alarm is 5°C below setpoint temperature.

Safety Interlocks

Mini-GASS systems are equipped with two safety interlock relays which also control the optional internal sample gas pump. These relays are double pole and double throw (DPDT) type. One set of contacts in each of the two relays is used for internal controls. The second set of contacts can be used for external alarm(s) interface, sample gas flow solenoid valve or external sample pump control. The external alarm relays can be wired either in an "OR" (parallel) or "AND" (series) configuration. It is suggested that whichever method is used, that the Normally Open contact set(s) are used. Connected this way, if the Mini-GASS system should lose power, the contacts would open, triggering an external alarm or stopping sample gas flow. This could alert the operator that there is an issue and at the same time prevent unconditioned, wet, sample gas from flowing into an analyzer.

Low purge air flow – This relay is electrically connected to monitor the dryer's purge gas flow. The relay will energize when the purge gas flow for the dryer is above the minimum flow rate. To accomplish this, a differential pressure switch is installed between the inlet and outlet of the dryer purge to sense the flow of purge gas. It sends power to the relay coil when a pressure difference related to the minimum flow of 10lpm is sensed.

Low temperature - This relay is electrically connected so that it will energize when the temperature of the dryer purge gas exhaust is no more than 5^{o}C below the temperature setpoint as indicated on the temperature controller.

Under normal operating conditions both safety interlock relays will remain energized. i.e. When the system is operating normally, normally open contacts will close and remain closed.

Preheating the Mini-GASS system

WARNING!

On AC powered units, temperature control display should light when power is turned "On".

DO NOT BEGIN SAMPLE FLOW AT THIS TIME!

Check that purge air is flowing after turning on AC power.

If for any reason there is no purge air flow or air flow is inadequate, turn off AC power prior to attempting to locate the purge air flow issue.

1. Turn on mains (AC) power to system.
2. Set purge gas pressure to 15PSIG.
3. Adjust purge air flow to 20 L/min for initial start.
4. Ensure purge air is exhausting from system.
5. Set purge air eductor vacuum level to 5 in-Hg.
6. The temperature controller will be alternately displaying "**–AL–**" and the actual purge air exhaust temperature until the temperature comes within 5°C of setpoint temperature. If equipped with the optional internal sample pump, the pump will begin operating at 5°C below the setpoint.
7. Expect the system to take about 45-60 minutes to come up to the temperature setpoint. The controller is set to "ramp" the temperature at a rate of 60C/hr. This prevents overheating of the dryer. *Note:* Initially the heaters may overrun the ramp rate causing the temperature controller to temporarily turn off its output.

NOTE: Do not start sample gas flow until the Mini-GASS System has fully heated and allowed to warm up and both alarms are off.

System Fine Tuning

An important note about dryer performance and lifespan is that lower temperature is better for both. Lower outlet humidity will be achieved when the system is operated at the lowest temperature possible while still preventing visible condensate between the filter and dryer.

1. The temperature set point should be set to ~5°C above incoming sample gas stream dew point temperature. This refers to the water dew point, not the acid gas dewpoint, assuming there is acid gas present. If acid gas is present, its dew point will typically be much higher than the maximum temperature the system can be operated. In this case, the acid gas mist and condensate present in the sample stream will be collected in the coalescing filter. This is the primary function of the filter.

2. Visually check that no condensate is present in sample line between filter and dryer.

3. If water droplets are visible, increase the set point on temperature controller by 5° C.

4. Allow about ½ hour for system to stabilize and then check again for condensate.

5. If necessary, continue to increase temperature in 5° C increments until condensate is no longer visible.

Do not exceed 100°C for the PD Nafion Dryer! Operation above these temperatures can cause damage to Nafion dryer. It is essential that purge gas flows continuously and setpoint temperature is not increased above 100°C for the to prevent possible damage to the dryer.

Maintenance

WARNING!

Most sample gas is hazardous. Care must be taken when opening the enclosures. To be safe, always assume that hazardous sample gas is present. Utilize appropriate Personal Protective Equipment (PPE) to mitigate the potential hazard.

Be aware that leaks may allow the sample gas to build up inside the enclosure.

Any components within the sample stream, including connecting tubing and piping, may contain hazardous materials.

Take appropriate precautions, including PPE suitable for handling the sample gas and any hazardous materials, along with appropriate ventilation, to prevent unsafe exposure to concentrations of hazardous gas and materials.

