

waukesha®



Dual Column Dehydrating Breather Manual

DCB-MANUAL – 2.90

Read and understand this manual prior to operating or servicing the products.



Patented Dual Column Auto Recharging Dehydrating Breathers are manufactured by Prolec-GE Waukesha, Inc., Service & Components Division
U.S. Patent Nos. 5,902,381; 6,797,037; 7,285,150; 7,332,015 & Patent Pending



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GENERAL DESCRIPTION

The third generation Waukesha® Auto Recharging Dehydrating Breather System, or Dual Column Breather (DCB), has been designed to remove moisture from the air entering load tap changer tanks, conservators or other sealed tanks. Heaters controlled by an adjustable timer and humidity sensor provide automatic recharging of the silica gel desiccant, eliminating the need for manual intervention. The use of dual columns ensures that fresh silica gel is always available for service. By adjusting the column regeneration cycle time, the system can be configured for various tank (air volume) sizes, from 100 to 40,000 gallons or more.

GENERAL DESCRIPTION *(continued)*

System Principle of Operation:

See Figure 1 on page 5. During normal operation, air enters the breather through slots in the upper housing and passes through desiccant to the center of the assembly. The center tube contains several holes along its entire length, forcing air to disperse through the maximum surface area of desiccant. Air then travels through the center tube, along a path (depending on the column in service) to the isolation solenoid and humidity sensor, and eventually through the top port to the conditioned air space.

During regeneration, a temperature regulating heater element within the center tube in the column that is not in service energizes to heat desiccant to a specified temperature. Any moisture present in the desiccant is driven outward to the borosilicate glass globe where it turns into condensate. The condensate runs to the bottom of the breather assembly, where it is discharged through the water drain filter. During regeneration, the solenoid valve located at the top of the breather assembly isolates the column being regenerated while allowing the conditioned air space to breathe through the column that is in service. Once regeneration of the out-of-service column is complete (3 hours plus 30 minute cool down), the column is placed in stand-by mode. When the in-service column times out or is triggered by the humidity sensor, the exhausted column is placed in regeneration mode and the stand-by column is placed in service, ensuring a continuous supply of dry air to the conditioned air space.

Construction:

Dual Column Breather (DCB) system is shipped as a single, integrated assembly along with accessories necessary for installation. The breather is constructed with a machined aluminum top, bottom and cast controls housing. Other components include heating elements, heat conductive fins, screen, condenser media, filter vent system and non-indicating silica gel (installed at the factory before shipment). Electrical and signal wiring is via conduit connections on the bottom of the control housing. The outer tube is optically clear borosilicate high strength glass. Sealed, Super Bright LED lamps on the control cover provide easy visual indication of breather status (reference table 3 on page 13).

Intelligent Controls:

DCB systems feature an integrated PCB microcontroller that constantly monitors the condition of airflow through the breather. User adjustable, time-based controls regenerate the desiccant regardless of condition. Humidity sensing capability automatically overrides and regenerates the desiccant, if needed, between set timer frequencies. Due to the dual column design, column regeneration is independent of breathing status of the conditioned air space.

Internal diagnostics constantly monitor, evaluate and adjust the performance of components to ensure breather operation will always provide optimum protection for the air space. All controls and components default to a standard desiccant breather in the event of power loss.

DCB systems include an alarm relay that monitors the heating, solenoid function and line power. This alarm relay may be monitored remotely via a SCADA system.

Also available, optional Modbus (RS-485) & 4-20 mA remote monitoring.

OPERATIONAL DIAGRAM: STANDARD DUAL COLUMN BREATHER

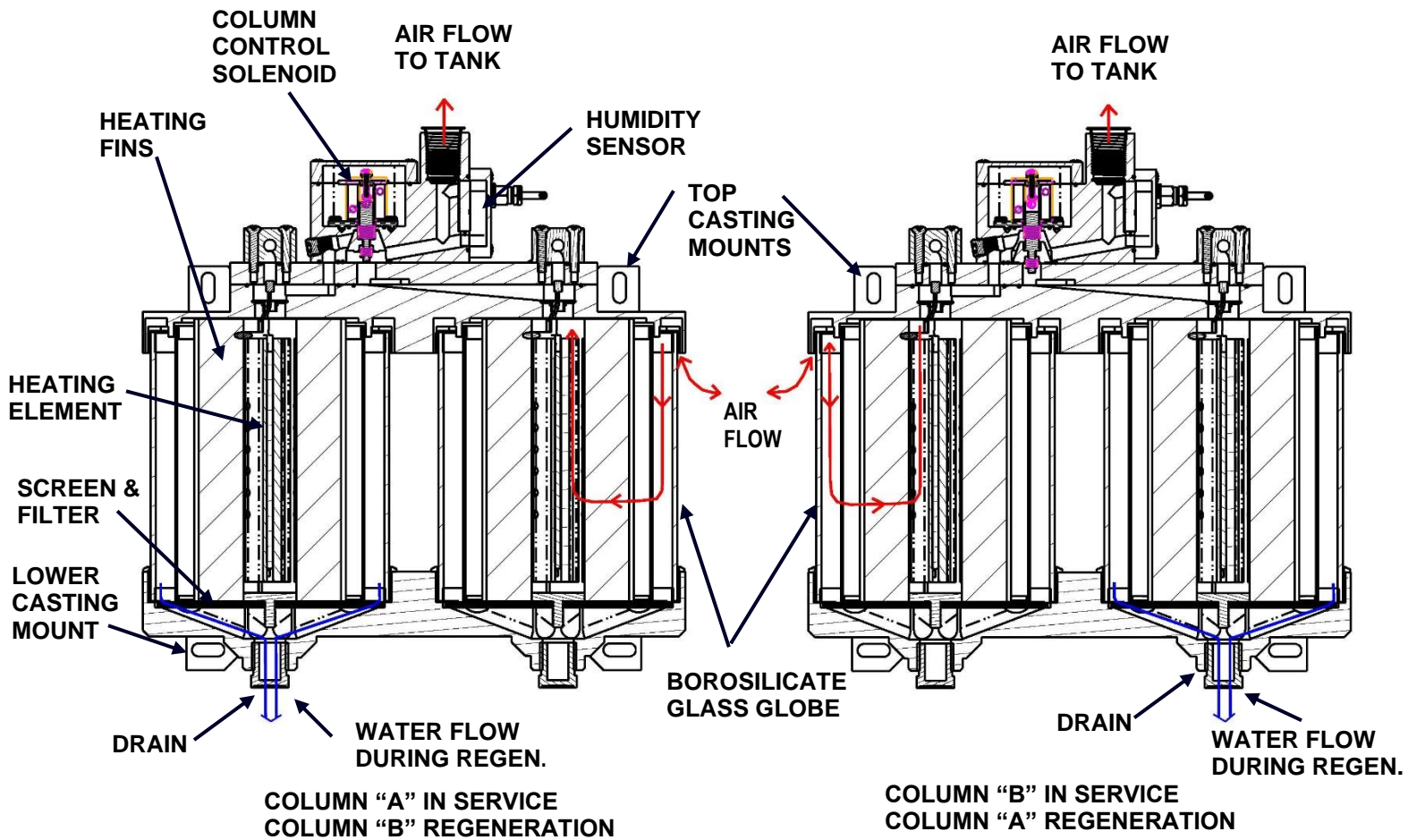


Figure 1 – Standard Dual Column Breather (DCB) Functional Operation and Component Identification

Only one column is in service at any one time.