Coalescing Filter

The Coalescing Filter element should be checked regularly to ensure that the element is in good condition. Perma Pure Coalescing Filters in the Mini-GASS system are designed to remove liquid mist and droplets from the gas stream. The flow of the filter is from the inside of the element outward. Liquid will collect in the bottom of the filter assembly. The collected liquid is then drained away either manually, or automatically by the system.

Particulate in the gas stream can also build up on the interior surface of the filter. The element must be removed for inspection and should be replaced at regular intervals.

If the element appears to be dirty or begins to cause flow restriction in system, it should be replaced. If it appears that there is excessive liquid in the bottom of the filter housing, adjust electronic drain cycle timer to a shorter interval so that coalesced liquids are drained away more frequently.

Coalescing Filter Element Replacement

1. Loosen bolt on bottom of filter.
2. Gently pull apart assembly and remove old element.
3. Place new element into grooves in top and bottom of housing.
4. When re-assembling, inspect for O-rings on top and bottom caps and on center bolt.
5. Install glass shell onto bottom piece.
6. Place new element (PN FF-250-E-2.5G) in groove in bottom piece. Be sure that element is seated correctly and parallel to glass shell.

7. Carefully mate bottom assembly onto top piece. Slight twisting motion may be required to allow shell to slip over O-ring seal.
8. Visually make sure element is seated correctly in top groove.

Replace bolt through hole in bottom piece and screw clockwise into top piece. (Continued)

NOTE: Do not over-tighten center bolt. It should be just tight enough so it does not vibrate loose. Over-tightening will not help the filter to seal.

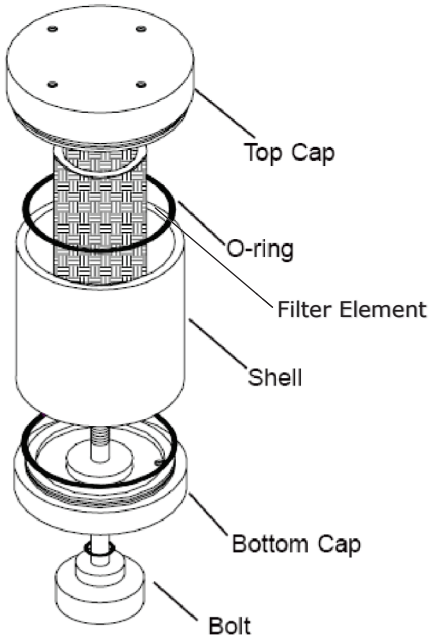

Figure 7 - Filter Element Replacement

PD Nafion Dryers

Under normal conditions, Perma Pure PD Nafion Dryers require little maintenance and can last for several years. However, if there is no pre-filter and the tubing becomes clogged or saturated with water, the dryer and/or dryer element may require replacement.

NOTE: When disassembling the dryer, the end fittings on the PD Nafion Dryer can be easily rotated on the shell tube. This rotation should be avoided to prevent twisting the membrane tubes inside the outer shell. Permanent damage to the Nafion element can result from mishandling.

Refer to Appendix A for PD dryer element replacement.

Please contact Perma Pure LLC for a replacement dryer assembly.

Ammonia Scrubber

NOTE: Always wear eye protection, protective gloves, and any other personal protective equipment necessary, when handling Ammonia Scrubber media. A dust mask is recommended.

Media Replacement: When deposits are visible on 75% of the scrubbing media, scrubbing media needs to be replaced.

Wear appropriate PPE, gloves, safety glasses, the media is acidic.

1. Unscrew thumbscrew on bottom of housing. Newer models will have a spring-loaded plunger pin that is simply pulled to release the yoke.
2. Swing yoke to one side.
3. Separate housing and bottom cap as an assembly from top cap.
4. Remove spring and top screen.
5. Remove old media and dispose of properly (rinse housing with soapy water to clean).
6. Fill housing with 50cc of Burl Saddles (tap housing to allow material to settle).
7. Pour 150cc of Scrubbing Media (tap housing to allow material to settle).
8. Replace stainless steel screen on top of media.
9. Replace spring on top of screen.
10. Clean O-rings on shell and inside top manifold (replace if necessary).
11. Place center tube into O-ring seal in top cap.
12. Push and twist to seal housing around O-ring.
13. Replace yoke and finger tighten thumbscrew (**do not over tighten**) or on newer models, reinsert spring-loaded plunger pin.

System Fuse

1. A blown fuse is an indication of a possible malfunction.
2. Turn cap marked "FUSE" counterclockwise ¼ turn and the fuse holder will come out.
3. Remove the blown fuse and replace with one of equal amperage rating. The standard fuse is a BUSS type AGC or equivalent.
4. After installing correct replacement fuse, re-install fuse holder by pressing inward and twisting ¼ turn clockwise.

NOTE: If the system has blown two fuses, service is most likely needed by qualified personnel.

Replacement Parts

MG-DTC	Digital temperature controller, single channel
MG-TCS	J-Type thermocouple
MG-SSR	Solid state relay
MG-FM	Flow meter, purge gas (0-60 lpm)
MG-PR	Pressure regulator, purge gas or vacuum eductor
MG-DPS	Differential pressure switch for purge flow detection
MG-PG-0-30	Pressure gage, purge gas (0-30 psi)
MG-VG-0-60	Vacuum gage, purge eductor (0-30" Hg)
SV-K10	Safety interlock solenoid valve, Kynar, 110V/60Hz
SV-K20	Safety interlock solenoid valve, Kynar, 220V/50Hz
FF-DCV	Drain check valve, polypropylene, for vacuum drain
DVV-B10	Drain solenoid valve, brass, for vacuum drain 110V/60Hz
DVV-B20	Drain solenoid valve, brass, for vacuum drain 220V/50Hz
DVP-K10	Drain solenoid valve, Kynar, for pressure drain 110V/60Hz
DVP-K20	Drain solenoid valve, Kynar, for pressure drain 220V/50Hz
MG-DVT	Drain valve timer
MG-DC	Mounting clamps for dryer (specify dryer model)

Replacement PD Nafion Dryers

All current PD Nafion dryers have one piece end fittings.

PD-50T-24MKA	50 tubes, 24" length, PVDF fittings, anodized aluminum shell
PD-100T-24MKA	100 tubes, 24" length, PVDF fittings, anodized aluminum shell
PD-200T-24MKA	200 tubes, 24" length, PVDF fittings, anodized aluminum shell

Replacement Elements for PD Nafion Dryers

With one-piece end fittings

PD-50T-24E-M	50 tube dryer replacement element, 24" long, includes O-rings
PD-100T-24E-M	100 tube dryer replacement element, 24" long, includes O-rings
PD200T-24E-M	200 tube dryer replacement element, 24" long includes O-rings

Coalescing Filter Parts

FF-250-E-2-5G	0.1um glass fiber, coalescing filter element

APPENDIX A

PD Dryer Element Replacement

Dryer Disassembly

Tools Needed:

- Phillips head screwdriver
- unsharpened pencil with eraser

1. Loosen locking screws on both ends of dryer.
2. Insert eraser end of pencil into one sample port until it rests on tube header face (Refer to figure 7).
3. Hold dryer vertically and place other end of pencil down onto a hard, slip resistant surface.
4. While supporting shell tube, push lower end fitting down with consistent pressure until it slips off shell tube.

   Do not attempt to pull fitting from shell tube; doing this is likely to damage dryer element tubing.
5. Repeat steps 2-4 for the opposite end.
6. Remove one O-ring from tube header.
7. Pull tube element from opposite end of dryer.

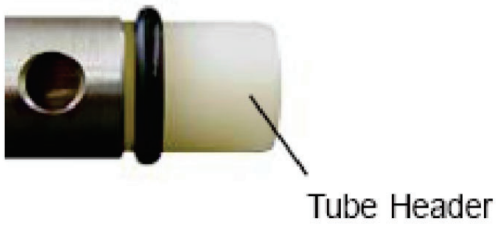

Figure 8– PD Dryer Disassembly

Dryer Assembly

Tool Needed:

- Phillips head screwdriver

1. Install one thick O-ring onto grooved tube header.
2. Slip opposite tube header into dryer shell. Check for Alignment.
3. Install other thick O-ring onto groove.
4. Push one thin O-ring into groove inside coupling (for SS and AL shells slip O-ring on shell across the two holes).
5. Firmly push coupling over tube header.
6. Align purge port with hole in shell tube (Refer to Figure 9).
7. Tighten locking screws until underside of screw head contacts top of boss.
8. Repeat steps 4-7 for opposite end.