SAFETY INFORMATION

Correct use of this equipment is important for your personal safety and for trouble-free functioning of the unit. Incorrect control or attempts to perform adjustments could cause damage or lead to incorrect operation. Be sure to read and understand all the instructions before attempting to operate the unit.

The unit is designed to produce dry air. Do not operate the unit beyond its limits (see Specifications Table 1 on page 7).

In addition to the warnings and cautions in this manual, use the following safety guidelines for safe operation of the unit.

⚠ WARNING This unit is an electrical appliance. Verify the main power supply is disconnected before you perform installation, maintenance or repair work.

⚠ WARNING If you must work on the equipment with the main power supply on, be aware of electrical hazards.

⚠ WARNING The heaters, glass tube and metal housing become hot when operating. Be careful when you touch the system if the yellow LED light is on (heater energized).

⚠ CAUTION Do not block ventilation inlets and outlets as this could cause damage to the unit.

⚠ WARNING In order to prevent injury or damage caused by the sudden release of compressed air, confirm the unit and connected systems are fully depressurized before you start uncoupling parts of the system.

IMPORTANT: The following words and symbols appear throughout this manual and designate important safety instructions:

⚠ DANGER **DANGER:** Indicates information important to the proper operation of the equipment. Failure to observe will result in damage to the equipment and/or severe bodily injury or death.

⚠ WARNING **WARNING:** Indicates information important to the proper operation of the equipment. Failure to observe may result in damage to the equipment and/or severe bodily injury or death.

⚠ CAUTION **CAUTION:** Indicates information important to the proper operation of the equipment. Failure to observe may result in damage to the equipment.

Read all safety instructions to avoid personal injury or death and to avoid damage to the unit or property.

SPECIFICATIONS

COMPONENTS		ELECTRICAL	
Airflow Solenoid	24 VDC Latching	Voltage/Frequency	100–240 VAC, 50/60 Hz
Humidity Sensor	RH 5% to 95%	Regenerating	Inrush 4.0 A max. Steady 1.2 A
Timer Control	DIP switch on PCB	Non-Regenerating	Steady 0.2 A
Indicator Lights	Super Bright LEDs	Alarm Relay (Connect to N.C. Connection)	Normally CLOSED, Held OPEN with Power (Res: 10A 120 VAC, 8A 30 VDC)
OPERATION		AMBIENT CONDITIONS	
Time-Based Settings	2, 5, 10 & 20 day cycle	Temperature Range: Standard DCB	-20°C to 80°C
Relative Humidity Trigger	Logic program can trigger a humidity based column shift	Temperature Range: Arctic Zone DCB	-50°C to 80°C
Heating	3 hour, full power	Air Quality	Normally clean ambient air
Cooling Time	30 minutes before Standby Mode	Relative Humidity	>95%
Failure Detection	Heater, solenoid valve, humidity sensor & power failure	ENVIRONMENT	
		Location	Indoor/Outdoors, wall or rack mounted

Table 1 – DCB Specifications

OPERATIONAL DIFFERENCES BETWEEN STANDARD AND ARCTIC WEATHER DCBs

Standard DCB

- Fully functional between -20°C and 80°C
- Below -20°C operation:
 - Still **FULLY** functional as a regenerating dry air breather at temperatures below -20°C, water from the automatic regeneration process could freeze in the filter vent below -20°C.
 - Some light frost may form on the inside of the glass globe but will in no way affect the operation of the DCB auto-recharging breather.
 - Does not affect the unit's ability to reliably provide dry air to the protected space, as the temperature rises above -20°C, any frozen water in the filter vent will quickly melt during the next regeneration cycle.

NOTE: At temperatures below -20°C, the air only contains a minimum amount of moisture content, which should minimize the occurrence of the filter vent freezing.

Arctic Weather DCB

- Fully functional between -50°C and 80°C.
- Below -50°C operation:
 - From 0°C to -50°C, the heated filter vent prevents freezing of the water generated from the regeneration process, allowing complete drainage.
 - Some light frost may form on the inside of the glass globe but will not affect operation of the Arctic Weather DCB.
 - Below -50°C, water from the automatic regeneration process may begin to freeze in the heated filter vent after regeneration; however, this will not affect operation of the Arctic DCB in servicing the protected space.

NOTE: At temperatures below -50°C, air only contains an absolute minimum amount of moisture content, which should minimize the occurrence of the heated filter vent freezing.

INSTALLATION *(using included hose and hose barbs)*

⚠ CAUTION The unit must be mounted in a vertical position. Do not mount the unit on its side or back.

⚠ CAUTION Do not block ventilation inlets and outlets as this could cause damage to the unit and provide inadequate protection for the airspace.

- Unit must be mounted level and vertical.
- All piping and fittings **MUST** be non-corrosive (polymer, brass, copper, stainless steel or equivalent).
- Unit and piping must be installed such that transformer oil cannot enter the breather.
- Install unit away from heat sources.
- Do not install in an enclosed cabinet; **PROPER VENTILATION IS REQUIRED.**