Figure 9 - PD Dryer Assembly

PARTS LIST		
ITEM	QUANTITY	DESCRIPTION
1	2	SCREW, 10-24 x 3/8" SS
2	2	COUPLING
3	2	ELEMENT HEADER SEAL, VITON
4	2	SHELL TUBE SEAL, VITON
5	1	DRYER ELEMENT
6	1	SHELL TUBE

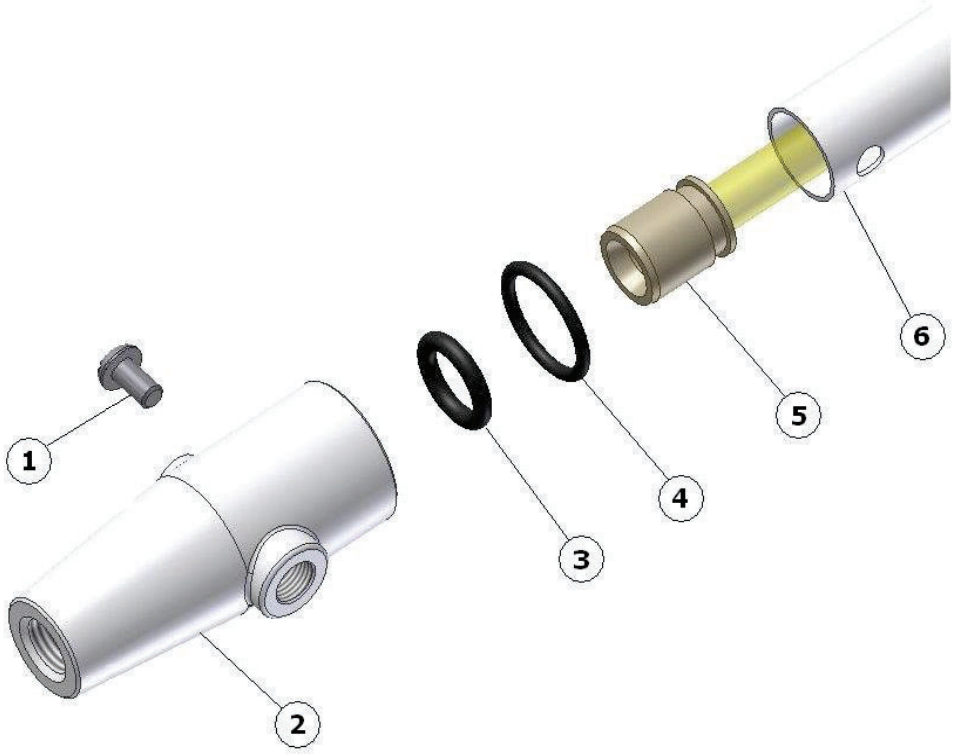

Figure 10

APPENDIX B

Diagrams

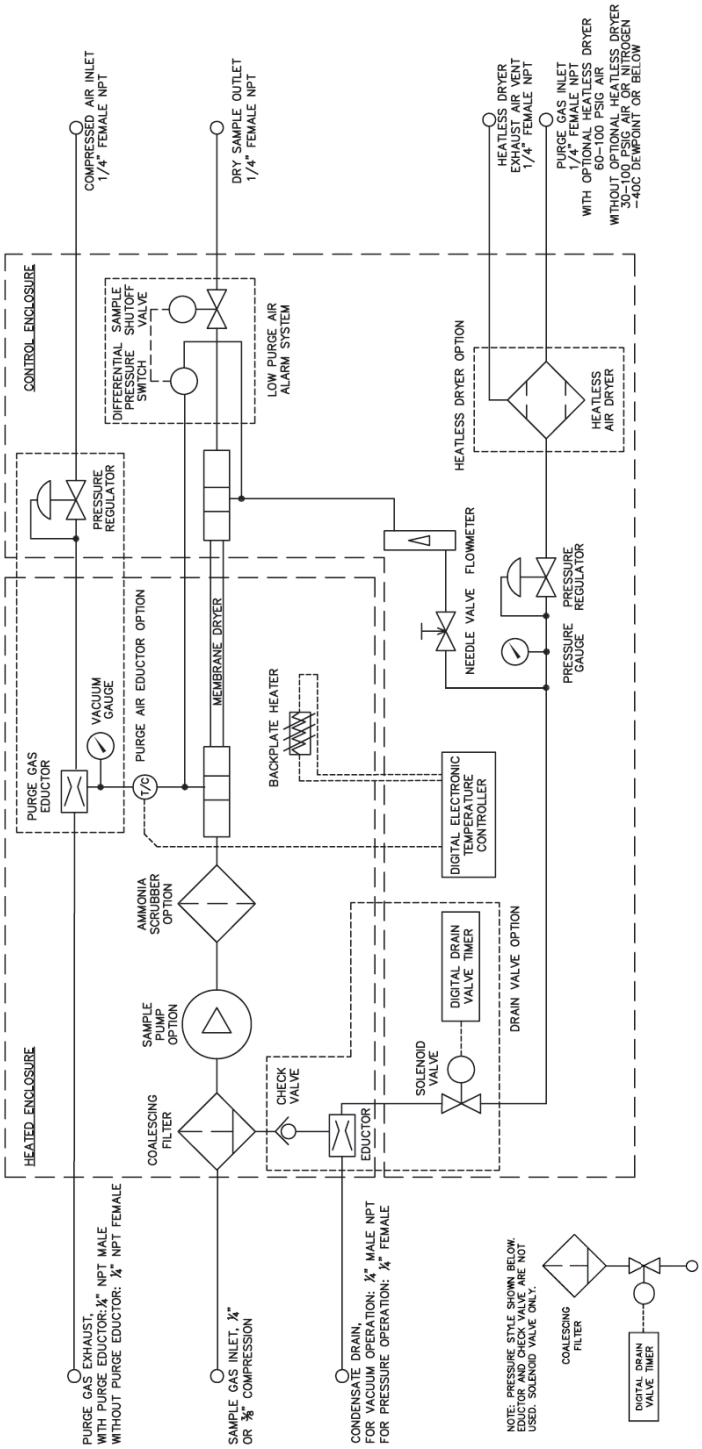

Figure 11 - Piping and Instrumentation Diagram MG-1228W
(See drawing file paperclipped to this pdf)