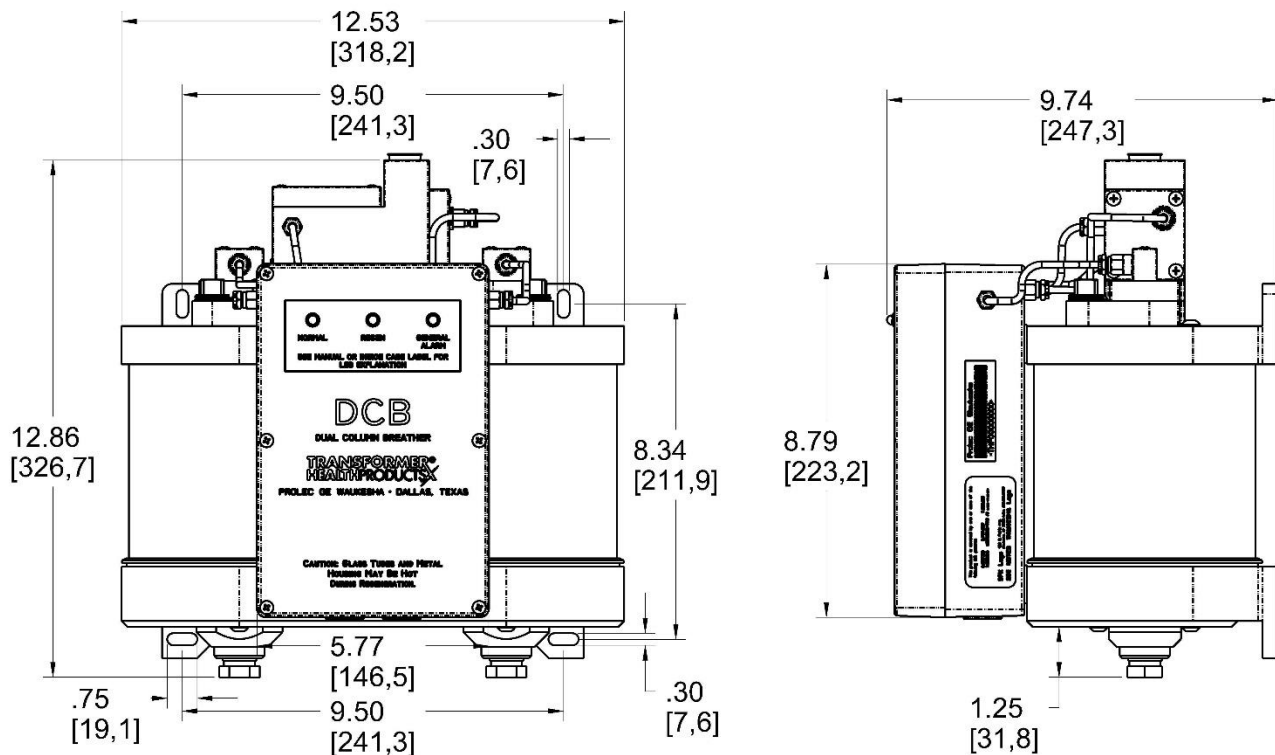


Figure 2 – DCB Mounting Dimensions, Inches [mm]

1. Measure and mark mounting holes or studs as shown by the center-to-center distances in Figure 2 above.
2. Place the unit into position and install with 1/4" hardware into top of breather casting (hardware not included).
3. Install included hose barb securely (see Figure 3 on page 10). Use of thread sealant or thread tape (if hose barb is not already pre-Teflon taped) is required to prevent water from flooding the silica gel chamber.

—CONTINUED ON NEXT PAGE—

INSTALLATION (continued)

4. Install included hose barb from outlet to tank piping or port; use of thread sealant or thread tape is required to prevent leaks.
5. Install included hose between hose barbs; ensure the absence of any loops or low spots in the output hose to the conditioned air space.
6. **Top output port on the breather MUST be sealed before installing any desiccant if silica gel maintenance is required.**
7. Install power conduit to the left access hole on the bottom of the control cabinet.
8. Install remote alarm conduit (if monitored) to right access hole on bottom of control cabinet.
9. Run the appropriate electrical alarm wiring (if monitored) and connect per Figure 4 on page 11.

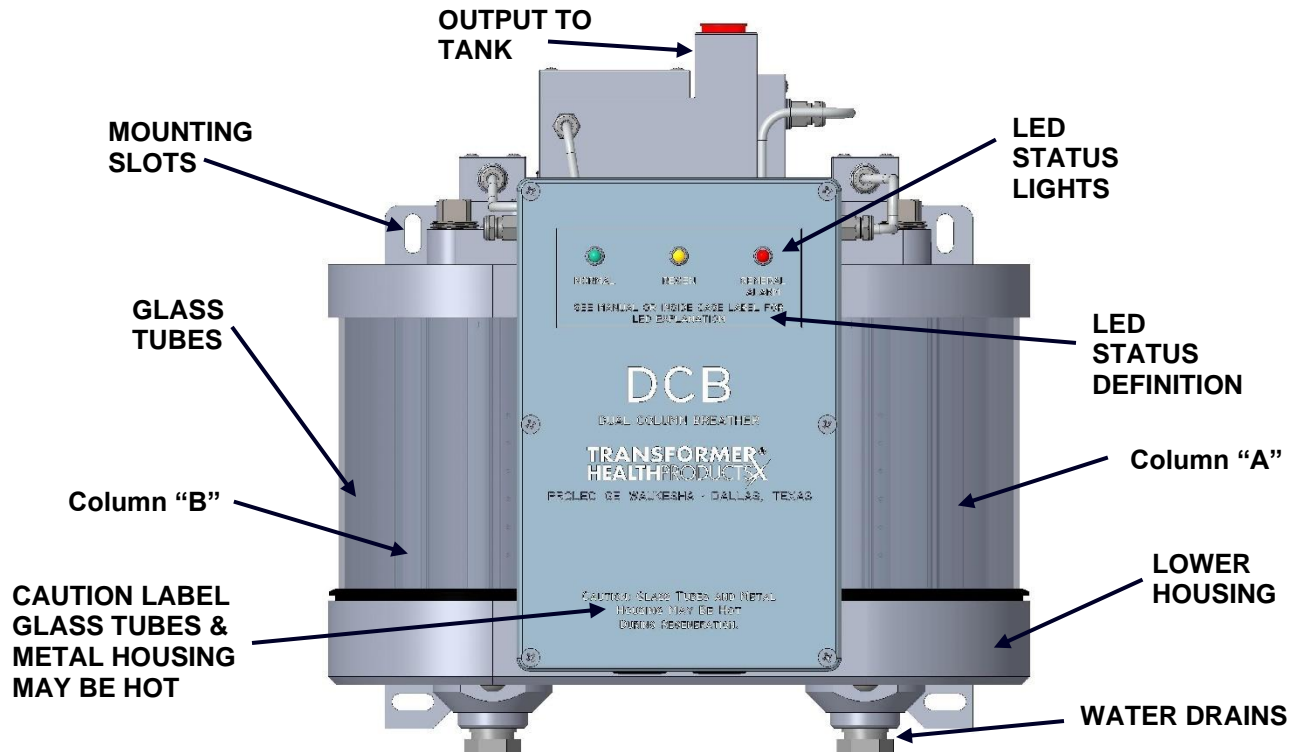


Figure 3 – DCB Components

CAUTION Connection to tank port is critical to ensure that no oil can enter the breather. IF the oil-filled tank connected to the breather is MOVED OR RE-Filled, the breather MUST be ISOLATED from the tank. Oil in the breather OR breather HOSE will result in VOIDING the Warranty.

CAUTION Piping between the unit and the tank MUST be dry, free of oil residue and debris.

CAUTION Unit ships with clear, non-indicating silica gel installed; silica gel fill ports provided for maintenance of silica gel (if required).

ELECTRICAL CONNECTIONS

⚠ WARNING Electrical shock hazard. Failure to follow these instructions could result in serious injury or death.

⚠ WARNING Disconnect the lid LED cable from keyed LED connector whenever the lid is removed during installation OR service to prevent DAMAGE to the lid mounted LEDs.

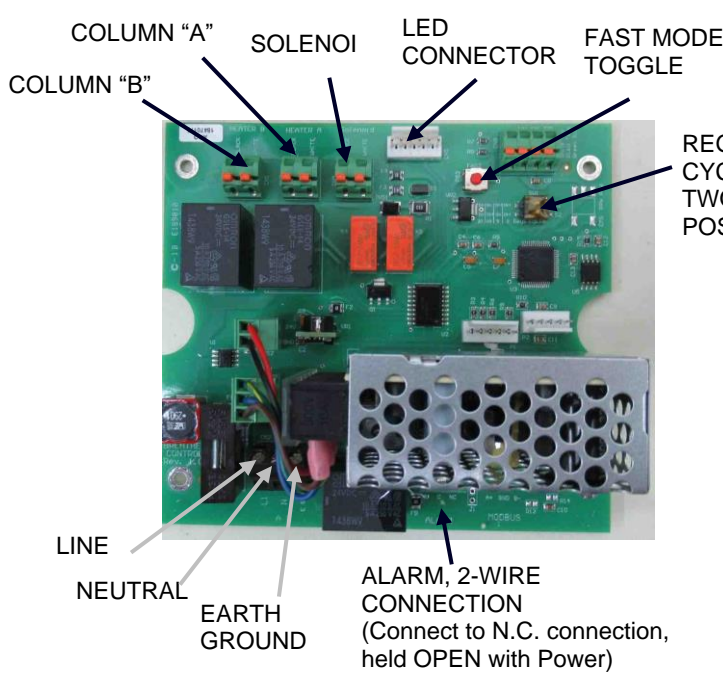
⚠ WARNING DO NOT use wire for POWER OR ALARMS that exceeds the capacity of the connection devices. Note: using crimp-on ferrules on 12 AWG (power) or 12 AWG (alarms) wire will exceed the capacity of the connection device and CAUSE BREAKAGE & void the warranty.

⚠ CAUTION It is RECOMMENDED that the DCB circuit is protected with a 15 Amp circuit breaker.

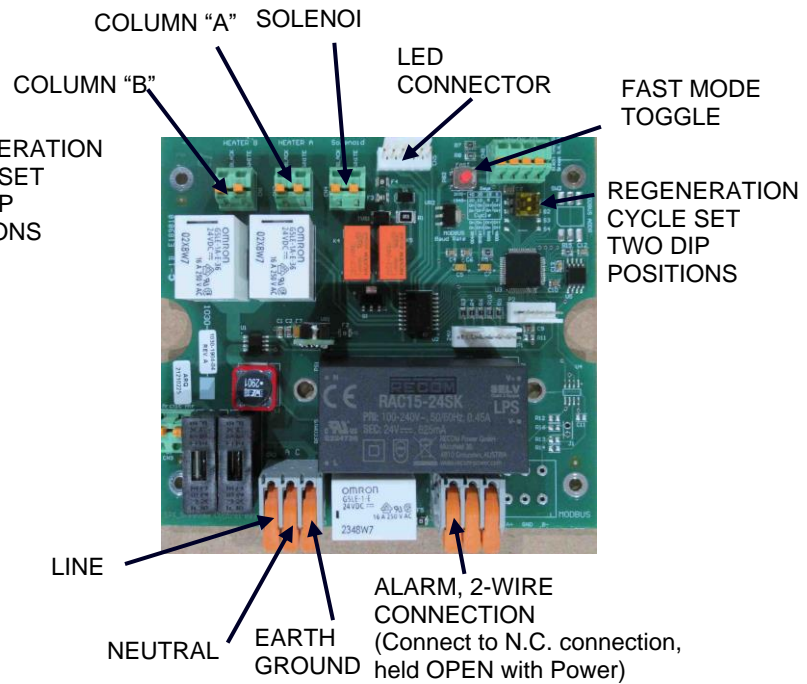
- Electrical ground is required on this appliance.
- Unit should be grounded according to local electrical codes to prevent the possibility of electrical shock. It requires a grounded receptacle with separate electrical lines, protected by fuses or circuit breaker of the proper rating; *check with a qualified electrician if you are in doubt as to whether the appliance is properly grounded.*
- Do not use an extension cord with this appliance.
- Remove temporary hole plugs from bottom of the control cabinet and make appropriate conduit connections to these openings. Power wiring should use the LEFT access hole. Remote alarm monitoring, Modbus & (optional) 4-20 mA wiring should use the RIGHT access hole.
 - Power Connector rated for up to **12 AWG round bare wire, stranded wire preferred.**
 - Alarm Connector rated for up to **12 AWG round bare wire, stranded wire preferred.**
 - If a contact closure is expected for an alarm condition, connect to the N.C. and Com terminals, as the alarm relay is N.C. held open with power.
- Plug-in cable adapters and mounting adapter plates are available for replacement compatibility with previous generation units (ARDB2-0000 and ARDB2-1000)
- For USA 120 VAC, 60 Hz. operation: Connect L1 to L1, Neut. to N & E-Gnd. To E-Gnd.
- For USA 240 VAC, 60 Hz. operation: Connect L1 to L1, L2 to N & E-Gnd. to E-Gnd.
- For Europe 230 VAC, 50 Hz operation: Connect L1 to L1, Neut. to N & E-Gnd. To E-Gnd.