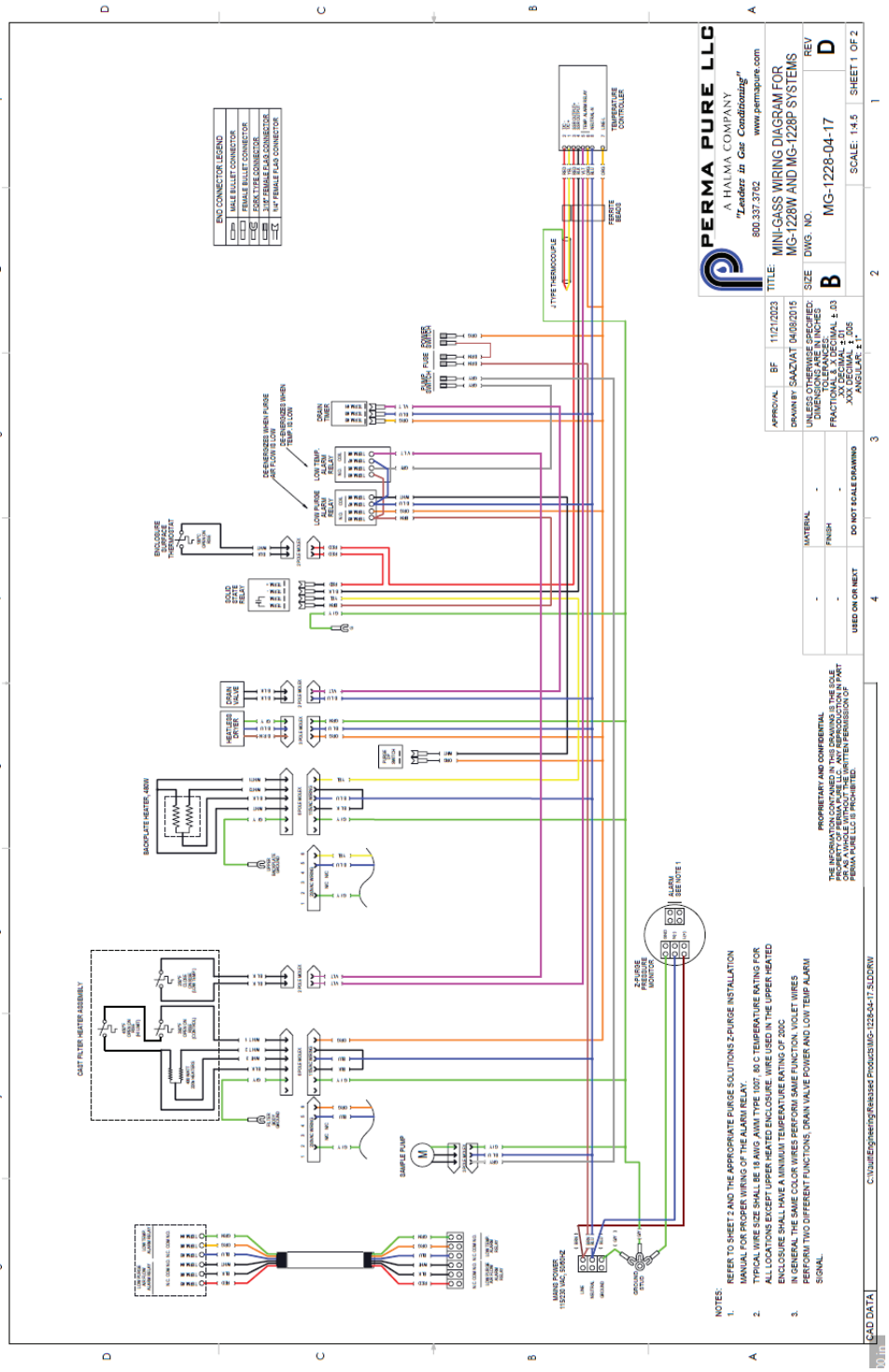

Figure 12 - Electrical diagram for MG-1228W, 1228P
(See drawing file paperclipped to this pdf)

APPENDIX C

Control System Safety Interlock

The interlock system is present to provide an output signal that is used **internally** to stop sample flow via the optional sample isolation valve or optional internal sample pump.
This system can also be used to provide an **external** output to a PLC or other control/monitoring system so that the status of the Mini-GASS can be monitored.

Two relays are used to perform this function:

- Low purge flow relay - A differential pressure switch across the purge air connections of the PD Nafion dryer senses the presence of purge air flow and energizes this relay when flow is present.

  A minimum purge flow rate of about 10 lpm is required. Below this flow, the Purge Alarm Relay will de-energize.

- Low temperature relay – The CAL 3300 temperature controller has an alarm function that is used to energize this relay when the system is operating at normal temperature.

  The actual point at which a low temperature alarm is triggered is 'setpoint minus 5C'.
  As an example, if the temperature controller is set at 90C, the alarm relay will de-energize at 85C. This should prevent a low temperature condition, which could allow condensation to form in the system.

NOTE: An increase in purge flow can trigger a temperature alarm. This is caused by the cooling effect of the purge gas flowing into the PD Nafion Dryer and is normal. The temperature controller will automatically compensate for the increase in cooling effect of the purge flow.

The interlock system used **internally** in the Mini-GASS to control the optional sample gas isolation valve or optional internal sample pump. The control system provides power to the interlock valve coil or sample pump motor via the alarm relays.