⚠ WARNING When reinstalling the control box cover, the **MAXIMUM** torque for the lid screws is **10.8 in-lbs. DO NOT OVERTIGHTEN.**

Standard DCB Control Modules:

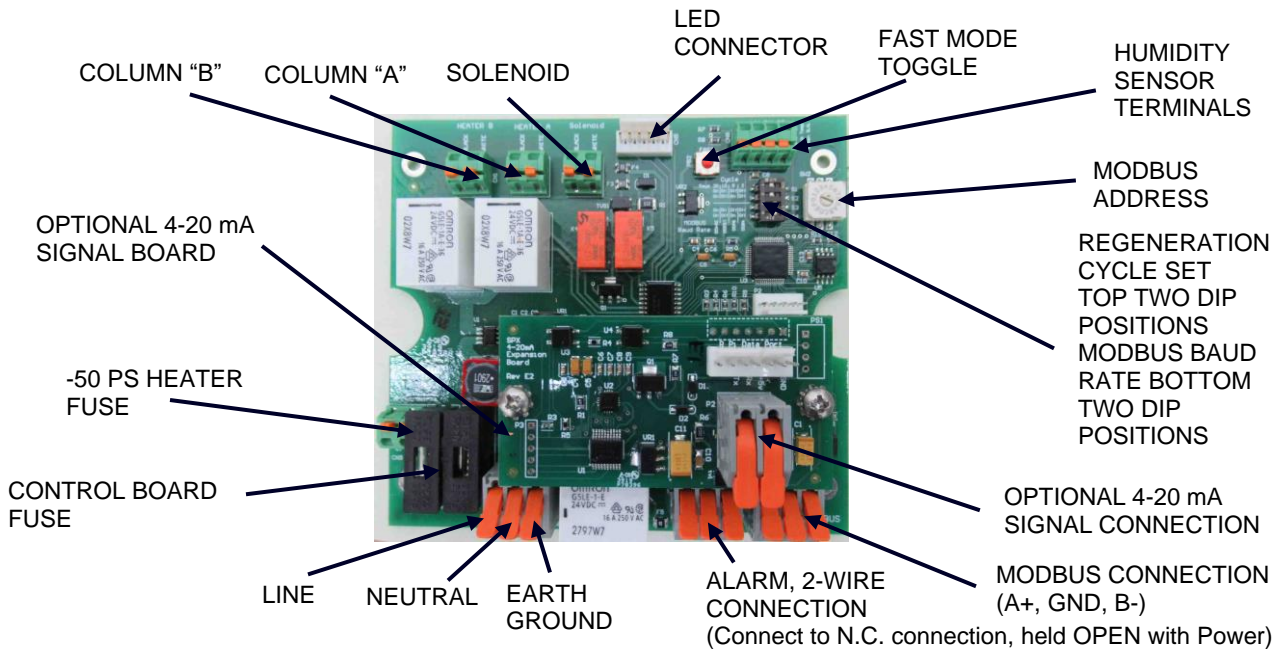


Open Frame Power Supply



Brick Style Power Supply

OPTIONAL: Modbus & 4-20 mA DCB Control Module:



Alarm relay contacts: 10A@120 VAC or 8A@30 VDC

Figure 4 – DCB Alarm and Power Connections, reference Appendix C

START-UP, DIP SWITCH SETTINGS AND FAST MODE

IMPORTANT: Verify the unit has been properly installed according to the installation instructions included in this manual.

⚠ CAUTION When the unit is energized, controls will proceed with regeneration cycle. The glass tube and metal housing will become hot to the touch.

1. Verify all electrical connections are secure & the breather mounted in a vertical position.
2. Energize breather, Self-check verifies solenoid, heaters and humidity sensor operation.
3. On power, all three LEDs will blink to verify operation. The GREEN LED will remain lit. The YELLOW LED will also light to signal the start of a regeneration cycle for the column that is not in service.
4. Verify heating occurs within 10 minutes; the glass tube should be warm to touch.
5. Unit is ready for operation.
6. See ALARMS & TROUBLESHOOTING & MAINTENANCE sections on following pages.

Regeneration Frequency

The DCB system is factory set for best performance and adjustments are limited to the preferred timer-based regeneration frequency. Timer-based regeneration cycle is factory set for a frequency of 2 days; however, the system can be set for 2, 5, 10 or 20 day cycles.

Changing Regeneration Frequency:

1. Ensure the unit is de-energized from the power source.
2. Remove the six screws from front access cover and store to the side. *Be careful with the wires connecting the LED to the PCB.*
3. Locate the DIP-switch controls and move DIP-switch S1 & S2 to the OFF position.
4. Factory default setting is for 2-day operation: S1-OFF, S2-OFF.
5. See Table 2 and Figure 5 below for positions of S1 and S2 for desired cycle frequencies. (Switch pictured set for 2-day cycle: S1-OFF, S2-OFF).

DIP Switch		Timer Cycle Time (days)
S1	S2	
OFF	OFF	2
OFF	ON	5
ON	OFF	10
ON	ON	20

Table 2 – S1 & S2 Switch Combinations

6. Re-install front cover and tighten the six screws.
NOTE: Maximum torque on cover screws is 40 in-lbs.

7. Fast Mode: 1 minute of programmed time = 1 second

NOTE: This mode should only be used for debug.

- Must ALWAYS be returned to normal operation.
- Ex.: 3 hour Regen + 30 Minute Cool = 210 seconds

**REGENERATION CYCLE SET
S1 & S2 SWITCH (OFF) (2 DAY)**

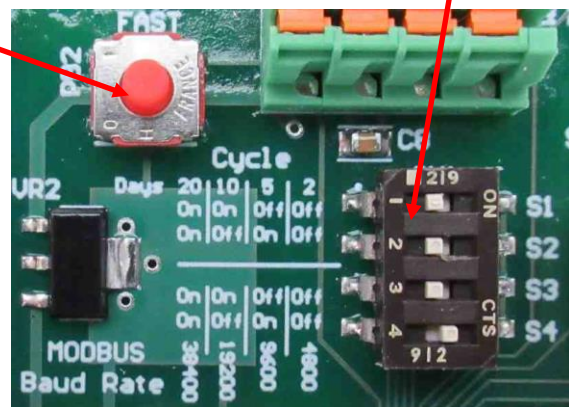


Figure 5 – Fast Mode & Cycle DIP

OPTIONAL:

Modbus Baud Rate: (RS-485) Optional Communications Package Only

The DCB system is factory set for best performance and adjustments are limited to the preferred Modbus data rates (baud). The Modbus data rate is factory set for a rate of 9600 baud.

However, it may be reset to 4800, 9600, 19200 or 38400 baud depending on customer-specific conditions. We recommend using shielded cable.

1. Locate the DIP-switch controls and move DIP-switch S3 to OFF & S4 to the ON position.
2. Factory default setting is for 9600 baud: S3-OFF, S4-ON. This can be increased or decreased based on your specific conditions.
3. See Table 3 and Figure 6 below for combinations of S3 and S4 positions for desired Modbus data rate (switch pictured set to factory default of 9600 baud: S3-OFF, S4-ON).

DIP Switch		Modbus (RS-485) Data Rate (baud)
S3	S4	
OFF	OFF	4800
OFF	ON	9600
ON	OFF	19200
ON	ON	38400

Table 3 – S3 & S4 Switch Combinations

**Modbus Data Rate SET
S3 & S4 SWITCH
(9600 baud)**

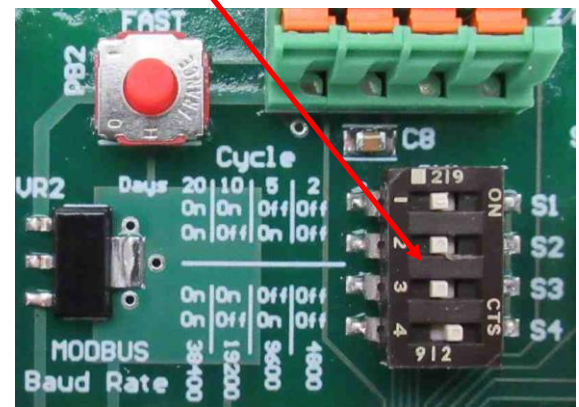


Figure 6 – Modbus data rate (baud)

Setting the Modbus (RS-485) Address:

1. If there are more Modbus data devices on the system, then the address may be set using the circular Modbus address switch.
2. Sixteen addresses are available from zero through F by turning the selector wheel using a small flat bladed screwdriver. See figure 7 at right.
3. The factory default will be address 5.
4. Information available via Modbus
 - a. Average humidity of tank input air
 - b. Average temperature of tank input air
 - c. Time in hours since last regeneration
 - d. Silica gel column in service
 - e. Any alarm conditions
5. Actions available via Modbus
 - a. Force system restart causing a repeat of the system self-check
6. For Modbus memory addresses, see **Appendix B**.
7. For Modbus & other connections, see **Appendix C**.

Modbus address settings

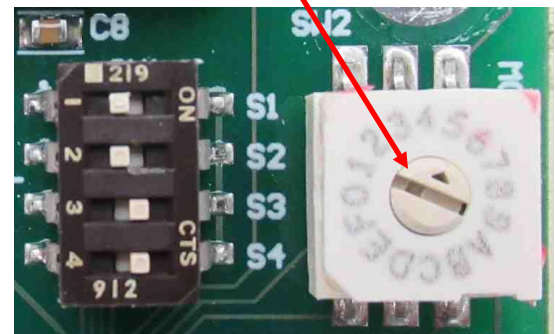


Figure 7 – Modbus address

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Optional 4–20 mA daughter board:

OPTIONAL 4–20 mA daughter board provides self-powered 4–20 mA signal that is linearly proportional to the % RH of the input tank air. The daughter board is mounted above the DCB power supply supported on two standoffs.

The optional 4–20mA powered data signal was designed to accommodate a MAXIMUM 500-ohm loop.

CALIBRATION			
Current Output		% Relative Humidity	Notes:
4 mA		0–5% RH	Minimum sensor reading is 5% RH
12 mA		50% RH	
20 mA		95–100% RH	Maximum sensor reading is 95% RH

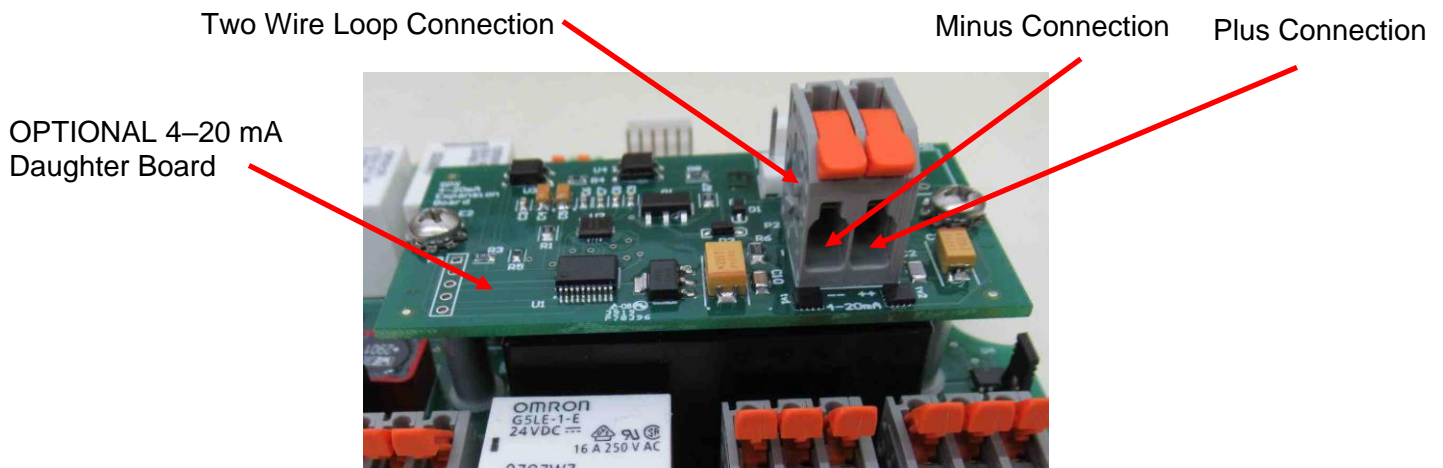


Figure 8 – 4-20 mA Daughter Board

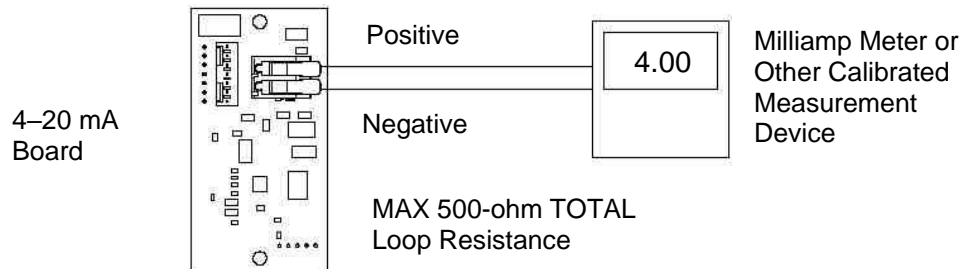


Figure 9 – 4-20 mA Schematic

ALARMS AND TROUBLESHOOTING

The DCB system features local LED indicators and alarm contacts that can be used to monitor the condition of the system remotely. The following table lists each alarm, corresponding condition and recommended action for the system.