Each of the relays is double pole, double throw, (DPDT) design. This just means that there are two sets of normally open/normally closed (N.O./N.C.) contacts in each relay.
One set of contacts is used **internally** by the Mini-GASS control circuit.

The second set of contacts is provided to allow connection to an **external** alarm or control system. It is recommended that if an external alarm system is used or the contacts are used to control an external sample pump, that the external device is wired through both sets of contacts so that if either set of contacts opens an alarm will sound and/or the sample pump will stop.

- Refer the electrical wiring diagram drawing MG-1228-04-17, page 28.

Internally these relays are wired in series to supply power to the optional sample pump.

To accomplish this, switched line voltage (115,230VAC, Orange wire) is supplied to the common (term. #5) connection of the low purge flow relay.

From the normally open (term. #3) connection of the low purge flow relay, a brown wire connects to the common (term. #3) connection of the low temperature relay

From the normally open (term. #3) connection of the low temperature relay, a gray wire connects to the sample isolation valve or sample pump. This allows the valve to open or the pump to start only if both relays are energized.

- Refer to Figure 13.
  For **external connection**, the second set of contacts in each relay is "dry". No power is applied. This allows the user to determine the control voltage that will be used. A typical use of the alarm signal, as described above, is to control sample flow. The actual use is left up to the customer.

  Relay contacts are rated at 250 VAC, 3A, resistive.

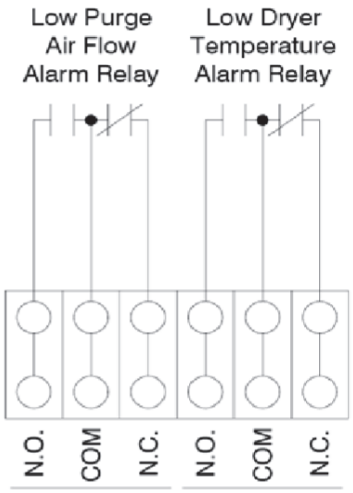

Figure 13 – Alarm Wiring