LED INDICATOR	CONDITION	FEEDBACK CONDITION	ACTION
Local Alarm Indications			
Green	Breather is in normal standby mode and tank is breathing normally through the desiccant	Local indication	None
Blinking Green	Fast mode (debug only)	Local indication	Return to NORMAL mode by toggling the FAST mode button
Yellow	Regeneration	Local indication	None
Blinking Yellow	Humidity sensor error	Local indication	Decrease breather time-based frequency & cycle the power to clear the alarm
Remote Alarm Contacts			
Blinking Red	Regeneration heater failure	Alarm relay contacts CLOSED	Cycle power; if alarm returns, contact factory
Red	Solenoid valve failure	Alarm relay contacts CLOSED	Cycle power; if alarm returns, contact factory
None	Power failure	Alarm relay contacts CLOSED	Investigate power failure

Remotely Monitored Alarm Indications (see Figure 4 on page 12 for wiring)

Table 4 – Local and Remote Alarm Indications

INSPECTIONS

DCB is a self-monitoring system that requires minimal attention. Periodic inspection is recommended to ensure the system is operating at optimum efficiency.

Annual Inspection

1. Visually check each bottom vent drain and inspect for restrictions, such as dust or other contaminants.
2. Clean or replace bottom drain vent, if necessary (Prolec GE Waukesha P/N 1030-1661).
3. Visually inspect desiccant for contamination, particularly oil that will show up as a dark or blackened desiccant color. Desiccant should be clear. If desiccant is saturated, timer regeneration frequency should be decreased (see START-UP section on page 13).
4. If desiccant is oil-contaminated, the breather must be cleaned of oil & the desiccant must be replaced.

NOTE: Each column uses 1 kg of silica gel (Prolec GE Waukesha P/N 1030-1797 = 1 kg bag of silica gel).

5. Clean breather glass tube(s), if necessary.
6. If control cover is removed, maximum torque on the cover screws is 40 in-lbs.

CAUTION

Glass cleaner or soap and water may be used to clean the glass tubes. Solvents **must not be used** for any reason as they may contact and degrade the rubber seals. ***Use of solvents on the unit immediately voids warranty.***

APPENDIX A: Flange Mount Installation

- 1) If transformer has breather piping which ends in DIN 42462-5 flange with integral gasket, order the DCB as follows:
 - If your breather pipe has a DIN 42462-5 flange, order DCB with connection option –X1X.
 - Connection option –X1X includes a flat flange, flat gasket and down pipe to connect to breather and securing hardware; flat gasket may be used as needed for the installation.
- 2) Installation with either of the connection options above is straightforward:
 - a. Verify the existing breather piping is clean and clear of debris and/or transformer oil contamination. If debris or contamination is introduced into the DCB, the DCB could fail and warranty is void.
 - b. Install the flange down pipe to the DCB top port; use of thread sealant is required to prevent leaks.
 - c. Install DCB using the flange plate and included hardware; DCB must be installed in the vertical position for proper operation.
- 3) See Figure 9 below for a typical flange installation.

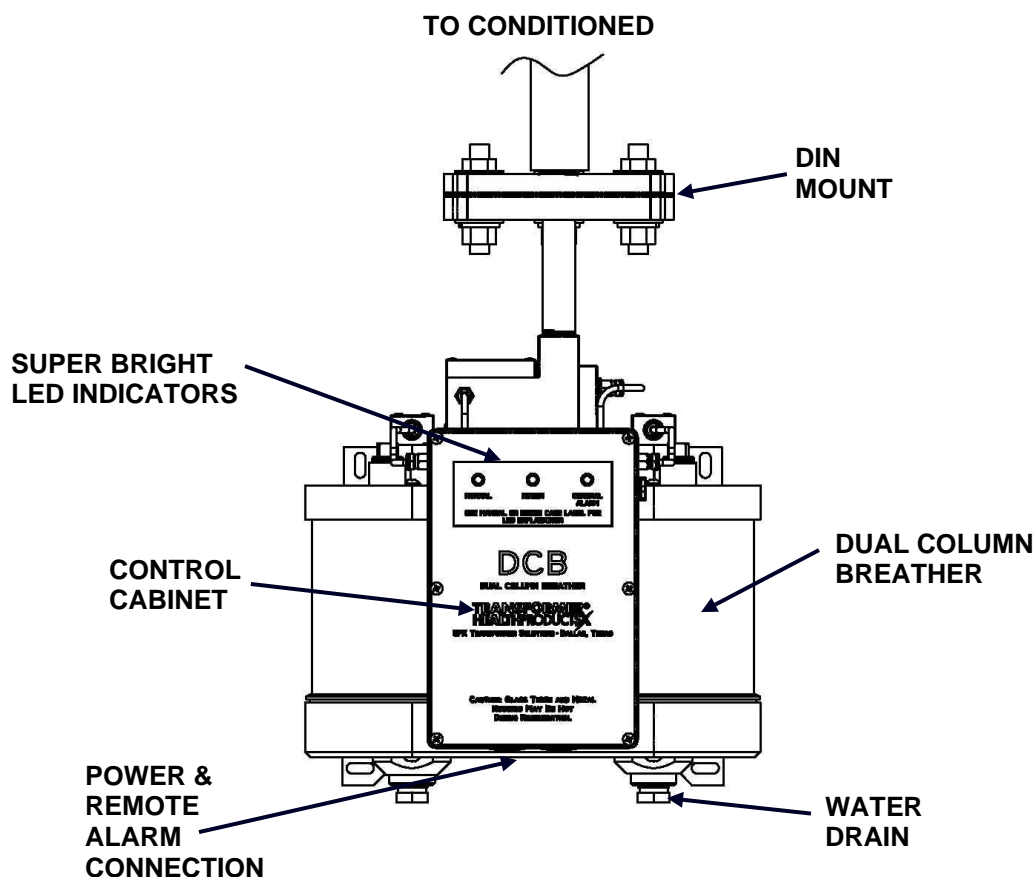


Figure 9 – Typical DCB Flange Installation

APPENDIX B: Modbus Registers

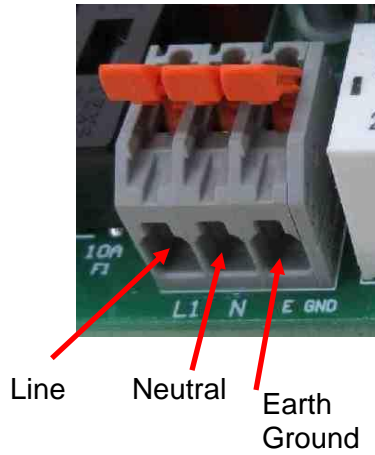
REGISTER ADDRESS	OPERATION	NOTES:
30001	Read	Average Humidity Value for the Tank Input Air, %RH
30002	Read	Average Temperature Value for the Tank Input Air, °C
30005	Read	Silica Gel Column in Service, 3000 “B”, 10000 “A”
30006	Read	Heater current during Regeneration Only (mA)
30007	Read	Any Alarm Condition (1 system in alarm, 0 system normal)
30008	Read	Time remaining in Regeneration Cycle: (Minutes)
30009	Read	After Regeneration Cool Down Timer (Seconds)
30012	Read	Time Since the Last Regeneration: (Hours)
40001	Read/Write	Year (XXXX), Input NOT required for Breather Functionality.
40002	Read/Write	Month (XX), Input NOT required for Breather Functionality.
40003	Read/Write	Day (XX), Input NOT required for Breather Functionality.
40004	Read/Write	Hour (XX), Input NOT required for Breather Functionality.
40005	Read/Write	Minute (XX), Input NOT required for Breather Functionality.
40006	Read/Write	Seconds (XX), Input NOT required for Breather Functionality.
* 40010	Read/Write	Read for the current Value for Regeneration Cycle Time: Write to change the Regeneration Cycle Time: Syntax: 2, 5, 10 & 20 (Days)
** 40008	Write	Write “E” (w/o quotations) to enable system reset
** 40036	Write	Write “R” (w/o quotations) to initiate system reset

NOTES:

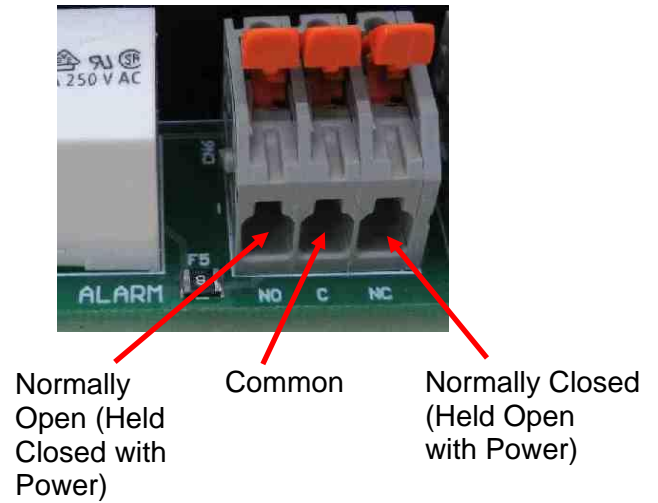
- * Use Modbus Function 6 to WRITE a new value to register 40010 to change the time between regenerations.
- ** Use Modbus Function 6 to Write “E” (w/o quotations) to register 40008, then Write “R” (w/o quotations) to register 40036 to initiate the system reset.

APPENDIX C: Customer Connection Points

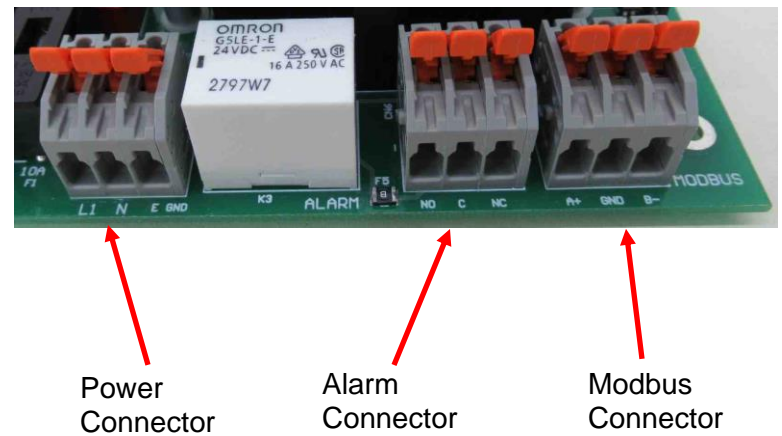
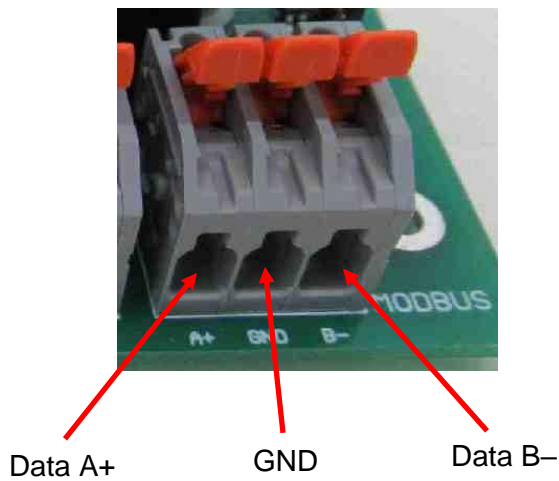
Power:



Alarm Relay:



Optional Modbus:



APPENDIX D: “Life Boat” Function:

Since the DCB is a dual column breather, we have provided an automatic “**Life Boat**” function. The heaters used for regeneration of the silica gel are extremely reliable positive temperature coefficient (PTC)-type heaters. In a rare event if a heater were to fail, the unit will detect the failure and provide an alarm. However, to continue the protection of the tank atmosphere, the breather will shift into a mode using the remaining operational column as a single column breather until the unit can be replaced. The “**Life Boat**” operational mode will continue as follows:

1. Regeneration heater failure is detected.
2. Alarm will be set and the BLINKING RED LED will be lit.
3. Since the heater failure would be detected during an attempted regeneration, the operational column will be in service.
4. The operational column would remain in service for the normal cycle time.
5. At the end of the normal cycle, the unit would detect a time-period when the tank is exhaling.
6. During this exhaling period, the operational tank would be isolated and regenerated, allowing the tank to exhale through the non-operational column.
7. After the regeneration and cool down period, the service to the tank would be switched back to the operational column for the normal cycle time.
8. This process would repeat until the breather was replaced.
9. If during the regeneration process the tank attempts to inhale, it will be switched back to the partially regenerated operational column until another exhale period is detected to finish the regeneration.

REPLACEMENT PARTS AND SERVICE

Please contact your local sales representative or authorized distributor for replacement parts and/or service, or visit us online at www.waukeshacomponents.com.

For technical support, call us at **800-338-5526**.